Data Resources will be provided separately on CD. Data Resources for River Road Training Site includes:

RRTS Previous Site Investigations

- 2012, Contaminants of Emerging Concern in the Tidal Delaware River: Pilot Monitoring Survey 2007-2009
- 2014, RRTS Military Munitions Response Program: Remedial Investigation Work Plan/Uniform Federal Policy-Quality Assurance Project Plan, March 2014
- 2015, RRTS Military Munitions Response Program: Remedial Investigation Report, April 2015
- 2019, FY16 Phase 1 Regional Site Inspections For Perfluorinated Compounds: Delaware Air National Guard – 166th Airlift Wing, New Castle Air National Guard Base, New Castle, Delaware, March 2019
- Delaware Department of Natural Resources and Environmental Control's New Castle County Airport Area Fact Sheet, PFOS/PFOA Detected in Ground Water from New Castle Public Wells

RRTS Site Background Documents

- 1998, New Castle County, Delaware Government Zoning Map Index: Zone 59
- 2005, USGS Geologic Map of New Castle County, Delaware, Kelvin W. Ramsey, 2005
- 2017, USEPA Amendment No. 2 to the 1988 Record of Decision for the Delaware Sand & Gravel landfill Superfund Site, New Castle, Delaware, 2017
- 2019, USEPA Fifth Five-Year Review Report for Army Creek Landfill Superfund Site New Castle County, Delaware, September 2019
- UCMR3 Summary Table

RRTS Site Property Documents

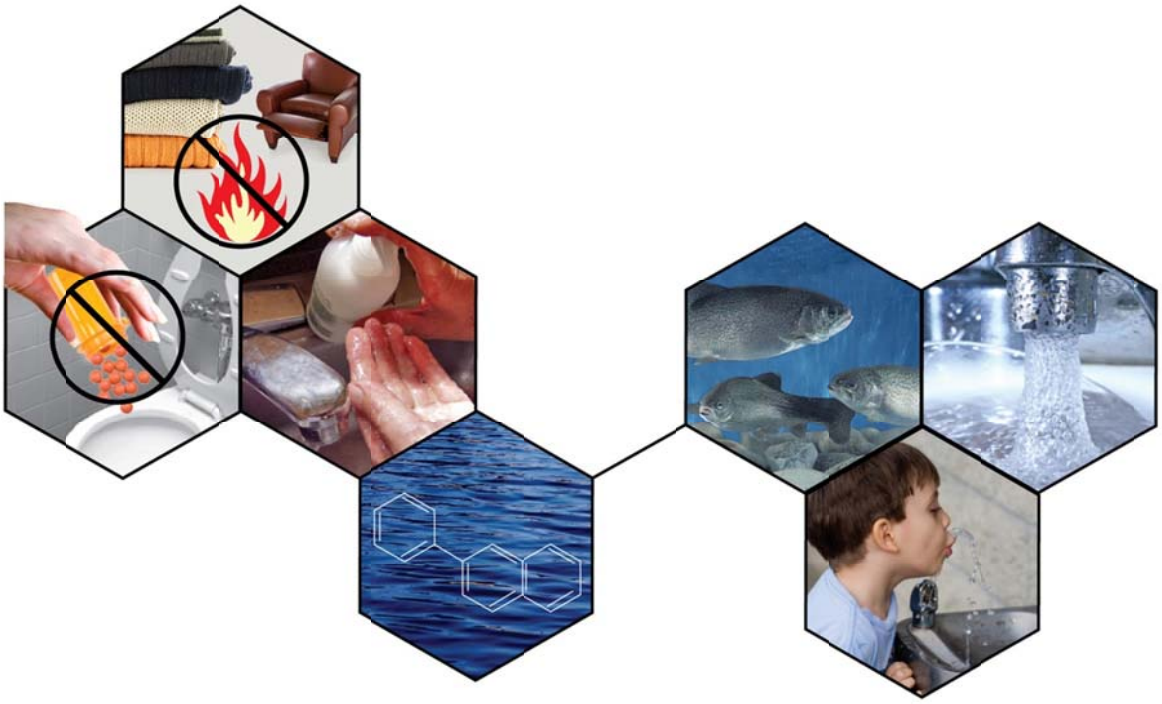
- 1908, RRTS Deed, November 16, 1908

Environmental Data Resources, Inc.™ Reports

- 2019, Aerial Photo Decade Package, Environmental Data Resources, Inc., August 27, 2019
- 2019, Historic Aerials Photo Package, Environmental Data Resources, Inc, August 27, 2019
- 2019, Certified Sanborn Map Report, Environmental Data Resources, Inc., August 26, 2019
- 2019, Radius Map Report with Geocheck, Environmental Data Resources, Inc., August 26, 2019

Contaminants of Emerging Concern
In the
Tidal Delaware River

Pilot Monitoring Survey
2007 -2009



Delaware River Basin Commission

final report prepared by

A. Ronald MacGillivray, Ph.D.

July, 2012
revised August, 2013

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1.0 Abstract

Contaminants of emerging concern are unregulated substances that have entered the environment through human activities. Current regulatory approaches are inadequate to address these contaminants and the increasing public concern over their environmental and human health implications. A pilot multi-year survey of contaminants of emerging concern in the main stem of the tidal Delaware River sampled and analyzed ambient waters in 2007, 2008 and 2009 for pharmaceuticals and personal care products, as well as perfluoroalkyl and polyfluoroalkyl substances (PFASs) by liquid chromatography/tandem mass spectrometry (LC/MSMS); hormones, sterols and nonylphenols by gas chromatography/mass spectrometry (GC/MS); and polybrominated diphenyl ethers (PBDE) by high resolution gas chromatography/mass spectrometry (HRGC/MS). Pharmaceuticals and personal care products (PPCP) detected at concentrations of ng/L in the river were comparable to compounds and concentrations measured in other studies of ambient water with the exception of codeine and metformin. Fifteen PPCP were identified for focused study in surface waters (acetaminophen, carbamazepine, clarithromycin, codeine, dehydronifedipine, erythromycin-hydrate, fluoxetine, gemfibrozil, 2-hydroxy-ibuprofen, ibuprofen, lincomycin, metformin, sulfamethoxazole, thiabendazole, and triclocarban) based on the criteria of environmental occurrence, aquatic ecotoxicity, potential human health effects to sensitive populations, and analytical feasibility. In addition, PPCP reported in fish tissue in other locations should be assessed in the Delaware Estuary. Natural and synthetic hormones were detected in ng/L levels. Hormones detected at low concentrations and at limited locations included estrone, norethindrone, 17-alpha-ethynyl-estradiol, desogestrel and testosterone. Hormones have been ranked in the top of chemicals in U.S. surface waters for ecological effects and warrant further study. PFASs were measured in ng/L concentrations with perfluorononanoate (C9) measured at the highest concentration. Although concentrations of PFASs in water appear to be trending downward each year, additional ecotoxicology and bioaccumulation information is needed for these compounds especially on longer chain and sulfonated PFASs. Nonylphenol levels did not exceed current United States Environmental Protection Agency national water quality criteria. PBDE were measured in pg/L to ng/L concentrations with homolog distributions similar to those observed in other North American locations. Because of the low levels found in water, additional monitoring of PBDE by the DRBC will focus on bioaccumulation in fish tissue. The effects of PPCP in estuarine and coastal waters are not well studied. Future work in the Delaware River should evaluate the sources as well as the fate and effects of PPCP in the water column, sediments and biota.

2.0 Introduction

The goal of the survey was to collect ambient water data for use in compiling basin data on contaminants of emerging concern (CEC) identified in the DRBC report titled Emerging Contaminants of Concern in the Delaware River Basin (http://www.state.nj.us/drbc/EmergingContaminantsFeb2007.pdf). Participants included the Delaware River Basin Commission (DRBC), Axys Analytical Services Ltd, and Delaware Department of Natural Resources Environmental Control and Environmental Laboratory Section (DNREC-ELS). More than 84,000 chemicals are listed on the USEPA Toxic Substance Control Act (TSCA) chemical substance inventory. New chemicals are introduced each year and released to the environment while improved analytical methods are available to detect many of these compounds. In addition, there is a growing body of information on adverse effects from some contaminants. Scientists, the public, and regulators have an increased interest in substances and toxic effects not historically monitored or assessed. The compounds included in the multi-year survey are unregulated compounds (pharmaceuticals, hormones and sterols, perfluoroalkyl and polyfluoroalkyl substances, and polybrominated diphenyl ethers) or recently regulated compounds (nonylphenols). The survey was conducted in the tidal Delaware River, the part of the river that has tidal flux from Trenton to the head of the Bay. This is an urbanized and industrialized area as shown in Figure 1 (river segment predominantly surrounded by developed (red) land use). Over 6 million residents live in contributing watersheds to the tidal Delaware River creating an area of concentrated consumer product usage. Two sites (E12 at RM105.4 and E16 at RM 131.1) in the survey are within segments of the river designated for use as public water supplies after reasonable treatment (Table3 and Figure 3). All sites in the survey are within segments of the river designated for fish ingestion as well as water uses such as maintenance of resident fish and other aquatic life and wildlife protection.

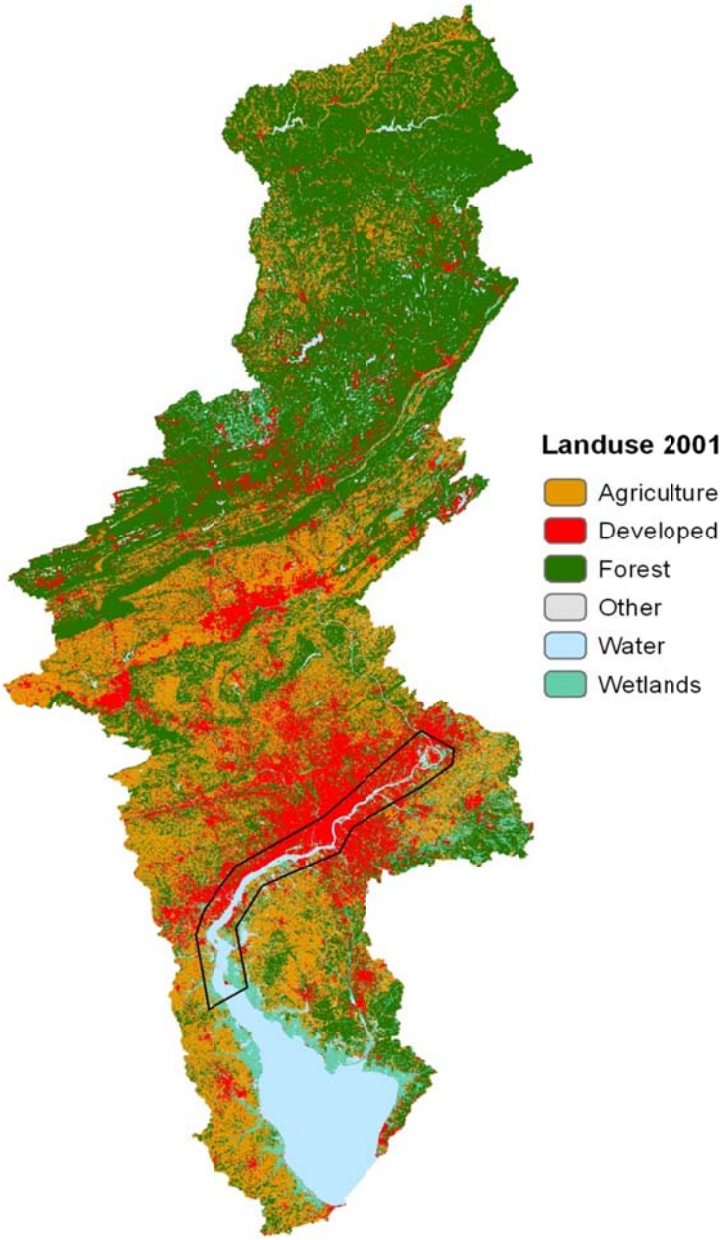

Figure 1. Map of Delaware River Basin Land Use in 2001 from USGS National Land Cover Database

3.0 Pharmaceutical Source Map for the Delaware River Basin

As part of an ongoing effort by the DRBC to assess the vulnerability of the Delaware River Basin to contaminants of emerging concern, a pharmaceutical source map was generated by merging information from a National Pollutant Discharge Elimination System Permit Compliance System (NPDES/PCS) retrieval file and a pharmaceutical manufacturing Standard Industrial Classification (SIC) code file. The merged file includes the facility name, address, NPDES number, SIC, SIC description, and coordinates. The pharmaceutical manufacturing SIC code file for the basin contains twenty-nine entries. Several facilities were deleted from the list based on current information from regulators in basin states. The DRBC pharmaceutical manufacturers list was cross-checked with a similar list obtained from Carey A. Johnston of the U.S. EPA, Office of Water. The EPA list consists of facilities likely to be subject to the Pharmaceutical Manufacturing Effluent Guidelines (Part 439). The EPA list is based on 2004 data from Permit Compliance System (PCS) and Toxics Release Inventory (TRI). Facility identification is done based on the primary SIC code reported to TRI or PCS. Facilities in the following SIC codes are regulated by the Pharmaceuticals Manufacturing Effluent Guidelines source category (Part 439): 2833 Medicinals and botanicals; 2834 Pharmaceutical preparations; 2835 Diagnostic substances; and 2836 Biological products, except diagnostics. In addition, the EPA identified several pharmaceutical manufacturing facilities in SIC Code 2048: Prepared Feed and Feed Ingredients for Animals and Fowls, Except Dogs and Cats. After the DRBC and USEPA lists were found to match, the list was used to generate the pharmaceutical source map. Wastewater treatment plants in the basin were added to the list and map as post-consumer use sources of pharmaceuticals. Figure 2 shows numerous potential sources to the Delaware River, from 584 sewage treatment facilities and 18 manufacturing sites, for only one category of contaminants of emerging concern (pharmaceuticals).

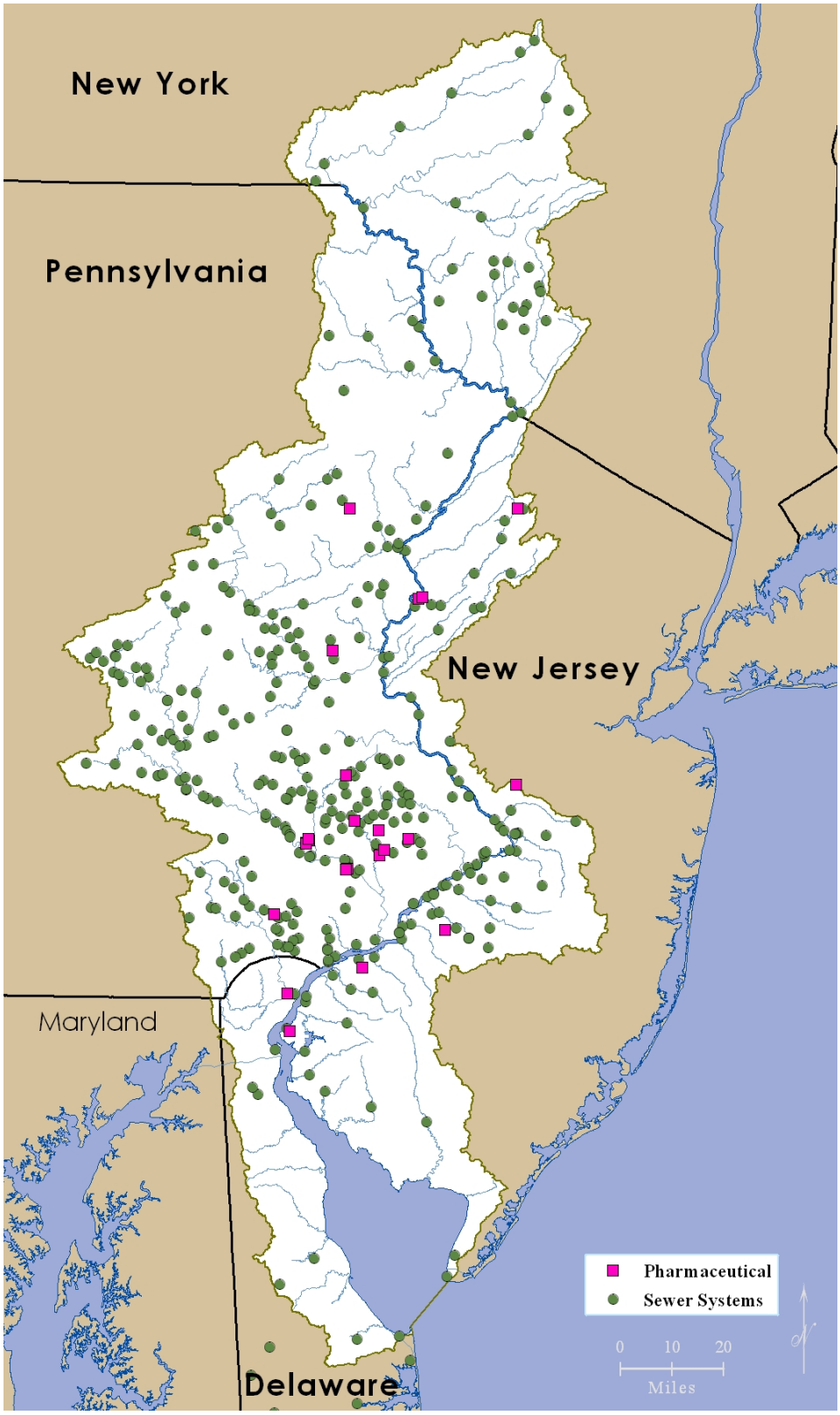

Figure 2. Pharmaceutical Source Map for the Delaware River Basin

4.0 Methods

4.1 Analytical Methods

Pharmaceuticals and personal care products (PPCP) were analyzed using Axys Method MLA-052 Rev 4 in 2007 and 2008 and MLA-075-Rev4 in 2009. Both methods are suitable for determination of pharmaceutical and personal care compounds in aqueous samples. The analysis required extraction at different pH conditions. Prior to extraction and/or clean-up procedures samples were adjusted to the required pH and spiked with surrogates. Aqueous samples were filtered prior to the analysis to remove solid particulate. Aqueous samples were cleaned up by solid phase extraction (SPE) and analyzed by liquid chromatography / electrospray ionization / tandem mass spectrometry (LC/ESI-MS/MS) in positive and negative ionization modes. The method has four modes that target different pharmaceuticals as follows: 1) acid extraction, positive ESI 2) tetracylines, positive ESI; 3) acid extraction, negative ESI; and 4) base extraction, positive ESI. PPCP analytes and estimated detection limits are listed in Appendix A Table A1.

Sterols and hormones were analyzed using Axys Method MLA-055 Rev 2 in 2007 and MLA-068 Rev 1 in 2008. Both methods are suitable for determination of concentration of a suite of steroids in aqueous samples. All samples were spiked with deuterated surrogate standards prior to analysis. Aqueous samples were solvent extracted with extracts cleaned up on a layered alumina Florisil column and derivatized with BSTFA prior to analysis by capillary gas chromatography and low resolution mass spectrometry (LRMS). Hormones were analyzed using Axys MLA-072 Rev 2 in 2009 by LC/MS/MS. The methods used to measure the hormones and sterols in the DRBC study are new analytical methods with few surrogates available and numerous QA/QC qualifiers. Sterol and hormone analytes and estimated detection limits are listed in Tables 6, 7 and 8.

Perfluoroalkyl and polyfluoroalkyl substances (PFASs) were analyzed using the Axys Method MLA-060 Rev 3. After spiking with isotopically-labeled surrogate standards and cleanup on SPE cartridges, samples were analyzed by LC-MS/MS. Final sample concentrations were determined by isotope dilution/internal standard quantification against extracted calibration standards in water. PFASs analytes and limits of quantification are listed in Table 9.

Polybrominated diphenyl ethers (PBDE) were analyzed using Axys Method MLA-033 Rev 3 to determine concentrations of a suite of brominated diphenyl ethers in aqueous samples as described in USEPA Method 1614. The sample is extracted and cleaned up on a series of chromatographic columns. The final extract is spiked with isotopically-labeled recovery (internal) standards prior to instrumental analysis. Analysis of the extract is performed on a high resolution mass spectrometer (HRMS) coupled to a high-resolution gas chromatograph (HRGC) equipped with a DB-5HT chromatography column. PBDE analytes and estimated detection limits are listed in Appendix A, Table A2.

Nonylphenols (NP) and nonylphenol ethoxylates (mono-NPEO1, di-NPEO2) were analyzed using Axys Method MLA-004 Rev 05 for determining the concentration of nonylphenols and nonylphenol ethoxylates in aqueous samples. Samples were spiked with isotopically-labeled surrogate standard prior to extraction. Samples were extracted, underwent acetylation steps, and were cleaned up by column chromatography. The cleaned up extract was analyzed by GC/MS. Nonylphenol and nonylphenol ethoxylates were reported as total concentrations, representing the sum of all the detected isomers in a specific target group. NP and NPEO analytes and estimated detection limits are listed in Table 11.

Analysis of Bisphenol A in aqueous samples containing less than 1% solids was based on Axys method MLA059 for the analysis of urine samples. Aqueous samples were adjusted to a pH of 2 and spiked with labelled ^{13}C quantification standards. Samples were extracted and cleaned up using solid phase extraction (SPE) procedures. The method determined the total of the free bisphenol A (not the glucuronidated metabolites). Analyte concentrations were determined by LC/MS/MS and quantified using the isotope dilution quantification method. The estimated detection limit for Bisphenol A was 0.05 ng/L.

Table 1 presents a summary of all the analytical methods used.

Table 1. Analytical Methods Overview

Parameters	Survey Year		
	2007 # of analytes / method	2008 # of analytes / method	2009 # of analytes / method
PFASs LC/MS/MS	13 MLA060 – Rev03	13 MLA060 – Rev04	13 MLA060 – Rev07
PPCP LC/MS/MS USEPA 1694 plus extended list of analytes	54 MLA052 – Rev04	72 MLA052 – Rev04	119 MLA075 – Rev04
Sterols and Hormones	24 MLA055 – Rev02 GC/LRMS	27 MLA068 – Rev01 GC/LRMS	17 MLA072 – Rev02 Hormones only LC/MS/MS
NP and NPEO GC/MS	3 MLA004 – Rev04	4 MLA004 – Rev05	4 MLA004 – Rev05
bis-phenol-A LC/MS/MS	Not monitored	1 MLA059 – Rev03	1 MLA059 – Rev04
PBDE HRGC/HRMS USEPA 1614	46 MLA033 - Rev03	Not monitored	Not monitored

4.2. Supplemental Water Quality Data Methods

In-field measurements of specific conductivity, salinity, water temperature, dissolved oxygen and pH were performed at all sites on each sample day. Laboratory analysis of transect composite samples from each site was also conducted according to the methods listed in Table 2.

Aquatic toxicity tests for short-term chronic toxicity and *in vitro* tests for estrogenic compounds were also conducted on the ambient water samples. The tests can assess chemical mixtures and possible additive effects as well as assess toxicants with no specific analytical method or chemicals not monitored by the chemical methods utilized (Appendix C).

Table 2. Supplemental Water Quality Methods

PARAMETER	METHOD REFERENCE	MDL[1]	LOQ[2]
CHLORIDE	EPA 300.0	1 mg/L	3 mg/L
CHROMIUM, HEXAVALENT	STD MTH 3500-Cr B	1.4 ug/L	5.0 ug/L
DISSOLVED OXYGEN (field)	STDMTD 18th ed. 4500-O	N/A	0.1 mg/L
ALKALINITY	EPA 2320B	0.9 mg/L	1.0 mg/L
HARDNESS	EPA 2340C	0.3 mg/L	1.0 mg/L
pH (field)	STDMTD 4500 H+	N/A	0.1 unit
SALINITY	STDMTD 2520	N/A	0.1 ppt
SPECIFIC CONDUCTANCE (field)	STDMTD 2510B	N/A	2.0 uS/cm
SUSPENDED SOLIDS, TOTAL (TSS)	EPA 160.2	NA	5.0 mg/L
TEMPERATURE, AIR/WATER (field)	EPA 170.1	N/A	N/A
ORTHOPHOSPHATE, DISSOLVED	EPA 365.1 Rev 2.0	0.002 mg/L	0.010 mg/L
PHOSPHOROUS, TOTAL	EPA 365.4	0.005 mg/L	0.040 mg/L
NH_3 – N	EPA 350.1 Rev 2.0	0.004 mg/L	0.020 mg/L
NO_2 – N	EPA 353.2 Rev 2.0	0.003 mg/L	0.008 mg/L
NO_3 - N	EPA 353.2 Rev 2.0	0.005 mg/L	0.010 mg/L
NO_3 – N & NO_2 - N	EPA 353.2 Rev 2.0	0.005 mg/L	0.010 mg/L
KJELDAHL, TOTAL - N	EPA 351.2 Rev 2.0	0.07 mg/L	0.20 mg/L
CADMIUM, TOTAL AND DISSOLVED	EPA 200.7 Rev 4.4	0.43 ug/L	5 ug/L

PARAMETER	METHOD REFERENCE	MDL[1]	LOQ[2]
CALCIUM	EPA 200.7 Rev 4.4	NA	1000 µg/L
CHROMIUM, TOTAL AND DISSOLVED	EPA 200.7 Rev 4.4	3.1 ug/L	10 ug/L
COPPER, TOTAL AND DISSOLVED	EPA 200.7 Rev 4.4	1.4 ug/L	5 ug/L
LEAD, TOTAL AND DISSOLVED	EPA 200.7 Rev 4.4	0.9 ug/L	3 ug/L
MAGNESIUM	EPA 200.7 Rev 4.4	NA	50 µg/L
NICKEL, TOTAL AND DISSOLVED	EPA 200.7 Rev 4.4	1.22 ug/L	20 ug/L
ORGANIC CARBON, DISSOLVED AND TOTAL	5310B	0.3 mg/L	3.0 mg/L
POTASSIUM	EPA 200.7 Rev 4.4	NA	50 µg/L
SILVER, TOTAL AND DISSOLVED	EPA 200.7 Rev 4.4	1.24 ug/L	10 ug/L
SODIUM	EPA 200.7 Rev 4.4	NA	100 µg/L
SULFATE	EPA 300.0 Rev 2.1	0.04 mg/L	1.5 mg/L
ZINC, TOTAL AND DISSOLVED	EPA 200.7 Rev 4.4	0.4 ug/L	10 ug/L

[1]Method Detection Limit; [2]Limit of Quantitation LOQ represents the lowest standard in the calibration curve or, in instances where a standard curve is not specified by the procedure, LOQ represents the limitations of the method.

[3] EMDL – Estimated Method Detection Limit as per DRBC guidance on PCB sampling at http://www.state.nj.us/drbc/PCB_info.htm ; [4] Method Limit

4.3 Sampling Procedures

Samples were collected from six locations in the tidal Delaware River (Table 3; Figure 3). The tidal portion of the Delaware River, from the head of the tide at Trenton, New Jersey, to the Delaware Bay at Liston Point, Delaware, was the study area. The salinity in the tidal Delaware ranges from <1 to 15 ppt. Sites E12 and E16 are in DRBC Water Quality Zones with designated uses that include public water supplies after reasonable treatment. Sites E1, E4, E6 and E9 are not in Zones designated as sources of drinking water.At mid-channel sampling sites, subsurface ambient water was directly sampled into 2L HDPE (high density polyethylene) bottles for analysis of PFASs. A Niskin bottle was used to collect transect composite ambient water at 0.6 of the water column into HDPE pails to be distributed to five 2.5 L amber glass bottles for analysis of other contaminants of emerging concern. A portion of the composite sample was distributed into 2.5 to 5 gal LDPE (low density polyethylene) cubitainers (VWR Int., Brisbane, CA) for chronic toxicity bioassays and into glass bottles for estrogenic assays. Field blanks were collected. Glass bottles and blank water were obtained from the analytical laboratory. The samples were placed on ice in coolers to maintain a temperature of $4^{o}C \pm 2^{o}C$ and transported to the respective laboratories for bioassays and physical-chemical analyses. Temperature inside the cooler for bioassays was tracked during transport with a temperature logger. Temperature of samples for chemical analysis were checked upon arrival at the laboratory.

Table 3. Sampling Sites

Site	RIVER MILE	DRBC ZONE	SITE DESCRIPTION	LATITUDE (dd.ddddd)	LONGITUDE (dd.ddddd)
E1	50	5	Liston Point	39.45500	75.5600
E4	68	5	S. of De. Memorial Bridge	39.65472	75.54667
E7	80	4	Opposite Mouth of Marcus Hook Creek	39.81336	75.39058
E9	90	4	South of Schuylkill River	39.875905	75.195988
E12	105	3	Mouth of Pennsauken Creek	39.99478	75.05978
E16	131	2	Biles Channel	40.181560	74.745050

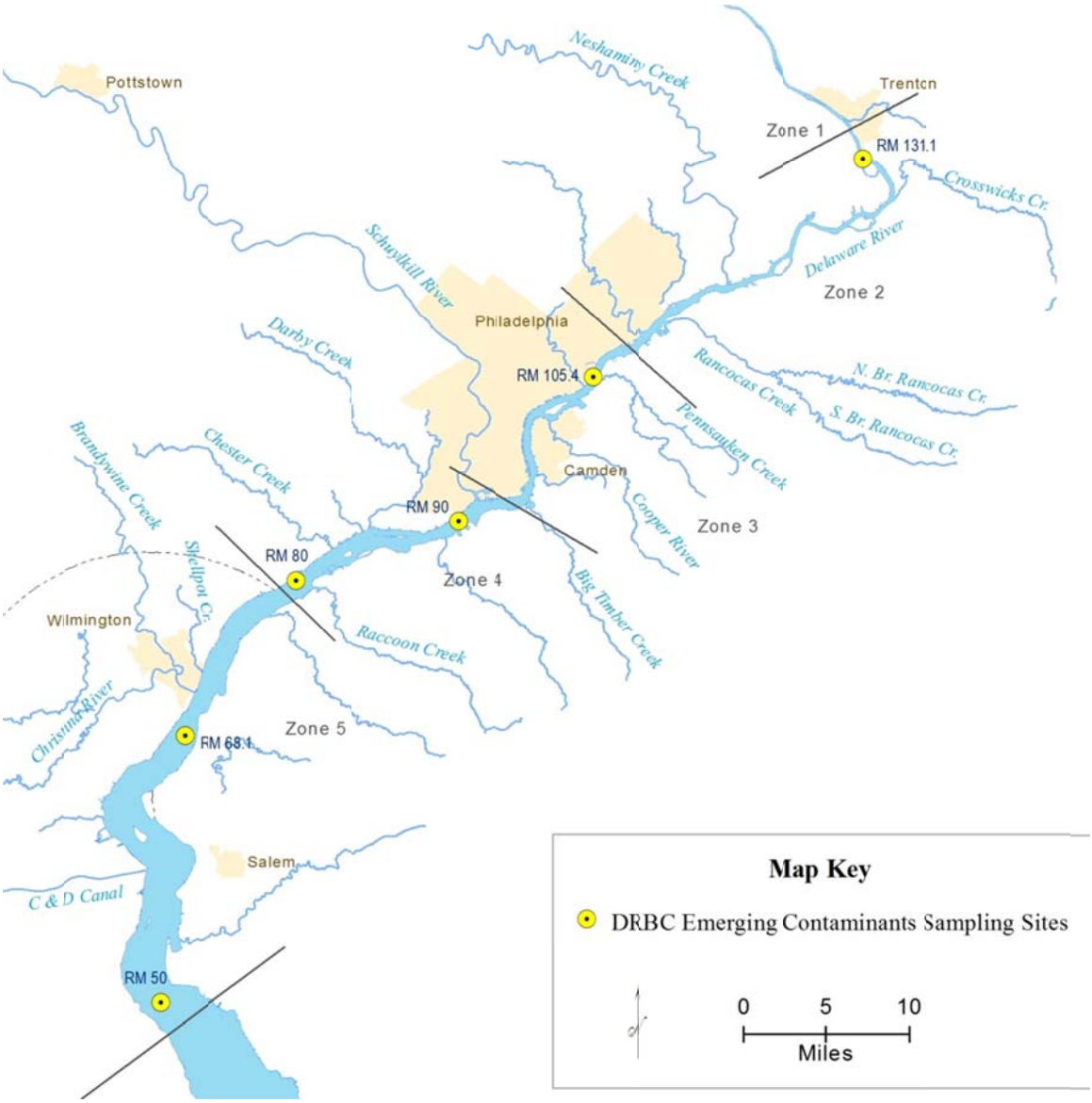

Figure 3. Map of Sampling sites in 2007, 2008 and 2009

4.4 Hydrology

Grab samples of ambient water were collected on October 17, 2007, August 6, 2008 and October 22, 2009 when the mean daily average flows for Delaware River at Trenton, NJ were at 5,390, 4,590 and 5,000 cfs, respectively. The river flows at sampling were below the harmonic mean flow of 6,500 cfs used to calculate protection of human health criteria for carcinogens and above the 30-day flow with a five year recurrence interval (30Q5) of 2,800 cfs used with human health criteria for systemic toxicants. The flows at sampling were also above the minimum flows for aquatic life protection based on a 7Q10 flow of 2,500 cfs. The sampling period is representative of late summer and autumnal river conditions in the tidal Delaware River, but not a worst case scenario.

4.5 Prioritization of PPCP

To evaluate and prioritize individual PPCP on the basis of the risk they pose to the aquatic ecosystem and human health and to add to the knowledge base on the assessment and informed management of the PPCP that pose the greatest risk, a review of the existing knowledge and available data on PPCP exposures and their ecological impacts to the aquatic environment was undertaken using resources listed below.

Databases used in the prioritization included:

US EPA ECOTOX, which currently includes more than 520,000 test results on the effects of more than 8,500 chemicals, including PPCPs, on over 6,400 terrestrial and aquatic species (http://cfpub.epa.gov/ecotox/);

ECOSAR (Ecological Structure Activity Relationship) a computerized predictive system that estimates the aquatic toxicity of chemicals. The program estimates a chemical's acute (short-term) toxicity and chronic (long-term or delayed) toxicity to aquatic organisms such as fish, aquatic invertebrates, and aquatic plants by using Structure Activity Relationships (SARs) (http://www.epa.gov/oppt/newchems/tools/21ecosar.htm);

Center for Coastal Environmental Health and Bimolecular Research (CCEHBR) Pharmaceuticals in the Environment, Information for Assessing Risk (PEIAR) website. A site designed to provide available information for assessing risks to aquatic resources from drugs entering waterways from both point and non-point sources (http://www.chbr.noaa.gov/peiar/default.aspx);

USEPA PPCP Literature Citation Database includes published literature relevant to the issues surrounding PPCPs as environmental contaminants (http://www.epa.gov/ppcp/lit.html).

Additional sources for ecotoxicology data were from the following:

Bergh, K. 2005 unpublished. Ecological Risk Assessment of Pharmaceuticals and Personal Care Products in Surface Water. (http://ir.lib.sfu.ca/retrieve/2491/etd1839.pdf);

Cleuvers, M. 2003. Aquatic ecotoxicity of pharmaceuticals including the assessment of combination effects. Toxicology Letters 142:185-194;

Cunningham, V. et al., 2006. Effects of Human Pharmaceuticals on Aquatic Life: Next Steps. Environment Science & Technology. Vol 40.Issue 11 pp 3456-3462;

Crane, M; C. Watts and T. Boucard. 2006. Chronic aquatic environmental risks from exposure to human pharmaceuticals. Science of the Total Environment 367:23-41;

Fent, K, A Weston and D. Caminanda. 2006. Ecotoxicology of human pharmaceuticals. Aquatic Toxicology 76:122-159;

Kuster, A. et al., 2009. Environmental risk assessment of hman pharmaceuticals in the European union: a case study with the β-blocker atenolol. Integr Environ Assess and Manag 6(1)514-523;

Oakes, K. D.et al., 2010. Environmental Risk assessment for the serotonin re-uptake inhibitor fluoxetine: case study using the European risk assessment framework. Integr Environ Assess and Manag 6(1)524-539;

Schmitt, H et al., 2009. Recommendations on the environmental risk assessment of pharmaceuticals: effect characterization. Integr Environ Assess and Manag 6(1): 588-602;

Winter et al 2008. Defining the chronic impacts of atenolol on embryo-larval development and reproduction in the fathead minnow (Pimephales promelas). Aquat. Toxicol. (3) 361-369;

Material Safety Data Sheets (MSDS); and

TCC Consortium. High Production Volume (HPV) Chemical Challenge Program Data Availablility and Screening Level Assessment for Triclocarban, CAS#:101-20-2. (http://www.epa.gov/hpv/pubs/summaries/tricloca/c14186tc.htm).

Using the available data, a risk based procedure was used to prioritize PPCP based on exposure and effects to aquatic organisms that compared measured environmental concentrations from the DRBC multi-year survey to predicted environmental effects levels from published literature or ECOSAR estimates. Predicted no environmental effects concentrations (PNEC) were estimated from acute toxicity (ECx or LCx) divided by an assessment factor of 1,000 or chronic toxicity (NOEC) divided by an assessment factor of 100. The aquatic toxicity data used were from single species tests. Toxicity

tests with unspecified genus and species were not used. The few available studies on the toxicity of pharmaceutical mixtures also were not included in the assessment (Fent et al., 2006; Kumar et al., 2010).

The list of priority PPCP derived in this way were compared to other prioritization and risk assessment approaches that used multiple prioritization criteria such as estimated environmental concentration, ecological and human toxicity, exposure to stream water and fish consumption, physicochemical properties, analytical feasibility, consumption/sales, prescription numbers, loadings, exposures, degradation, and persistence (Bruce, *et al*., 2010; Collier, 2007; Cooper *et al*., 2008; Cunningham *et al*., 2009; de Voogt *et al*, 2009; Kostich and Lazorchik, 2008; Kumar and Xagoraraki, 2010a, 2010b; Ottmar *et al*., 2010; and Schwab *et al*., 2005; Schmitt *et al*., 2009, Roos *et al*., 2012).

The four key criteria selected for prioritizing PPCP in the tidal Delaware River were the following:

1) environmental occurrence (maximum detected concentration in DRBC surveys),
2) aquatic ecotoxicity (Hazard Quotient of Measured Environmental Concentration to the Predicted No Effect Concentration (MEC/PNEC)),
3) human health effects (reported concerns due to possible carcinogenicity, mutagenicity, reproductive and developmental effects, immunotoxicity, and interactions among drugs when exposed to multiple contaminants especially in sensitive populations),
4) analytical feasibility (USEPA Method 1694 test parameters with validated analytical methods).

Other considerations worth noting in the prioritization include:

1) Occurrence data for some compounds, specifically codeine and metformin, warrant their inclusion for priority study in the Delaware Estuary,
2) A number of compounds such as diclofenac, ethinylestradiol and oxytetracycline that have been identified as priority compounds in other studies were not detected in this study of the tidal Delaware River and were not included in the priority list (Cooper et al., 2008; Collier, 2007),
3) Although aquatic ecotoxicity data were not available for dehydronifedipine, this pharmaceutical has been included in the priority list of pharmaceuticals based on occurrence data and ecological effects (Kumar and Xagoraraki, 2010b).
4) A number of metabolites were detected (benzoylecgonine, desmethyldiltiazem, 1,7-dimethylxanthine, 10-hydroxy amitriptyline and 2-hydroxy-ibuprofen) some at concentrations higher than the parent compound. Although aquatic ecotoxicity data were not available for this compound, 2-hydroxy-ibuprofen was included in the priority list based on occurrence data, toxicity data of the parent compound and the need to further investigate metabolites (Celiz, et al., 2009).
5) The use of physical chemical properties to predict bioaccumulation of PPCP from the water column to fish tissue or aquatic biota is not a key criteria used in this

prioritization because there is limited information on the environmental fate of ionized compounds the chemical form of many PPCP in the environment (Tarazona *et al*, 2009). However, PPCP such as diphenylhydramine, norfluoxetine, sertaline, desmethylsertraline, carbamazepine, diltiazem, fluoxetine, and gemfibrozil that have been detected in fish in EPA studies and by other researchers should be further assessed in the Delaware Estuary (http://water.epa.gov/scitech/swguidance/ppcp/fish-tissue.cfm, Brooks et al., 2005).

5.0 Results and Discussion

5.1 Pharmaceutical and Personal Care Products

A wide range of pharmaceutical and personal care products (PPCP) including prescription medicines, over the counter medicines (OTC), antibiotics, and anti-bacterials used in consumer products were targeted in this study. Until recently, the fate and transport of many common PPCP were not of great concern. However, many of these synthetic compounds may ultimately pose a threat to human health and/or the environment. It has been established that some of these substances, i.e., endocrine disruptors, that affect the function of the endocrine system, have the potential to be detrimental to the development of humans and other organisms by adversely affecting physiology and reproduction (Daughton and Ternes 1999). A number of chemicals have been identified as being of environmental concern including lipid regulators (gemfibrozil), analgesics/anti-inflammatories (codeine, acetaminophen, and ibuprofen), antiepileptics (carbamazapine), antidepressants (fluoxetine), oral contraceptives (ethynylestradiol), and antimicrobial disinfectants (triclosan and triclocarban) (Daughton and Ternes, 1999; Fent et al., 2006). The EPA has listed 2-methoxyethanol, erythromycin, mestranol, and nitroglycerin, as well as, the hormones estrone, estriol, estradiol, equilin, equilenin, 17-α estradiol and 17-α ethynyl estrdiol, mestranol and norethindrone as substances that may require regulation under the Safe Drinking Water Act (SDWA) on the Contaminant Candidate List 3 (CCL3) and/or Unregulated Contaminants Monitoring Rule 3 (UCMR3):
(http://water.epa.gov/scitech/drinkingwater/dws/ccl/ccl3.cfm)
(http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/ucmr3/methods.cfm)

Most PPCP compounds detected and concentrations found in the tidal Delaware River are comparable to those reported in other occurrence studies of ambient waters for pharmaceuticals and other organic wastewater contaminants. Of the PPCP analyzed in water samples from the tidal Delaware River, 57 compounds were detected in 2007, 2008 or 2009 at concentrations in the ng/L range. Ten PPCP were detected in all three years (azithromycin, caffeine, carbamazepine, clarithromycin, codeine, dehydronifedipine, diltiazem, diphenhydramine, erythromycin-hydrate and fluoxetine) (Appendix B, Table B.4). However, the analytical method used was improved each year increasing the number of PPCP analytes from 54 in 2007 to 72 in 2008 and 119 in 2009 (Table 1).

Therefore, most of the chemicals are represented by a single measurement but, chemicals with multiple measurements are represented by mean (standard deviation) in Table 4. With the exception of codeine and metformin, the compounds detected and concentrations found in the tidal Delaware River are comparable to those reported in other studies of ambient waters for the occurrence of pharmaceuticals and other organic wastewater contaminants in Pennsylvania streams (Loper *et al*., 2006); metropolitan Chicago rivers (Mack, unpublished); estuarine environments (Pait *et al*., 2006); and national reconnaissance studies of surface waters by the USGS (Focazio, 2004, Kolpin *et al*., 2002). Most of the PPCP in the DRBC study were below detection limits while those chemicals measured were typically at low concentrations (Table 4 and Appendix B, Tables B1 to B4). It should be noted that the results reported from these studies are based on filtered water samples and are therefore biased toward hydrophilic (soluble) compounds that are less likely to sorb to suspended particles or rapidly transported to river sediment.

The analgesic codeine, one of the top five most highly prescribed prescription pharmaceuticals, had concentrations peak in the Delaware River at the RM 68.1 with a mean of 89.97 ng/L and a range of 38 to 159 ng/L compared to background concentrations in the river of <10 ng/L. Generally, Loper et al., 2006 found non-detects in a Pennsylvania study except in a few creeks with concentrations between 29 to 56 ng/L. Two pharmaceutical facilities that use codeine in their manufacturing processes have been identified near the RM 68.1 site. Both facilities discharge indirectly to the Delaware River through POTWs. Although codeine is reported to have a high removal rate in POTWs, effluent at the two POTWs receiving the indirect discharges had codeine concentrations of 377 and 2,590 ng/L (three day average). This is in comparison to the occurrence of codeine in effluents measured in a national EPA study where six out of nine POTW facilities were found to have concentrations in the range of ND to 25 ng/L and three facilities had concentrations of 628, 642 and 890 ng/L (USEPA, 2009). A recent study of effluent from wastewater treatment facilities with indirect pharmaceutical discharges found 10 to 1000 times higher pharmaceutical concentrations than those typically found in WWTP effluents. The authors concluded that facilities involved in the manufacture of pharmaceutical products are an under-investigated source of pharmaceuticals to the environment (Phillips *et al*., 2010).

Metformin was detected in the DRBC multi-year survey between RM 80 to 90 in the range of 1,000 to 3,500 ng/L compared to no detection in a study of the Chesapeake Bay (Pait et al., 2006) and in the range of several 100 ng/L in most German rivers (Scheurer et al., 2009). This antidiabetic drug has one of the highest pharmaceutical production levels world-wide. A recent publication on pharmaceutical loadings in wastewater treatment plants concluded that metformin and two other PPCP (valacyclovir and gabapentin) warrant study of fate, transport and occurrence due to the fact that these drugs have high effluent concentrations, significant potential for ecotoxicity and have been included in limited prior research (Ottmar et al., 2010).

A Pennsylvania Department of Environmental Protection (PADEP) study in cooperation with United States Geological Survey (USGS) reported analysis of 15 pharmaceuticals

and 31 antibiotics in water samples from streams with inputs from agricultural areas dominated by animal-feeding operations and wells currently used to supply water for livestock on a farm, in south-central Pennsylvania. The study compared the impact of municipal wastewater and agricultural run-off on the occurrence of the target analytes. In streams receiving municipal wastewater effluent (the scenario in the study that is most similar to the urban tidal Delaware River), 13 phamaceuticals and 11 antibiotics were detected. Maximum concentrations observed for caffeine was 4,750 ng/L, para-xanthine (a degradation product of caffeine) was 853 ng/L, carbamazapine was 516 ng/L, ibuprofen was 277 ng/L and individual antibiotic concentration maxima were in the range of 200 to 1,600 ng/L (Loper *et al*., 2006).

In a study of contaminants of emerging concern in metropolitan Chicago rivers, water column samples from three freshwater streams were sampled at low-flow conditions for twenty-five PPCP, hormones and sterols. Land use in the three streams was reported to be 64 to 78% urban. Not surprisingly, in effluent dominated steams, individual fecal sterols were detected at concentrations between 200 to 5,000 ng/L. However, the hormones equilenin, estriol, progesterone, and testosterone were not detected. PPCP were measured at maximum concentrations of 7.8 ng/L for tylosin, 16 ng/L for triclosan, 170 ng/L for carbamazapine, 200 ng/L for trimethoprim, 210 ng/L for cotinine, 310 ng/L for caffeine and 410 ng/L sulfamethoxazole. Concentrations of PPCP in the three Chicago area streams for the most part were higher than those measured in the Delaware River. It should be noted that both the DRBC and Chicago area studies are grab samples representing a single snap shot in time and space of each river under specific flow conditions and season. Nevertheless, it is noteworthy that similar contaminants of emerging concern are present in surface waters of different urban areas within the United States (Mack, 2008).

In national reconnaissance studies of surface waters, the USGS conducted a number of monitoring projects for pharmaceuticals and other organic wastewater contaminants (Focazio, 2004). The USGS criteria for selecting compounds to measure were based on the quantities in use, anticipated environmental behavior, pathways for release, health significance (known and potential), ability to measure the compound, potential as chemical indicators/tracers and stakeholder priorities. The detection of multiple contaminants in surface water was observed in Kolpin et al., 2002. Surface waters were monitored in 1999 through 2000 for 95 organic wastewater contaminants (OWC) in 139 streams including Assunpink Creek in New Jersey. The most commonly detected compounds were coprostranol, cholesterol, N-N-diethyltoluamide (DEET), caffeine, tri(2-chloroethyl)phosphate, triclosan, 4-nonylphenol, nonylphenol monoethoxylate (NPEO1), tris (2-butoxy-ethyl)phosphate, and octylphenol ethoxylate (OPEO1) at low µg/L (ppb) concentrations.

In a NOAA National Status and Trends Program study of three estuarine environments (Chesapeake Bay, Biscayne Bay, and Gulf of Fallones), analytes at most of the sites were below quantifiable concentrations. In the Chesapeake Bay sites, 13 of 24 pharmaceutical and related compounds were detected but fewer were quantified. Erythromycin hydrate was detected at many sites but below quantification levels. Compounds measured at

quantifiable levels were trimethoprim at 1 ng/L, sulfamethoxazole at 11 ng/L, fluoxetine at 3 ng/L, and acetaminophen at 2 μg/L. In Biscayne Bay, two compounds (cotinine and thiabendazole) were above detection limits but below quantification limits. A third compound acetaminophen was quantified at 3 μg/L. In the Gulf of the Farallones, two compounds were above the detection limit but below the quantification limit and no compounds were above the quantification limit. The detection limits and quantification limits (laboratory reporting limits) were not specified in the report (Pait *et al*., 2006). The authors reviewed the ecotoxicology literature on the compounds detected and concluded that the effects of pharmaceuticals in estuarine and coastal waters is not well studied. They recommended future work to document occurrence of pharmaceuticals in both water column and sediments followed by appropriate laboratory and field studies to assess possible impacts.

5.1.1 Aquatic Toxicity

All sites in the survey are within segments of the river with designated uses such as maintenance of resident fish and other aquatic life as well as wildlife protection. A DRBC review of the literature found limited aquatic ecotoxicity data on the detected compounds, primarily on individual compounds using single species tests. Thus, any assessment of risk to aquatic life is preliminary. Nevertheless, a screening level calculation by a risk characterization ratio method which calculates the ratio of the Measured Environmental Concentration to the Predicted No Effect Concentration (MEC/PNEC) indicated a Hazard Quotient of >1.0 for acetaminophen, clarithromycin, fluoxetine, ibuprofen, sulfamethoxazole and triclocarban effects on aquatic organisms. A ratio greater than one estimates that the predicted environmental concentration would be above the no-effects concentration and is generally considered cause for concern (Cunningham et al, 2006). The Hazard Quotient was calculated using maximum concentrations from the DRBC survey and the most sensitive species and endpoints from a limited data set reported in the literature or predicted from an ECOSAR predictive model while using standard adjustment factors for acute and chronic toxicity data as described in the report entitled High Production Volume (HPV) Chemical Challenge Program Data Availability and Screening Level Assessment for Triclocarban CAS #: 101-20-2, Prepared for the HPV Challenge Program by The TCC Consortium on December 27, 2002 (http://www.epa.gov/hpv/pubs/summaries/tricloca/c14186tc.htm).

Using the same approach, Hazard Quotients of 0.1 to 1.0 were calculated for effects on aquatic organisms for carbamazepine, codeine, erythromycin-hydrate, gemfibrozil, lincomycin, and thiabendazole. A ratio greater than one tenth but less than one is considered a low risk but not an insignificant risk by some assessors because of the chemical specificity and potency of many PPCP (Ankley *et al*., 2006, Crane *et al*., 2007 European Medicines Agency. 2006). For a substance with acute ecotoxicity data only, the combined safety factor used in this assessment is 10,000 (1,000 from the calculation of the PNEC and 10 from the use of a 0.1 hazard quotient). This combined safety factor of 10,000 is equivalent to the safety factor recommended as a default aid to prioritization of human pharmaceuticals in the absence of identified specific environmental concerns.

This is a factor of 10 greater than the assessment factor applied to non-biologically active industrial chemicals (Crane *et al*., 2007). A summary of aquatic toxicology data (endpoints, organisms and sources), assessment factors, measured environmental concentrations, estimated PNEC and calculated hazard quotients used in this assessment are tabulated in Appendix C. Aquatic Toxicology Data.

If effects data was not available in the published literature, predictions from ecological structure activity relationship (ECOSAR) were used. Some pharmaceutical compounds detected in the DRBC survey did not have readily available aquatic toxicology data in the literature or ECOSAR predictions of aquatic effects (2-hydroxy-ibuprofen, dehydronifedipine, desmethyldiltiazem, fluticasone propionate and norverapamil). A number of compounds only had acute data readily available. PPCP would be better assessed for ecotoxicity if chronic toxicity, bioavailability, bioaccumulation and duration of exposure data were readily available (Jjemba, 2006).

It should be restated that this is a preliminary screening assessment of the data. Other approaches for assessment might use species sensitivity distribution to estimate PNECs , threshold concentration action levels or integration of river monitoring data in fate and transport models to estimate distribution and effects of contaminants of emerging concern. Assessment of ecotoxicity from contaminants of emerging concern in the tidal Delaware River would be further informed by estrogenicity screening, biomarker measurements and population (sex ratio) surveys.

5.1.2 Human Health Effects

Although the focus of this study was contaminants of emerging concern in surface water and aquatic toxicity, human health effects were considered in the prioritization. Two sites (E12 at RM105.4 and E16 at RM 131.1) in the survey are within segments of the river designated for use as public water supplies after reasonable treatment (Table3 and Figure 3). All sites in the survey are within segments of the river designated for fish ingestion. Numerous studies have concluded that healthy adults are unlikely to be adversely affected at the levels of exposure currently reported for PPCP (Cunningham et al., 2009; Kostich and Lazorchik, 2008; and Schwab et al., 2005). However, potential concerns have been identified for pregnant women, and children from pharmaceutical contaminants in potable water (Collier, 2007). Potential human health effects have also been incorporated in recent risk assessment and prioritization schemes with identified concerns including carcinogenicity, mutagenicity, reproductive and developmental effects, immunotoxicity, allergic reactions, microbial resistance to antibiotics and interactions among drugs when exposured to multiple contaminants (Bruce, *et al*., 2010; Kumar and Xagoraraki, 2010a, 2010b, and Ottmar *et al*., 2010) (Table 5). Human health risk assessment methodologies differ from ecological assessments and may identify other pharmaceuticals from those prioritized in this report that may need consideration (Kumar et al. 2010). It is also important to reiterate that the data presented in this report are from

surface water some of which is source water that will receive additional treatment prior to use as drinking water.

5.1.3 Priority PPCP

Based on the criteria used in this assessment of environmental occurrence, aquatic ecotoxicity, potential human health effects and analytical feasibility, the following PPCP should be considered priority pollutants for future monitoring and assessment in surface waters of the tidal Delaware River: acetaminophen, carbamazepine, clarithromycin, codeine, dehydronifedipine, erythromycin-hydrate, fluoxetine, gemfibrozil, 2-hydroxy-ibuprofen, ibuprofen, lincomycin, metformin, sulfamethoxazole, thiabendazole, and triclocarban (Table 4).

While hormones were detected at low concentrations and a few location in this study and the analytical feasibility of measuring hormones by EPA Method 1698 or other equivalent methods is limited to a few laboratories, hormones should be considered for future study in surface waters of the Delaware River because of their high potential for ecological effects (Kumar and Xagoraraki, 2010b)

In addition, PPCP such as diphenylhydramine, norfluoxetine, sertaline, desmethylsertraline, carbamazepine, diltiazem, fluoxetine, and gemfibrozil that have been detected in fish in EPA studies and by other researchers should be further assessed in the Delaware River (http://water.epa.gov/scitech/swguidance/ppcp/fish-tissue.cfm, Brooks et al., 2005).

Although the value of identifying priority pollutants is well established, because of the limited environmental assessment data available on contaminants of emerging concern, monitoring the environmental occurrence and effects of as many parameters as possible in future studies is recommended. It is also important to note that available information on the environmental effects of PPCP is rapidly increasing and any assessment should be updated periodically using current information.

Table 4. PPCP Detected in 2007, 2008 or 2009 Surveys. Most chemicals represented by a single measurement with multiple measurements represented by the mean (standard deviation).

	Concentration (ng/L) by Site / River Mile					
Compound	**E1 / 50**	**E4 / 68.1**	**E7 / 80**	**E9 / 90**	**E12 / 105.4**	**E16 / 131.1**
Acetaminophen*	ND	ND	ND	105	ND	ND
Albuterol	ND	0.40	0.83	0.84	0.56	0.34
Alprazolam*	0.42	0.46	0.61	0.58	0.38	ND
Amitriptyline*	0.49	1.01	1.17	1.39	0.83	0.76
Amphetamine*	ND	ND	3.83	5.53	4.52	ND
Atenolol*	13.80	20.20	53.80	58.80	28.60	11.60
Azithromycin	ND	ND	ND	ND	ND	9.53(6)
Benzoylecgonine*	6.92	16.20	30.50	39.60	10.60	6.04
Caffeine	18.25(8)	49.53(16)	106.57(15)	158.77(9)	71.50(3)	52.40(8)
Carbadox	ND	ND	7.48	5.89	2.20	ND
Carbamazepine	21.30(8)	47.20(16)	55.63(15)	42.60(9)	23.93(3)	18.50(8)
Clarithromycin	4.78*	ND	2.20(1)	8.38(5)	6.21(1)	4.24(2)
Cocaine*	0.97	0.34	1.21	1.05	2.33	2.58
Codeine	15.52(11)	89.97(62)	11.67(6)	8.96(5)	5.89(2)	3.40#
Cotinine	21.20~	20.00(2)	36.25(3)	36.75(2)	12.60(3)	7.66(2)
DEET*	28.30	32.90	42.80	40.80	17.50	6.34
Dehydronifedipine	0.87(0.3)	1.68(1)	2.19(1)	1.69(1)	0.82(0.2)	ND
Desmethyldiltiazem*	ND	1.31	1.96	3.35	1.38	0.96
Diltiazem	0.47(0.04)	2.57(1)	8.73(3)	10.71(2)	3.67(1)	3.08(1)
Dimethylxanthine	ND	220	193	239	ND	ND
Diphenhydramine	0.85(0.24)	0.89(0.2)	1.13(0.5)	3.38(1)	2.44(2)	4.93(2)
Enalapril*	ND	ND	0.34	ND	ND	ND
Erythromycin-H2O	1.98(1)	5.22(2)	9.15(5)	9.69(5)	4.11(3)	2.87(2)
Fluoxetine	8.02#	4.52(1)	ND	ND	ND	ND
Fluticasone propionate*	ND	ND	2.11	2.06	2.31	2.69
Gemfibrozil	5.35(2)	16.24(8)	30.90(12)	41.03(15)	15.44(10)	9.39(3)
Hydrocodone*	8.11	16.20	5.49	3.21	2.16	ND
10-hydroxy-amitriptyline*	ND	ND	0.25	0.38	0.23	0.21
2-Hydroxy-ibuprofen*	ND	113	346	286	ND	ND
Ibuprofen*	ND	ND	71.20	76.60	30.00	ND
Lincomycin	37.40`	18.40`	ND	ND	ND	ND
Meprobamate*	15.00	32.90	38.20	32.80	17.80	6.23
Metformin	ND	1036.50(1094)	2194.00(1974)	2355.00(1718)	861.00(157)	459.50(296)
Methylprednisolone	ND	0.80	ND	ND	ND	ND
Metoprolol*	11.50	23.70	35.40	42.40	21.20	15.10
Naproxen	ND	7.93(4)	16.34(6)	46.23(21)	31.37(12)	18.70(1)
Norfloxacin	ND	ND	ND	ND	ND	9.70
Norverapamil*	ND	ND	ND	ND	ND	0.17
Ofloxacin	ND	ND	ND	ND	ND	1.60
Oxycodone*	40.70	53.10	20.80	15.30	6.65	1.83
Propoxyphene*	1.02	1.92	2.15	2.96	1.18	1.51
Ranitidine	ND	ND	1.52	2.16	1.23	1.01
Sertraline	ND	ND	ND	1.16	0.64	0.69
Sulfadiazine	ND	2.91	2.36	ND	ND	ND
Sulfadimethoxine	1.64	0.49	0.81	1.42	ND	0.37
Sulfamethoxazole	39.23(18)	107.70(33)	116.93(31)	87.73(11)	37.13(17)	19.80(6)
Sulfanilamide	ND	ND	24.20	ND	ND	ND
Sulfathiazole	2.35	ND	ND	ND	ND	ND
Theophylline*	ND	ND	118.00	145.00	ND	ND

	Concentration (ng/L) by Site / River Mile					
Compound	**E1 / 50**	**E4 / 68.1**	**E7 / 80**	**E9 / 90**	**E12 / 105.4**	**E16 / 131.1**
Thiabendazole*	2.97	3.45	10.50	73.60	25.20	ND
Triamterene*	3.80	1.06	3.65	4.47	2.92	2.15
Triclocarban	ND	ND	ND	8.52(2)	4.74(1)	7.95(2)
Trimethoprim	4.73#	8.70(2)	16.03(3)	15.13(5)	6.04(2)	5.53(1)
Valsartan*	14.00	38.40	51.10	97.60	91.80	58.50
Verapamil*	ND	ND	ND	0.29	0.24	0.85

detected in 2007 only a mean and standard deviation cannot be calculated
` detected in 2008 only a mean and standard deviation cannot be calculated
~ detected in 2009 only a mean and standard deviation cannot be calculated
* analyzed in 2009 only a mean and standard deviation cannot be calculated
Priority PPCP for the tidal Delaware River are in bold.

Table 5. Prioritization Criteria for PPCP in Surface Waters of The Tidal Delaware River

Compound	Environmental Occurrence	Aquatic Ecotoxicity	Potential Human Health Effects	Analytical Feasibility EPA 1694
Acetaminophen	X	X	X	X
Carbamazepine	X	X	X	X
Clarithromycin	X	X		X
Codeine	X	X	X	X
Dehydronifedipine	X	NA	X	X
Erythromycin-hydrate	X	X	X	X
Fluoxetine	X	X	X	X
Gemfibrozil	X	X	X	X
2-Hydroxy-ibuprofen	X	NA		X
Ibuprofen	X	X	X	X
Lincomycin	X	X	X	X
Metformin	X			X
Sulfamethoxazole	X	X	X	X
Thiabendazole	X	X		X
Triclocarban	X	X		X

X = Data or information was available and used for the prioritization

5.2 Hormones and Sterols

In the 2007 and 2008 surveys, both sterols and hormones were included in the list of analytes. In those surveys, the fecal sterols (coprostanol, epicoprostanol, cholestanol) and a cholesterol precursor (desmosterol) as well as the plant sterols (campesterol, stigmasterol and beta-sitosterol) were detected (Table 6-7). The fecal sterols indicate the presence of human sewage but are not major contributors to ecotoxicity in the river.

In the 2009 survey only hormones were included in the list of analytes. Hormones detected in 2007, 2008 and 2009 at low concentrations and at limited locations include estrone, norethindrone, 17-α-ethynylestradiol, desogestrel and testosterone (Table 8). Concentration for environmental safety such as water quality criteria for aquatic life and human health are not available for hormones however; some information relevant to environmental assessment of these compounds is provided below.

Estrone (a natural hormone used in pharmaceuticals) and norethindrone (a synthetic hormone) were also detected in 2007 only at different sample sites and at concentrations of 1.3 and 4.24 ng/L, respectively (Appendix B, Tables B5 to B7). These values are lower than the median and maximum levels of 27 ng/L and 112 ng/L for estrone and 48 ng/L and 872 ng/L for norethindrone reported in the USGS national reconnaissance survey of streams (Koplin *et al*., 2002). In a study within the Delaware River Basin, Velicu and Suri (2009) report a estrone detection frequency of >90% in 21 surface water locations with concentrations ranging from 0.6 to 2.6 ng/L. Estrone is a steroid estrogen that is generally detected in the greatest quantity in aqueous samples partly because it is a transformation product of 17β-estradiol (Jurgens et al,, 2002). Dilution, sorption and biodegradation in surface waters quickly lowers the concentrations of estrone to the low ng/L levels but higher concentrations of estrone have been reported in sediment (Petrovic *et al*, 2002). Steroid estrogens have been linked to endocrine disruption in fish and their presence in water is attributed to incomplete removal from sewage during treatment (Hurst et al., 2001). Long-term(>60day) and short-term PNEC for use in risk assessment of aquatic organisms have recently been derived for estrone at 6 and 20 ng/L, respectively (Caldwell *et al*, 2012). Using the maximum measured concentration of estrone in the Delaware River, hazard quotients of 0.2 (long-term exposure) and 0.07 (short-term exposure) can be calculated. Since estrone was detected in 2007 only at one site, a short-term exposure to 1.3 ng/L estrone at the site seems to be indicated. Estrone has also been reported to have bioaccumulative properties (Gomes, *et al*, 2004). Neither fish tissue nor other aquatic biota were analyzed for hormones in the DRBC study.

Norethindrone (as reported as norethisterone or 19-nor-17-α-ethynyltestosterone) is a progestogen and a constituent of oral contraceptives that has been measured in streams (Koplin *et al*., 2002) and river sediment (López de Alda *et al*., 2002). Limited information is available on the ecotoxicity of norethindrone. It has been identified as a priority pharmaceutical for further study in Europe (The Environmental Side Effects of Medication. European Molecular Biology Organization (EMBO) Report by Alistair B.A. Boxall (http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1299201).

Norethindrone is also on the California Office of Environmental Health Hazard Assessment list of chemicals known to cause cancer and reproductive toxicity (http://www.oehha.org/prop65/prop65_list/files/P65single091208.pdf). Norethindrone levels reported in drinking water may are a potential concern for pregnant women (Collier, 2007)

The ovulation inhibiting hormone 17-α-ethynylestradiol was detected in 2008 at four sites with concentrations ranging from 1.97 to 4.01 ng/L. The hormone was not detected in 2009 and had interference in analytical detection in 2007 (Appendix B, Table B7). A 7-year, whole-lake experiment showed that chronic exposure of fathead minnow (*Pimephales promelas*) to low concentrations (5 to 6 ng/L) of 17-α-ethynylestradiol led to feminization of males, altered oogenesis in females, and near extirpation of the species from the lake (Kidd et al, 2007). Long-term (>60day) and short-term PNEC for use in risk assessment of aquatic organisms have also recently been derived for 17-α-ethynylestradiol at 0.1 and 0.5 ng/L, respectively (Caldwell *et al*, 2012). Using the maximum measured concentration of estrone in the Delaware River, hazard quotients between 20 to 40 (long-term exposure) and 0.2 to 8 (short-term exposure) can be calculated. In a recent publication, the hormone was also ranked in the top twenty pharmaceuticals, personal care products and endocrine-disrupting chemicals in U.S. surface waters for potential ecological effects (Kumar and Xagoraraki, 2010b). Ethinylestradiol has been identified as a pharmaceutical contaminant in potable water and is of potential concern for pregnant women (Collier, 2007).

In 2009, the ovulation inhibitor hormone desogestrel was measured at 242 and 68 ng/L at two sites and the sex hormone testosterone was measured at 1.37 ng/L at one site (Appendix B, Table B8). The MSDS for desogestrel states that the compound may be very toxic to aquatic life without providing specific ecological toxicity data. Concentrations of desogestrel measured in the Delaware River exceed some predicted acute toxicity values (48 to 336 ng/L LC50) and chronic toxicity values (17 to 237 ng/L ChV) in ECOSAR. Testosterone was ranked in the top ten pharmaceuticals, personal care products and endocrine-disrupting chemicals in U.S. surface waters for potential health effects (Kumar and Xagoraraki, 2010b). However, measured concentrations of testosterone in the Delaware River were orders of magnitude lower than ECOSAR predicted aquatic toxicity values (9 to 87 mg/L LC50) and chronic toxicity values (0.4 to 5 mg/L ChV) as well as observed LC50 at 6.2 mg/L and sublethal chronic toxicity endpoints at 0.31 to 2.48 mg/L in *Daphnia magna* (Barbosa, *et al*., 2008)

The EPA has listed the following hormones which may require regulation under the Safe Drinking Water Act (SDWA) on the Contaminant Candidate List 3 (CCL3) and/or Unregulated Contaminants Monitoring Rule 3 (UCMR3): 17- alpha estradiol, equilenin, equilin, 17-beta estradiol, estriol, estone, 17-alpha ethynylestradiol, mestranol, norethindron, testosterone and 4-androstene-3,17-dione.
(http://water.epa.gov/scitech/drinkingwater/dws/ccl/ccl3.cfm)
(http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/ucmr3/methods.cfm)

Table 6. Sterol and Hormone Analytes in 2007 survey

	Maximum concentration (ng/L)	EDL (ng/l)
androsterone	ND	5.45
androstenedione	ND	6.17
equilenin	ND	0.853
estriol	ND	3.43
17-α-ethynylestradiol	ND	2.74
β-sitosterol	ND	12.8
stigmasterol	ND	9.59
ergosterol	ND	8.12
desmosterol	88.3	5.69
17-α-estradiol	ND	1.44
17-β-estradiol	ND	1.28
estrone	1.3	0.815
norgestrel	ND	13.2
norethindrone	4.24	2.67
equilin	ND	0.986
testosterone	ND	9
estradiol benzoate	ND	0.52
desogestrel	ND	6.08
campesterol	150.86	7.06
mestranol	ND	2.13
17 α-dihydroequlin	ND	2.89
stigmasterol	225	9.59
progesterone	ND	24.2

ND - not detected
EDL – estimated detection limit
17-α-ethinylestradiol was elevated by the presence of interference in 2007 and is not listed.
Hormones and sterols at each sample site are reported in Appendix B.

Table 7. Sterol and Hormone Analytes in 2008 survey

	Maximum concentration (ng/L)	EDL (ng/l)
Androsterone	ND	5.49
Desogestrel	ND	4.56
17-α-Estradiol	ND	1.17
Estrone	ND	1.35
Equilin	ND	1.5
Androstenedione	ND	11.3
17-α-Dihydroequilin	4.01	1.01
17β-Estradiol	ND	1.11
Testosterone	ND	12.4
Equilenin	ND	0.794
Mestranol	ND	1.35
Norethindrone	ND	2.24
17-α-Ethinylestradiol	4.01	2.66
Progesterone	ND	17.4
Norgestrel	ND	7.95
Estriol	ND	
β-Estradiol 3-benzoate	ND	0.384
Coprostanol	267	1.75
Epicoprostanol	18.1	2.29
Cholesterol	2120	6.64
Cholestanol	152	5.57
Desmosterol	1250	9.99
Ergosterol	11.4	5.12
Campesterol	546	6.85
Stigmasterol	643	24.4
β-Sitosterol	856	24.5
β-Stigmastanol	856	22.5

ND - not detected
EDL – estimated detection limit
Hormones and sterols at each sample site are reported in Appendix B.

Table 8. Hormone Analytes in 2009 survey

	Maximum concentration (ng/L)	EDL (ng/l)
17-α-Dihydroequilin	ND	4.01
Equilenin	ND	0.801
Equilin	ND	8.01
17-β-Estradiol	ND	4.01
17-α-Estradiol	ND	4.01
Estrone	ND	4.01
17-α-Ethinylestradiol	ND	5.01
Allyl Trenbolone	ND	0.801
Androstenedione	ND	2
Androsterone	ND	81.5
Desogestrel	242	120
Estriol	ND	16
Mestranol	ND	20
Norethindrone	ND	4.01
Norgestrel	ND	4.01
Progesterone	ND	0.801
Testosterone	1.37	0.801

ND - not detected
EDL – estimated detection limit
Hormones and sterols at each sample site are reported in Appendix B.

5.3 Perfluoroalkyl and polyfluoroalkyl substances

Perfluoroalkyl and polyfluoroalkyl substances (PFASs) are found in a variety of industrial and household products such as stain repellant textiles, fire-fighting foams, and paper coatings. PFASs have unique properties to repel both water and oil. They are a diverse group of compounds that have varying degrees of persistence, toxicity and bioaccumulation in the environment. Overall, PFASs with longer fluorinated carbon chains have greater potential to bioaccumulate especially compounds with greater than seven fluorinated carbons. Furthermore, perfluoroalkyl sulfonic acid and sulfonates (e.g., PFOS) are more bioaccumulative than perfluoroalkyl carboxylic acids (e.g., PFOA) with the same number of carbons. (Conder, *et al*, 2008).

Although national water quality criteria have not been derived for PFASs, benchmarks for PFOA and PFOS have been proposed by state agencies and researchers. Although some of the values discussed below are site-specific and have been developed for waters outside of the Delaware River Basin, they are used as relative benchmarks of environmental health and safety in order to prioritize additional studies. Surface water criteria to protect aquatic life, wildlife, and human health are the most appropriate benchmarks for the waters sampled in this survey. Nevertheless, proposed drinking water criteria are included in this summary, when available, with an acknowledgement that different methodologies are used to derive surface water aquatic life criteria and drinking water criteria. PFOA, PFOS, PFNA, PFHxS, PFHpA, and PFBS have been placed on the EPA contaminant candidate list 3 as contaminants known or anticipated to occur in public water systems and which may require regulation under the Safe Drinking Water Act (SDWA).
(http://water.epa.gov/scitech/drinkingwater/dws/ccl/ccl3.cfm)
(http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/ucmr3/methods.cfm)

PFASs were detected at ng/L levels in the DRBC survey (Table 9 and Appendix B, Tables B8 to B10). All but two PFASs (perfluorododecanoic acid and perfluorooctane sulfonamides) were detected in this survey. PFASs were detected at every site sampled. Although PFASs are increasingly being detected in the environment, little information is available on the ecotoxicology of many PFASs. Additional information is needed especially on longer chain and sulfonated compounds. The following summary includes available information comparing PFASs concentrations in the Delaware River to concentrations found in other locations and to benchmarks developed for environmental health and safety.

Perfluorooctanoate (PFOA) has been described as a ubiquitous contaminant in surface waters and reported as the predominant PFAS in the Hudson River with a median concentration of 35 ng/ L and a range of 22 to 173 ng/L (Sinclair *et al*, 2006). Similar PFOA concentrations were measured in the Delaware River at 3.54 to 75.40 ng/L in the DRBC survey (Table 9 and Figure 4). At the reported concentrations, PFOA in the Delaware River did not exceed the USEPA Provisional Health Advisory short-term value for drinking water short-term exposure at 400 ng/L (USEPA, 2011). Neither did PFOA

concentrations, in areas of the Delaware River used as source waters for drinking water (upstream of RM 95), exceed a NJDEP preliminary health-based guidance value for chronic exposure of 40 ng/L for PFOA in drinking water. (Memorandum to Barker Hamill, Assistant Director for Water Supply Operations, http://www.nj.gov/dep/watersupply/pfoa_dwguidance.pdf)

Perfluorooctanesulfonate (PFOS) was detected in the Delaware River in the range of 2.7 to 8.42 ng/L (Table 9 and Figure 5). Levels described as background (0 to 30 ng/L PFOS) for surface waters of Georgia, Michigan, and New York (Sinclair *et al*, 2006, Konwick *et al*, 2008). The concentrations observed in the Delaware River are also well below PFOS concentration measured in the Conasauga River in Georgia (maximum level at 318.3 ng/L) (Konwick *et al*, 2008) and Lake Onondaga near Syracuse, New York (maximum level at 1,090 ng/L) (Sinclair *et al*, 2006). Nevertheless, the bioaccumulation properties of PFOS indicate the need for low concentrations in water to assure environmental safety. Concentrations of PFOS in the Delaware River did not exceed a USEPA Provisional Health Advisory of 200 ng/L for short-term exposure (USEPA, 2011), an aquatic life chronic benchmark of 5,100 ng/L or an avian wildlife value of 47 ng/L estimated by other authors (Giesy *et al*, 2010; Rostkowski *et al*., 2006) (Figure 5). In the Delaware Estuary, PFOS have been reported as a contaminant in osprey eggs (Toschik *et al*, 2005). Although PFOS concentrations are low in the river water sampled, bioaccumulation of PFOS with potential adverse human health effects from fish consumption and effects on wildlife populations make further studies warranted.

Perfluorononanoate (PFNA) at a maximum of 976 ng/L was the PFAS with the highest concentrations in the DRBC surveys (Table 9). Figure 6 shows the distribution of PFNA in the tidal river. The highest concentrations occur between RM 68.1 and 80. The concentrations found are higher than the 0 to 6 ng/L concentrations of PFNA found in streams of an industrial area in Korea (Rostkowski *et al.*, 2006) and levels measured in the Conasauga River (maximum level at 32.8 to 369 ng/L) near carpet manufacturing facilities in Georgia, USA (Konwick *et al*., 2008). Insufficient information is available to make a preliminary assessment of human health and ecotoxicology for PFNA. However, PFNA (nine fluorinated carbons) has been detected in wildlife indicating the potential for bioaccumulation and biomagnification as reported by Conder *et al*., (2008) substantiating the need for further study of PFN in the Delaware River.

Perfluorohexanesulfonate (PFHxS) was below the detection limit at three sites in this study and detected in the range of 2.97 to 4.48 ng/L at three other sites (Table 9 and Appendix B, Tables B8 to B10). The concentrations measured are similar to concentrations observed in numerous New York state waters (0.7 to 5.6 ng/l) and lower than most observations in Lake Onondaga, New York (4.2 to 8.5 ng/L) (Sinclair *et al*., 2006). Concentration for environmental safety such as water quality criteria for aquatic life and human health are not available for PFHS.

Perfluorohexanoate (PFHxA) was detected at all six sites in each of the three years of this study in the range of 1.4 to 79.80 ng/L (Table 9 and Appendix B, Tables B8 to B10). Higher concentrations were generally observed between RM 50 and 80. In Korean

streams with industrial activity, PFHxA are reported to be in the range of 0.77 to 27 ng/L (Rostkowski *et al.*, 2006). Concentration for environmental safety such as water quality criteria for aquatic life and human health are not available for PFHxA.

Perfluoroundecanoate (PFUnA) was detected at four downriver sites between RM 50 and 90 in concentrations ranging from 1.42 to 26 ng/L (Table 9 and Appendix B, Tables B8 to B10). PFUnA has been reported at concentrations lower than other PFASs such as PFOA in surface water (D'eon *et al*, 2009). However, PFUnA has also been detected in wildlife indicating possible biomagnification and bioaccumulation (Conder *et al*, 2008; Toschik *et al*, 2005). The eleven carbon chain PFUnA was the predominant PFAS observed in recent DRBC fish tissue samples. A comparison of PFUnA concentrations in water and fish tissue from the tidal Delaware River is shown in Figure 7.

Table 9. Perfluoroalkyl and polyfluoroalkyl substances in Ambient Water

	Maximum concentration			
	2007 (ng/L)	2008 (ng/L)	2009 (ng/l)	Limit of Quantification (ng/l)
Perfluorodecanoate (PFDA) C10	10	6	3	1.0
Perfluorododecanoate (PFDoA) C12	NR	NR	NR	1.0
Perfluoroheptanoate (PFHpA) C7	24	16	10	1.0
Perfluorohexanoate (PFHxA) C6	80	80	7	1.0
Perfluorononanoate (PFNA) C9	976	650	546	1.0
Perfluorooctanoate (PFOA) C8	75	48	28	1.0
Perfluoropentanoate (PFPeA) C5	35	32	14	1.0
Perfluoroundecanoate (PFUnA) C11	26	12	4	1.0
Perfluorobutanoate (PFBA) C4	19	26	8	1.0
Perfluorobutanesulfonate (PFBS) C4	3	26	8	2.0
Perfluorohexanesulfonate (PFHxS) C6	4	4	4	2.0
Perfluorooctanesulfonate (PFOS)C8	8	12	8	2.0
Perfluorooctane sulfonamide (PFOSA)	NR	NR	NR	

NR - not reported, below quantification limit
Perfluoroalkyl and polyfluoroalkyl substances at each sample site are reported in Appendix B, Table B.4.

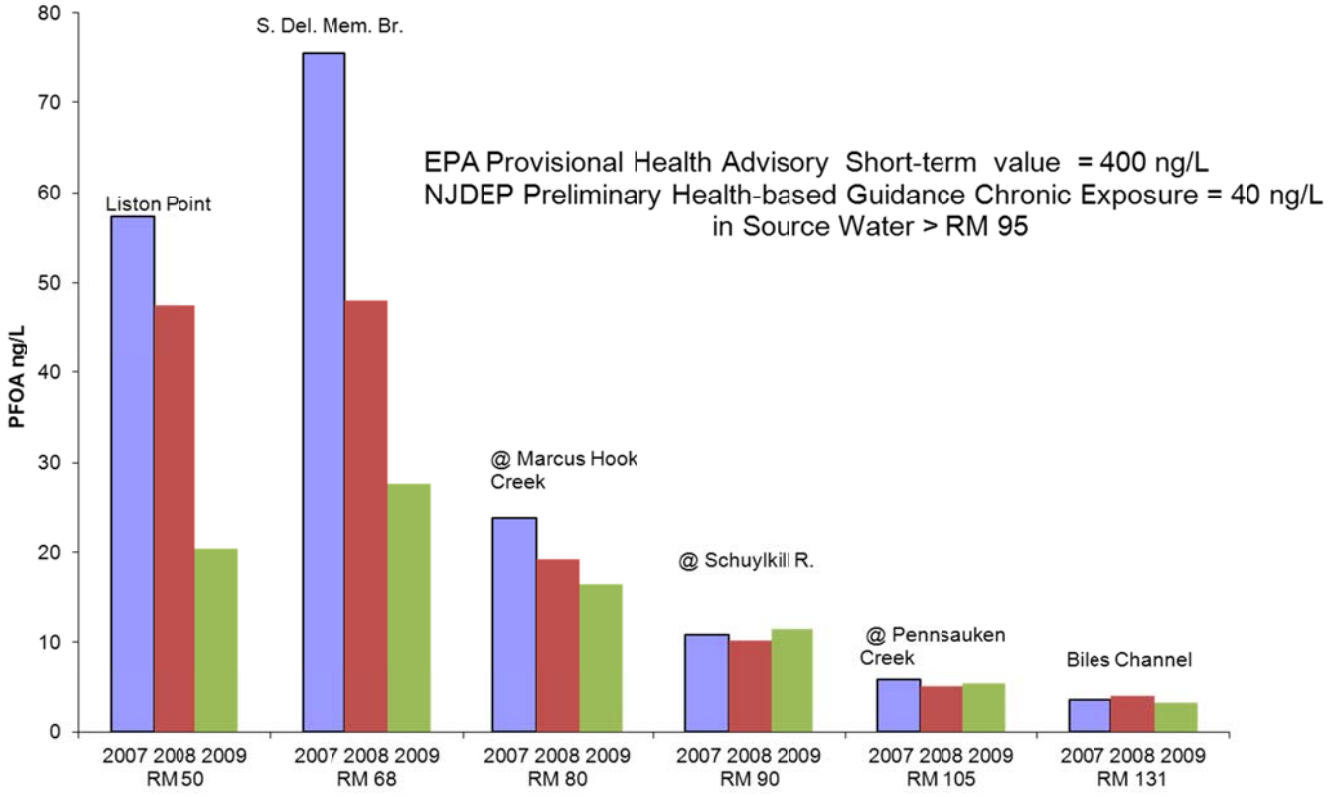

Figure 4. Perfluorooctanoic acid (PFOA) in ambient water

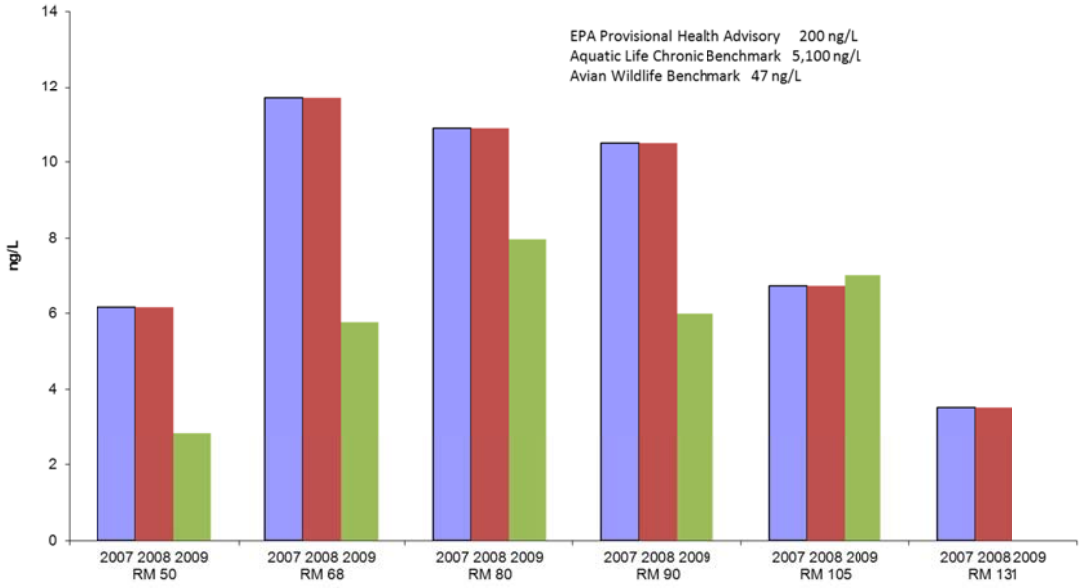

Figure 5. Perfluorooctanesulfonate (PFOS) in ambient water

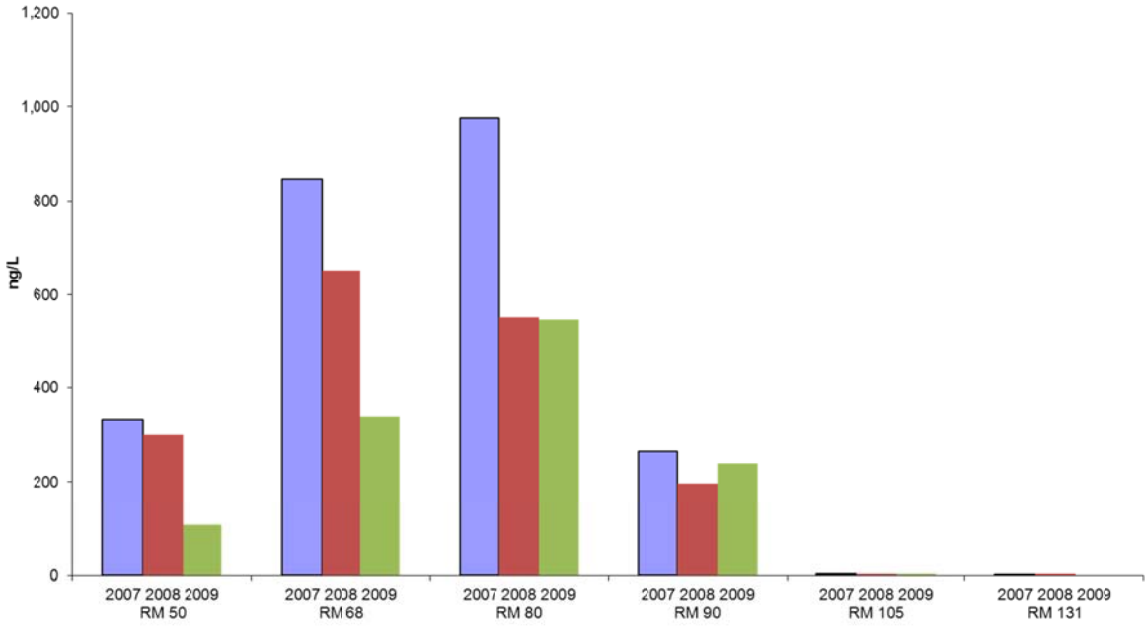

Figure 6. Perfluorononanoic acid (PFNA) in ambient water

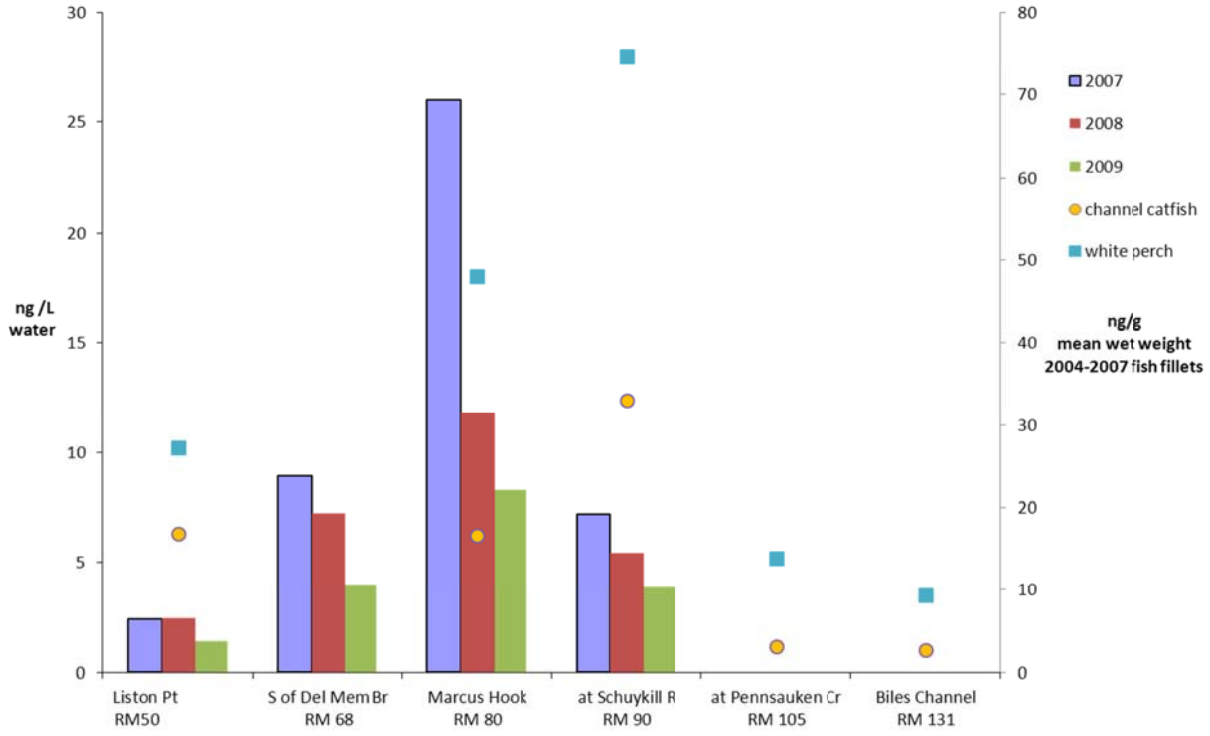

Figure 7. Perfluoroundecanoic acid (PFUdA) in water and fish tissue

5.4 Polybrominated Diphenyl Ethers

5.4.1 Ambient Water

Polybrominated diphenyl ethers (PBDE) are flame retardants found primarily in polymers and plastics. They are widely distributed in the environment and are present at increasing levels in people (U.S. Environmental Protection Agency. Polybrominated Diphenyl Ethers (PBDE) Project Plan, March 2006. http://www.epa.gov/oppt/pbde/pubs/proj-plan32906a.pdf). Flame retardants have been placed on the EPA Unregulated Contaminant Monitoring Rule 2 list to collect data for contaminants suspected to be present in drinking water, but that do not have health-based standards set under the Safe Drinking Water Act (SDWA). The flame retardants are 2,2',4,4'- tetrabromodiphenyl ether (BDE-47), 2,2',4,4',5-pentabromodiphenyl ether (BDE-99), 2,2',4,4',5,5'-hexabromodiphenyl ether (BDE-153) and 2,2',4,4',6-pentabromodiphenyl ether (BDE-100). (http://water.epa.gov/lawsregs/sdwa/ucmr/ucmr2/methods.cfm)

The analytical method used in this study measured forty-six individual PBDE congeners. However, in the interest of simplicity, the congeners are grouped by homologs (compounds with similar structures such as congeners with 5 bromine atoms are grouped together as pentabromodiphenyl ether homologs) (Appendix A, Table A2). In the DRBC ambient water study, the homologs with the maximum concentrations were decabromodiphenyl ethers (DeBDE) and nonabromodiphenyl ethers (NoBDE) (Table 10). The predominant homolog at three river sites was DeBDE detected in the range of 2,090 to 7,630 pg/L (Figure 8). In addition, nonabromodiphenyl ethers (NoBDE), pentabromodiphenyl ethers (PeBDE), and tetrabromodiphenyl ethers (TeBDE) were predominant at different sites detected in the range of 29 to 161 pg/L (Figure 8). Overall, total polybrominated diphenyl ethers (tPBDE) were detected at concentrations between 87 to 9,376 pg/L in ambeint water (Appendix B, Table B11). In unpublished reports, tPBDE have been measured in surface water at levels between 31 to 158 pg/L in Lake Michigan and at 6 pg/L in Lake Ontario (Canadian Environmental Protection Act, 1999 Ecological Screening Assessment Report on Polybrominated Diphenyl Ethers (PBDEs) (http://www.ec.gc.ca/CEPARegistry/documents/subs_list/PBDE_SAR/PBDEs_SAR_EC_June_2006_(en).pdf).

Comparisons among studies are difficult because it is unclear the methods used to measure the PBDE in the other studies and the number of congeners used to calculate the tPBDE. Nevertheless, the homolog distribution observed in the Delaware River is similar to those observed in other North American surface waters. DeBDE is the most prevalent commercial PBDE and is often found in sewage sludge, sediment and water. Any assessment of risk from PBDE should consider the fact that some BDE such as PeBDE and OcBDE have low potential for direct toxicity but can bioaccumulate. The environmental concern from other BDE such as DeBDE is primarily due to persistence and the potential for congeners to transform to bioaccumulative forms.

5.4.2 Fish Tissue

Environmental monitoring programs conducted worldwide during the past decade have shown increasing levels of some BDE congeners in contrast to a general decline in the occurrence of dioxins, PCBs and chlorinated pesticides. PBDEs have been observed in whole or fillet fish tissue at concentrations from non-detect to 1,300 ppb (ng/g) total PBDE wet weight (ww) in U.S. waterways (Wenning et al, 2011). DRBC monitoring in the tidal Delaware River from 2004 to 2007 found ranges for tPBDE of 13 to 168 ng/g ww and 562 to 5,046 ng/g lipid in channel catfish and white perch with BDE 47, 99 and 100 the most abundant congeners. Studies of other biota in the Delaware Estuary found tPBDE at 82 to 572 ng/g ww in osprey eggs and 10 to 5,652 ng/g lipid in American eels with BDE 47 the most abundant congener in both studies (Toschik *et al*., 2005; Ashley *et al*., 2007).

Risk from human consumption based on concentrations observed in fish from the Delaware River was assessed by establishing screening threshold values for four PBDE congeners (BDE-47, BDE-99, BDE-153 and BDE-209) that have oral reference doses listed in EPA-IRIS for non-carcinogenic effects. The fish tissue screening threshold values were established by following USEPA's "Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories – Volume 1, 2 and 3 (http://water.epa.gov/scitech/swguidance/fishshellfish/techguidance/guidance.cfm). The fish tissue screening values (FTSV) are 400 ppb for PBDE-47, PBDE-99, and PBDE-153 and 28,000 ppb for PBDE-209. None of the white perch or channel catfish tissue samples collected in the main stem Delaware River in 2004 to 2007 exceeded these screening values. Maximum concentrations in tidal Delaware River fish tissue were 80 ppb for PBDE-47, 53 ppb for PBDE-99, 8 ppb for PBDE-153 and 1 ppb for PBDE-209.

While total PBDE in Delaware Estuary fish has been reported as greater on average than in fish sampled at other U.S. and international locations, non-cancer risk as a function of fish consumption was reported as relatively low. (Greene, R. 2007. http://www.epa.epa/waterscience/fish/forum/2007/)

FTSVs for carcinogenic effects are not available for PBDE. Although BDE-209 has suggestive evidence of carcinogenic potential, an oral slope factor is not listed in IRS. There are insufficient data currently available to determine if BDE-47, BDE-99, and BDE-153 are potential carcinogens. The DRBC plans to continue to monitor PBDE in fish tissue if adequate funding is available.

Table 10. Polybrominated Diphenyl Ether Homologs in 2007 Ambient Water Survey

	Maximum concentration (pg/L)	Detection limit (ng/l)
Dibromodiphenyl ethers DiBDE	4.06	10
Tribromodiphenyl ethers TriBDE	22.75	10
Tetrabromodiphenyl ethers TeBDE	237.62	10
Pentabromodiphenyl ethers PeBDE	216.02	10
Hexabromodiphenyl ethers HxBDE	50.21	10
Heptabromodiphenyl ethers HpBDE	10.75	20
Octabromodiphenyl ethers OcBDE	44.7	20
Nonabromodiphenyl ethers NoBDE	1,161	100
Decabromodiphenyl ethers DeBDE	7,630	200

PBDE homologs at each sample site are reported in Appendix B.
n=6

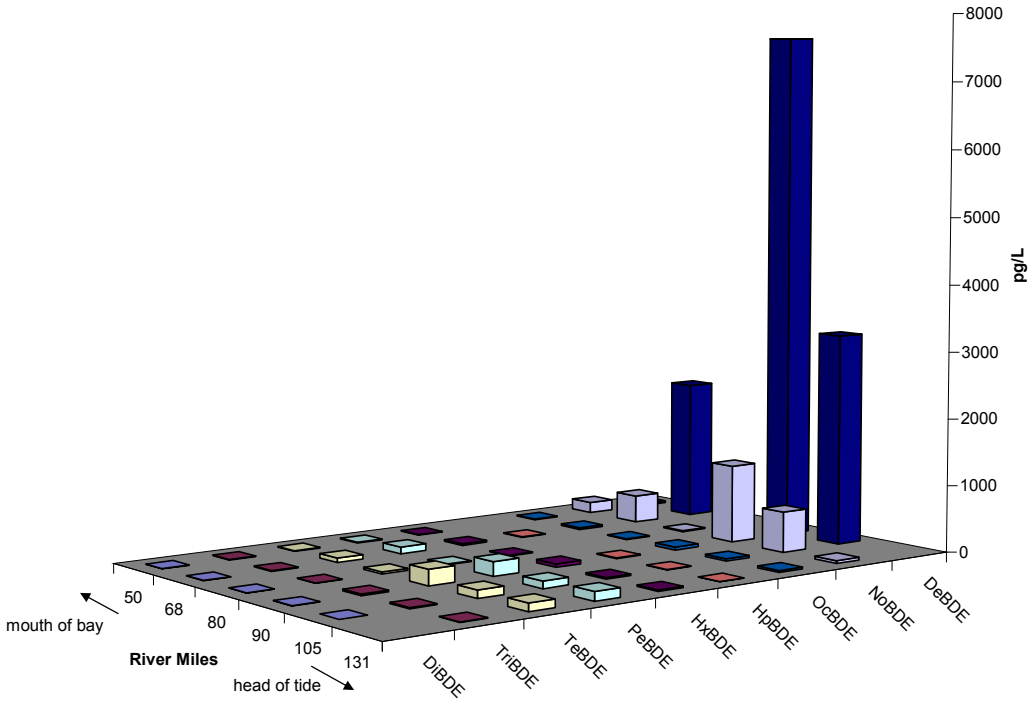

Figure 8. PBDE in ambient waters of the tidal Delaware River

5.5 Nonylphenol and Nonylphenol ethoxylates

Nonylphenol ethoxylates (NPEO) are surfactants used in detergents and other industrial applications. Nonylphenols (NP) are often found in the environment as microbial decay products of NPE. In general, NP are considered more toxic than NPEOs (Vazquez-Duhalt *et al.,* 2005). Although NP are not unregulated, our understanding of their toxicity is still emerging especially in the area of estrogenic effects. In 2006, the USEPA propagated aquatic life criteria for NP (Aquatic Life Ambient Water Quality Criteria Nonylphenol Final, EPA-822-R-05-005, http://www.epa.gov/waterscience/criteria/nonylphenol/final-doc.pdf). NP levels in the tidal Delaware River in the time and space of this limited study did not exceed USEPA criteria of 1.7 µg/L marine Criterion Continuous Concentration (CCC) or 6.6 µg/L freshwater CCC (Table 11 and Figure 9).

In interpreting the concentrations of NP in the environment with regard to the criteria, it should be noted that since studies in the literature that measured estrogenic effects by NP did not meet data quality for deriving criteria, they were not included in the calculation of the USEPA criteria for NP. However, chronic toxicity data used in the derivation of the criteria did include growth and reproduction endpoints. Therefore, to the extent that these chronic toxicity endpoints include the effect of endocrine disruption, the estrogenicity of NP is included in the derivation of the criteria. In short, upon development of standardized tests for estrogenicity, the criteria will certainly be revised.

The concentrations of NP measured in the tidal Delaware River, with a maximum of 0.0876 µg/l, are well below those considered protective (Table 11 and Appendix B, Table B12). Figure 12 shows the distribution of NP in the tidal river. Water concentrations of NP have been reported as high as 644 µg/L in Spanish waters (Sole *et al*., 2000). Maximum concentrations have been reported in the UK at 53 µg/L (Blackburn and Waldock, 1995) and in the Hudson River Estuary at 95 µg/l (Dachs *et a*l., 1999). Published studies including those that measured estrogenicity indicate that surface waters containing < 1 µg/l of NP are at low risk, surface waters containing between 1 to 10 µg/l are at some risk and surface water at >10 µg/l are at a significant risk of environmental harm (Vazquez-Duhalt *et al*., 2005). It should also be noted that the lipohilic NP can bioaccumulate (Vazquez-Duhalt *et al*., 2005). Because of its widespread occurrence in the environment and the evolving knowledge of its ecotoxicity, NP should continue to be characterized as a contaminant of emerging concern in DRBC studies.

Table 11. Nonylphenol and Nonylphenol Ethoxylates in 2007 Survey

	Maximum concentration µg/l / ng/l	Detection limit ng/l
4-nonylphenol	0.0876 / 87.6	10
4-nonylphenol monoethoxylate	0.0398 / 39.8	50
4-nonylphenol diethoxylate	ND	50

ND - not detected
NP and NPEOs at each sample site are reported in Appendix B.

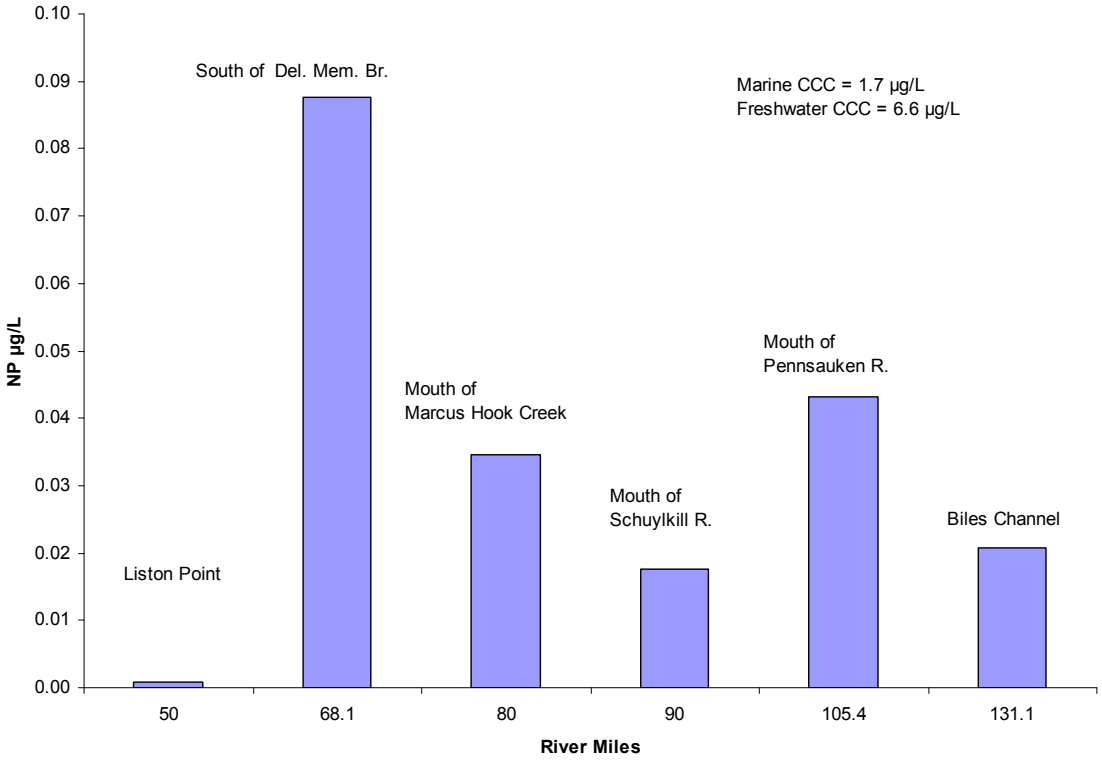

Figure 9. Nonylphenol (NP) in ambient waters of the tidal Delaware River

5.6 Bisphenol A

Bisphenol A was not detected, at a detection limit of 0.05 ng/L, in ambient waters of the tidal Delaware River at any of the six sites sampled in 2008, the only year the parameter was included in the survey.

6.0 Conclusions

Pharmaceuticals and personal care products (PPCP) detected at concentrations of ng/L in the Delaware River were comparable to compounds and concentrations measured in other studies of ambient water in urban areas with the exception of codeine and metformin. Fifteen PPCP were identified for future focused study in surface waters of the tidal Delaware River based on the criteria of environmental occurrence, aquatic ecotoxicity, potential human health effects to sensitive populations, and analytical feasibility. The effects of PPCP in estuarine and coastal waters are not well studied. Future work should evaluate the sources as well as the fate and effects of PPCP in the Delaware River water column, sediments and biota.

Natural and synthetic hormones were detected in ng/L levels in the main stem Delaware River. They have been ranked in the top chemicals in U.S. surface waters for potential ecological effects warranting further study in the Delaware River Basin.

Perfluoroalkyl and polyfluoroalkyl substances (PFASs) were measured in ng/L concentrations in water and fish tissue. The predominant PFAS is perfluorononanoic acid (PFNA) in surface water and perfluoroundecanoic acid (PFUdA) in fish tissue. Although concentrations of PFASs in water appear to be trending downward each year in the Delaware River, additional ecotoxicology and bioaccumulation information is needed for these compounds especially on longer chain and sulfonated PFASs.

Nonylphenol (NP) concentrations in the Delaware River did not exceed current USEPA national water quality criteria. However, because of widespread occurrence in the environment and the evolving knowledge of ecotoxicity, NP and NPEOs should continue to be characterized as a contaminant of emerging concern in Delaware River Basin studies.

Polybrominated diphenyl ethers (PBDE) were measured in pg/L to ng/L concentrations with homolog distributions in the tidal Delaware River similar to those observed in other North American locations. Because of the low levels found in water, future monitoring of PBDE in the Delaware River Basin should focus on bioaccumulation in fish tissue and other biota.

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8.0 Acknowledgements

Reviewers for this report were Dr. Thomas Fikslin, DRBC; Dr. Robert Hoke, Haskell Global Centers for Health and Environmental Sciences, E. I. du Pont de Nemours and Co.; Dr. Richard Greene, DNREC; Julie Petix, NJDHSS; Dr. Daniel Caldwell, Johnson & Johnson, Co (Section 5.2 Hormones and Sterols); Dr. Jeffrey Ashley, Philadelphia University. (Section 5.4 PBDE); Dr. Franklin Houghton, University of Pittsburgh (Appendix C Assays for Estrogenic Compounds); and Greg Cavallo PG, DRBC (data management and review). Technical assistance was also received from Kelly Mayo-Bean, USEPA. Preparation and chemical analyses was performed by Axys Analytical Services Ltd. Field support was provided by DRBC staff. Maps are courtesy of Karen Reavy, DRBC. This project was supported by the Delaware River Basin Commission and the United States Environmental Protection Agency.

Appendix A: PPCP and PBDE Analytes

Table A1. PPCP Analytes and Estimated Detection Limits (EDL)

Compound	EDL	UNITS	Compound	EDL	UNITS
Metformin	61.1	NG/L	Albuterol	0.308	NG/L
2-Hydroxy-ibuprofen	90.2	NG/L	Verapamil	0.149	NG/L
Caffeine	14.7	NG/L	Alprazolam	0.298	NG/L
Theophylline	58.7	NG/L	10-hydroxy-amitriptyline	0.147	NG/L
Acetaminophen	58.7	NG/L	Enalapril	0.308	NG/L
Valsartan	3.92	NG/L	Norverapamil	0.149	NG/L
Sulfamethoxazole	0.915	NG/L	Bisphenol A	2460	NG/L
Ibuprofen	14.7	NG/L	Furosemide	49.6	NG/L
Naproxen	2.94	NG/L	Glipizide	5.9	NG/L
Atenolol	1.82	NG/L	Glyburide	2.95	NG/L
Gemfibrozil	1.51	NG/L	Hydrochlorothiazide	19.7	NG/L
Oxycodone	1.08	NG/L	Triclosan	59	NG/L
DEET	0.497	NG/L	Warfarin	1.47	NG/L
Metoprolol	2.09	NG/L	Carbadox	1.47	NG/L
Benzoylecgonine	0.294	NG/L	Cefotaxime	16.6	NG/L
Carbamazepine	1.49	NG/L	Ciprofloxacin	5.9	NG/L
Meprobamate	3.97	NG/L	Clinafloxacin	13.7	NG/L
Codeine	3.71	NG/L	Cloxacillin	1.18	NG/L
Cotinine	1.54	NG/L	Digoxin	14.7	NG/L
Trimethoprim	3	NG/L	Digoxigenin	18.6	NG/L
Hydrocodone	1.85	NG/L	Enrofloxacin	2.95	NG/L
Azithromycin	1.49	NG/L	Flumequine	1.47	NG/L
Methylprednisolone	6.24	NG/L	Fluoxetine	1.47	NG/L
Clarithromycin	1.47	NG/L	Lincomycin	6.88	NG/L
Triclocarban	2.94	NG/L	Lomefloxacin	2.95	NG/L
Diltiazem	0.294	NG/L	Miconazole	1.47	NG/L
Erythromycin-H2O	0.294	NG/L	Norfloxacin	14.7	NG/L
Diphenhydramine	0.597	NG/L	Norgestimate	2.95	NG/L
Amphetamine	1.49	NG/L	Ofloxacin	14.7	NG/L
Triamterene	0.299	NG/L	Ormetoprim	0.59	NG/L
Thiabendazole	1.49	NG/L	Oxacillin	2.95	NG/L
Desmethyldiltiazem	0.147	NG/L	Oxolinic Acid	0.59	NG/L
Ranitidine	0.768	NG/L	Penicillin G	1.18	NG/L
Propoxyphene	0.294	NG/L	Penicillin V	2.95	NG/L
Fluticasone propionate	1.99	NG/L	Roxithromycin	0.295	NG/L
Cocaine	0.147	NG/L	Sarafloxacin	31.3	NG/L
Sulfadimethoxine	0.294	NG/L	Sulfachloropyridazine	1.47	NG/L
Dehydronifedipine	0.596	NG/L	Sulfadiazine	1.47	NG/L
Amitriptyline	0.294	NG/L	Sulfamerazine	0.769	NG/L
Sertraline	0.392	NG/L	Sulfamethazine	0.59	NG/L

Table A1 (cont.). PPCP Analytes and Estimated Detection Limit (EDL).

Compound	EDL	UNITS	Compound	EDL	UNITS
Sulfamethizole	0.693	NG/L	Trenbolone acetate	0.295	NG/L
Sulfanilamide	14.7	NG/L	Anhydrochlortetracycline (ACTC)	60.9	NG/L
Sulfathiazole	1.47	NG/L	Anhydrotetracycline (ATC)	14.7	NG/L
Tylosin	5.9	NG/L	Chlortetracycline (CTC)	5.9	NG/L
Virginiamycin	9.82	NG/L	Demeclocycline	14.7	NG/L
1,7-Dimethylxanthine	147	NG/L	Doxycycline	5.9	NG/L
Amlodipine	1.47	NG/L	4-Epianhydrochlortetracycline (EACTC)	77.6	NG/L
Benztropine	0.295	NG/L	4-Epianhydrotetracycline (EATC)	21.9	NG/L
Betamethasone	1.47	NG/L	4-Epichlortetracycline (ECTC)	14.7	NG/L
Diazepam	0.295	NG/L	4-Epioxytetracycline (EOTC)	5.9	NG/L
Fluocinonide	5.9	NG/L	4-Epitetracycline (ETC)	8.75	NG/L
Hydrocortisone	59	NG/L	Isochlortetracycline (ICTC)	5.9	NG/L
Norfluoxetine	1.47	NG/L	Minocycline	151	NG/L
Paroxetine	3.93	NG/L	Oxytetracyclin (OTC)	5.9	NG/L
Prednisolone	5.9	NG/L	Tetracycline (TC)	5.9	NG/L
Prednisone	19.7	NG/L	Atorvastatin	24.1	NG/L
Promethazine	0.393	NG/L	Cimetidine	2.89	NG/L
Propranolol	1.97	NG/L	Clonidine	24.1	NG/L
Simvastatin	19.7	NG/L			
Trenbolone	3.93	NG/L			

Table A2. PBDE Analytes in 2007 Survey and Their Detection Limits

Polybrominated Diphenyl Ethers EPA Method 1614 (MLA-033)		Detection limit (pg/l)
2,4-DiBDE	BDE - 7	10
2,4'-DiBDE	BDE - 8	10
2,6-DiBDE	BDE - 10	10
3,3'-DiBDE	BDE - 11	10
3,4-DiBDE	BDE - 12	10
3,4'-DiBDE	BDE - 13	10
4,4'-DiBDE	BDE - 15	10
2,2',4-TriBDE	BDE - 17	10
2,3',4-TriBDE	BDE - 25	10
2,4,4'-TriBDE	BDE - 28	10
2,4,6-TriBDE	BDE - 30	10
2,4',6-TriBDE	BDE - 32	10
2',3,4-TriBDE	BDE - 33	10
3,3',4-TriBDE	BDE - 35	10
3,4,4'-TriBDE	BDE - 37	10
2,2',4,4'-TeBDE	BDE - 47	10
2,2',4,5'-TeBDE	BDE - 49	10
2,2',4,6'-TeBDE	BDE - 51	10
2,3',4,4'-TeBDE	BDE - 66	10
2,3',4',6-TeBDE	BDE - 71	10
2,4,4',6-TeBDE	BDE- 75	10
3,3',4,4'-TeBDE	BDE- 77	10
3,3',4,5'-TeBDE	BDE - 79	10
2,2',3,4,4'-PeBDE	BDE - 85	10
2,2',4,4',5-PeBDE	BDE - 99	10
2,2',4,4',6-PeBDE	BDE - 100	10
2,3,3',4,4'-PeBDE	BDE - 105	10
2,3,4,5,6-PeBDE	BDE - 116	10
2,3',4,4',6-PeBDE	BDE - 119	10
2,3',4,5,5'-PeBDE	BDE - 120	10
3,3',4,4',5-PeBDE	BDE - 126	10
2,2',3,3',4,4'-HxBDE	BDE - 128	10
2,2',3,4,4',5'-HxBDE	BDE - 138	10
2,2',3,4,4',6'-HxBDE	BDE - 140	10
2,2',4,4',5,5'-HxBDE	BDE - 153	10
2,2',4,4',5,6'-HxBDE	BDE - 154	10
2,2',4,4',6,6'-HxBDE	BDE - 155	10

Polybrominated Diphenyl Ethers EPA Method 1614 (MLA-033)			Detection limit (pg/l)
2,3,4,4',5,6-HxBDE	BDE -	166	10
2,2',3,4,4',5,6-HpBDE	BDE -	181	20
2,2',3,4,4',5',6-HpBDE	BDE -	183	20
2,3,3',4,4',5,6-HpBDE	BDE -	190	20
2,2',3,4,4',5,5',6-OcBDE	BDE -	203	20
2,2',3,3',4,4',5,5',6-NoBDE	BDE -	206	100
2,2',3,3',4,4',5,6,6'-NoBDE	BDE -	207	100
2,2',3,3',4,5,5',6,6'-NoBDE	BDE -	208	100
2,2',3,3',4,4',5,5',6,6'-DeBDE	BDE -	209	200

Appendix B: Data Tables

Table B1. PPCP in ambient water - 2007 (ng/L)

RM	Azithromycin	Caffeine	Carbamazepine	Clarithromycin	Codeine	Dehydronifedipine	Diltiazem	Diphenhydramine	Erythromycin-H_2O	Fluoxetine
50	ND	12.5	18.8	ND	16	1.1	0.502	1.11	2.68	8.02
68.1	ND	57.2	44.9	ND	159	2.59	3.17	1.02	7.06	3.63
80	ND	24.6	60.4	2.86	14.9	2.97	12.3	1.64	14.4	ND
90	ND	72.2	37.5	10.9	11.4	2.27	12.8	4.56	14.9	ND
105.4	ND	10.4	24.7	5.45	4.52	0.941	4.1	2.21	6.68	ND
131.1	4.96	36.5	11.8	5.18	3.4	ND	2.79	3.47	3.95	ND

RM	Norfloxacin	Ofloxacin	Sulfadiazine	Sulfadimethoxine	Sulfamethoxazole	Sulfanilamide	Trimethoprim	Gemfibrozil	Ibuprofen	Naproxen	Triclocarban
50	ND	ND	ND	1.64	49.8	ND	4.73	6.4	ND	ND	ND
68.1	ND	ND	2.91	ND	124	ND	11.1	22.5	15.9	11.1	ND
80	ND	ND	2.36	ND	150	24.2	16.6	30.5	ND	17.6	ND
90	ND	ND	ND	ND	99.9	ND	11.3	44.3	ND	45	6.34
105.4	ND	ND	ND	ND	37.8	ND	4.36	14.5	ND	27.9	4.36
131.1	9.7	1.6	ND	ND	12.7	ND	ND	6.36	ND	18	6.54

Table B.2. PPCP in ambient water - 2008 (ng/L)

RM	Azithromycin	Caffeine	Carbamazepine	Clarithromycin	Codeine	Dehydronifedipine	Diltiazem	Diphenhydramine	Erythromycin-H_2O	Fluoxetine
50	ND	ND	30.5	ND	4.65	0.637	0.422	0.766	1.19	ND
68.1	ND	44.1	64.5	ND	72.7	1.74	2.26	ND	4.36	5.4
80	ND	117.1	67.3	ND	4.21	2.19	7.01	0.69	6.23	ND
90	ND	166.1	52.9	2.65	3.29	1.61	9.83	1.91	4.94	ND
105.4	ND	86.1	20.2	ND	ND	ND	2.39	1.01	0.61	ND
131.1	ND	74	27.6	1.61	ND	ND	2.68	3.64	0.97	ND

RM	Norfloxacin	Ofloxacin	Sulfadiazine	Sulfadimethoxine	Sulfamethoxazole	Sulfanilamide	Trimethoprim	Gemfibrozil	Ibuprofen	Naproxen	Triclocarban
50	ND	ND	ND	ND	18.8	ND	ND	3.13	ND	ND	ND
68.1	ND	ND	ND	0.485	129	ND	7.29	7.32	ND	ND	ND
80	ND	ND	ND	ND	112	ND	13.1	18.7	ND	9.52	ND
90	ND	ND	ND	ND	80.5	ND	13.8	24.9	ND	26.2	8.53
105.4	ND	ND	ND	ND	20.1	ND	ND	6.31	ND	21.8	3.7
131.1	ND	ND	ND	0.37	24.5	ND	6.27	10.1	ND	18	6.8

RM	Sulfathiazole	Lincomycin	Albuterol	Metformin	Ranitidine	Dimethylxanthine	Cotinine	Carbadox	Thiabendazole
50	2.35	37.4	ND	ND	ND	ND	ND	ND	2.97
68.1	ND	18.4	ND	1810	ND	220	21.2	ND	3.45
80	ND	ND	0.668	3590	0.922	193	34.3	7.48	10.5
90	ND	ND	0.711	3570	1.14	239	35.6	5.89	73.6
105.4	ND	ND	ND	972	ND	ND	10.4	2.2	25.2
131.1	ND	ND	ND	669	0.754	ND	8.99	ND	ND

Table B.3. PPCP in ambient water - 2009 (ng/L)

RM	Azithromycin	Caffeine	Carbamazepine	Clarithromycin	Codeine	Dehydronifedipine	Diltiazem	Diphenhydramine	Erythromycin-H_2O	Fluoxetine
50	ND	24	14.6	4.78	25.9	ND	0.492	0.66	2.07	ND
68.1	ND	47.3	32.2	ND	38.2	0.698	2.28	0.75	4.25	ND
80	ND	178	39.2	1.53	15.9	1.41	6.87	1.07	6.82	ND
90	ND	238	37.4	11.6	12.2	1.19	9.51	3.66	9.24	ND
105.4	ND	118	26.9	6.96	7.25	0.698	4.52	4.11	5.04	ND
131.1	14.1	46.7	16.1	5.93	ND	ND	3.76	7.68	3.7	ND

RM	Norfloxacin	Ofloxacin	Sulfadiazine	Sulfadimethoxine	Sulfamethoxazole	Sulfanilamide	Trimethoprim	Gemfibrozil	Ibuprofen	Naproxen	Triclocarban
50	ND	ND	ND	ND	49.1	ND	ND	6.53	ND	ND	ND
68.1	ND	ND	ND	ND	70.1	ND	7.72	18.9	ND	4.75	ND
80	ND	ND	ND	0.809	88.8	ND	18.4	43.5	71.2	21.9	ND
90	ND	ND	ND	1.42	82.8	ND	20.3	53.9	76.6	67.5	10.7
105.4	ND	ND	ND	ND	53.5	ND	7.71	25.5	30	44.4	6.17
131.1	ND	ND	ND	ND	22.2	ND	4.78	11.7	ND	20.1	10.5

RM	Sulfathiazole	Lincomycin	Albuterol	Metformin	Ranitidine	Dimethylxanthine	Cotinine	Carbadox	Thiabendazole
50	ND	ND	ND	0	ND	ND	21.2	ND	ND
68.1	ND	ND	0.399	263	ND	ND	18.8	ND	ND
80	ND	ND	0.996	798	2.11	ND	38.2	ND	ND
90	ND	ND	0.968	1140	3.18	ND	37.9	ND	ND
105.4	ND	ND	0.555	750	1.23	ND	14.8	ND	ND
131.1	ND	ND	0.344	250	1.27	ND	6.33	ND	ND

RM	Valsartan	Atenolol	Oxycodone	Benzoylecgonine	Meprobamate	Metoprolol	Hydrocodone	Amphetamine	Triamterene	Cocaine	Propoxyphene
50	14	13.8	40.7	6.92	15	11.5	8.11	ND	3.8	0.965	1.02
68.1	38.4	20.2	53.1	16.2	32.9	23.7	16.2	ND	1.06	0.339	1.92
80	51.1	53.8	20.8	30.5	38.2	35.4	5.49	3.83	3.65	1.21	2.15
90	97.6	58.8	15.3	39.6	32.8	42.4	3.21	5.53	4.47	1.05	2.96
105.4	91.8	28.6	6.65	10.6	17.8	21.2	2.16	4.52	2.92	2.33	1.18
131.1	58.5	11.6	1.83	6.04	6.23	15.1	ND	ND	2.15	2.58	1.51

Table B3. continued PPCP in ambient water - 2009 (ng/L)

RM	Amitriptyline	Sertraline	Alprazolam	Enalapril	Methylprednisolone	Norverapamil	Verapamil	Acetaminophen	Fluticasone propionate	Ibuprofen
50	0.491	ND	0.422	ND	ND	ND	ND	ND	ND	ND
68.1	1.01	ND	0.456	ND	0.8	ND	ND	ND	ND	ND
80	1.17	ND	0.612	0.343	ND	ND	ND	ND	2.11	71.2
90	1.39	1.16	0.583	ND	ND	ND	0.287	105	2.06	76.6
105.4	0.834	0.636	0.375	ND	ND	ND	0.238	ND	2.31	30
131.1	0.759	0.692	ND	ND	ND	0.172	0.852	ND	2.69	ND

RM	Theophylline	2-Hydroxy-ibuprofen	Desmethyldiltiazem	10-hydroxy-amitriptyline	DEET	Thiabendazole
50	ND	ND	ND	ND	28.3	2.47
68.1	ND	113	1.31	ND	32.9	3.66
80	118	346	1.96	0.245	42.8	3.27
90	145	286	3.35	0.382	40.8	2.63
105.4	ND	ND	1.38	0.227	17.5	1.5
131.1	ND	ND	0.961	0.214	6.34	1.78

Table B.4. PPCP 2007 to 2009 mean ng/L

RM	Azithromycin	Caffeine	Carbamazepine	Clarithromycin	Codeine	Dehydronifedipine	Diltiazem	Diphenhydramine	Erythromycin-H_2O	Fluoxetine
50	ND	18	21	5	16	1	0	1	2	8
68.1	ND	50	47	ND	90	2	3	1	5	5
80	ND	107	56	2	12	2	9	1	9	ND
90	ND	159	43	8	9	2	11	3	10	ND
105.4	ND	72	24	6	6	1	4	2	4	ND
131.1	10	52	19	4	3	ND	3	5	3	ND

Table B5. Sterols and Hormones in ambient water - 2007 (ng/L)

RM	Estrone	Norethindrone	Coprostanol	Epicoprostanol	Cholesterol	Cholestanol	Desmosterol	Campesterol	Stigmasterol	beta-Sitosterol
50	ND	4.24	6.84	2.47	390	47.46	52.5	100.86	87	312
68.1	ND	ND	57.9	15	595	137.16	88.3	150.86	139	286
80	ND	ND	90	16.7	761	143.16	60.1	145.86	225	294
90	ND	ND	82.8	10.9	309	64.66	27.7	53.56	160	293
105.4	ND	ND	87.6	11.4	256	50.96	34.3	66.36	195	415
131.1	1.3	ND	198	15.3	643	67.16	49.6	73.16	198	534

ND= not detected

17α-ethinyl estradiol concentrations in 2007 were elevated by the presence of interference and are not reported.

Table B6. Sterols and Hormones in ambient water - 2008 (ng/L)

RM	Estrone	Norethindrone	Coprostanol	Epicoprostanol	Cholesterol	Cholestanol	Desmosterol	Campesterol	Stigmasterol
50	ND	ND	10.1	ND	766	55.5	94.7	226	86.4
68.1	ND	ND	22.5	6.35	904	110	105	350	175
80	ND	ND	50.9	12.3	1130	152	239	308	341
90	ND	ND	70.2	14.4	1220	115	343	281	322
105.4	ND	ND	67.4	10.8	2120	115	1250	546	396
131.1	ND	ND	267	18.1	1790	104	83	324	643

RM	17 alpha-Ethinyl-Estradiol	beta Stigmastanol	beta-Sitosterol	Ergosterol
50	ND	31.1	335	6.22
68.1	1.97	68	306	11.4
80	2.3	60	476	9.65
90	ND	43.4	403	ND
105.4	4.01	46.2	546	ND
131.1	2.4	39.3	856	6.44

ND= not detected

Table B7. Hormones in ambient water - 2009 (ng/L)

RM	Estrone	Norethindrone	17 alpha-Ethinyl-Estradiol	Desogestrel	17 alpha-Dihydroequilin	Equilenin	Equilin	17 beta-Estradiol
50	ND	ND	ND	242	ND	ND	ND	ND
68.1	ND	ND	ND	239	ND	ND	ND	ND
80	ND	ND	ND	ND	ND	ND	ND	ND
90	ND	ND	ND	ND	ND	ND	ND	ND
105.4	ND	ND	ND	ND	ND	ND	ND	ND
131.1	ND	ND	ND	ND	ND	ND	ND	ND

RM	17 alpha-Estradiol	Allyl Trenbolone	Androstenedione	Androsterone	Estriol	Mestranol	Norgestrel	Testosterone	Progesterone
50	ND	ND	ND	ND	ND	ND	ND	ND	ND
68.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
80	ND	ND	ND	ND	ND	ND	ND	ND	ND
90	ND	ND	ND	ND	ND	ND	ND	ND	ND
105.4	ND	ND	ND	ND	ND	ND	ND	ND	ND
131.1	ND	ND	ND	ND	ND	ND	ND	1.37	ND

ND= not detected

Table B8. PFASs (ng/L) in ambient water - 2007

	Liston Point RM 50	De. Mem Bridge RM 68.1	Marcus Hook Creek RM 80	Schuylkill R. RM 90	Pennsauken Creek RM 105.4	Biles Channel RM 131.1
Perfluorobutanoate (PFBA) C4	17.60	19.00	5.89	2.92	1.43	1.71
Perfluoropentanoate (PFPeA) C5	35.40	30.50	10.40	5.09	4.56	ND
Perfluorohexanoate (PFHxA) C6	57.90	79.80	16.20	6.00	3.59	1.40
Perfluoroheptanoate (PFHpA) C7	19.80	24.30	12.30	4.55	2.85	ND
Perfluorooctanoate (PFOA) C8	57.30	75.40	23.80	10.80	5.80	3.54
Perfluorononanoate (PFNA) C9	331.00	847.00	976.00	265.00	3.32	1.71
Perfluorodecanoate (PFDA) C10	6.97	9.97	4.62	2.07	1.11	ND
Perfluoroundecanoate (PFUnA) C11	2.42	8.92	26.00	7.22	ND	ND
Perfluorododecanoate (PFDoA) C12	ND	ND	ND	ND	ND	ND
Perfluorobutanesulfonate (PFBS) C4	2.79	2.34	ND	ND	ND	ND
Perfluorohexanesulfonate (PFHxS) C6	2.97	ND	4.48	4.12	ND	ND
Perfluorooctanesulfonate (PFOS) C8	5.96	7.27	7.05	8.42	7.49	2.70
Perfluorooctane sulfonamide (PFOSA) C8	ND	ND	ND	ND	ND	ND

ND= not detected

Table B9. PFASs (ng/L) in ambient water - 2008

	Liston Point RM 50	De. Mem Bridge RM 68.1	Marcus Hook Creek RM 80	Schuylkill R. RM 90	Pennsauken Creek RM 105.4	Biles Channel RM 131.1
Perfluorobutanoate (PFBA) C4	25.9	20.6	4.51	4.87	2.6	1.63
Perfluoropentanoate (PFPeA) C5	31.6	28.2	8.9	5.88	ND	ND
Perfluorohexanoate (PFHxA) C6	80.1	53.8	10.5	6.26	5.02	2.92
Perfluoroheptanoate (PFHpA) C7	16.3	15.4	7.23	4.51	2.72	2.03
Perfluorooctanoate (PFOA) C8	47.5	48	19.2	10.2	5.1	3.99
Perfluorononanoate (PFNA) C9	**301**	650	552	196	4.25	3.24
Perfluorodecanoate (PFDA) C10	5.25	6.21	2.33	1.69	ND	ND
Perfluoroundecanoate (PFUnA) C11	2.47	7.23	11.8	5.44	ND	ND
Perfluorododecanoate (PFDoA) C12	ND	ND	ND	ND	ND	ND
Perfluorobutanesulfonate (PFBS) C4	24.4	15.4	3.73	3.24	ND	ND
Perfluorohexanesulfonate (PFHxS) C6	2.12	3.55	2.1	3.17	ND	ND
Perfluorooctanesulfonate (PFOS) C8	6.16	11.7	10.9	10.5	6.71	3.53
Perfluorooctane sulfonamide (PFOSA) C8	ND	ND	ND	ND	ND	ND

ND= not detected

Table B10. PFASs (ng/L) in ambient water - 2009

	Liston Point RM 50	De. Mem Bridge RM 68.1	Marcus Hook Creek RM 80	Schuylkill R. RM 90	Pennsauken Creek RM 105.4	Biles Channel RM 131.1
Perfluorobutanoate (PFBA) C4	7.46	8.15	3.37	2.84	1.87	ND
Perfluoropentanoate (PFPeA) C5	13.8	11.7	3.98	3.17	2.23	1.34
Perfluorohexanoate (PFHxA) C6	40	47.4	6.54	6.07	5.45	3.27
Perfluoroheptanoate (PFHpA) C7	7.78	9.81	5.02	4.01	1.95	1.14
Perfluorooctanoate (PFOA) C8	20.4	27.7	16.4	11.5	5.37	3.29
Perfluorononanoate (PFNA) C9	108	338	546	240	3.68	1.65
Perfluorodecanoate (PFDA) C10	2.08	2.62	1.75	ND	ND	ND
Perfluoroundecanoate (PFUnA) C11	1.42	3.97	8.3	3.86	ND	ND
Perfluorododecanoate (PFDoA) C12	ND	ND	ND	ND	ND	ND
Perfluorobutanesulfonate (PFBS) C4	9.88	8.57	2.62	ND	ND	ND
Perfluorohexanesulfonate (PFHxS) C6	ND	2.74	3.62	3.05	2.89	ND
Perfluorooctanesulfonate (PFOS) C8	2.86	5.75	7.97	5.99	7	ND
Perfluorooctane sulfonamide (PFOSA) C8	ND	ND	ND	ND	ND	ND

ND= not detected

Table B11. PBDE in ambient water – 2007 (pg/L)

RM	DiBDE	TriBDE	TeBDE	PeBDE	HxBDE	HpBDE	OcBDE	NoBDE	DeBDE	tPBDE
50	4.06	8.34	10.88	12.1	7.56	ND	12.2	161	30	246
68.1	4.3	11.97	65.16	101.187	24.97	7.78	25.6	413	2,090	2,744
80	3.08	6.85	28.62	12.07	12.02	ND	11.4	13.3	ND	87
90	3.38	22.75	237.62	216.02	50.21	10.75	44.7	1161	7,630	9,376
105.4	1.95	16.22	119.59	108.65	21.8	6.45	32.1	608	3,170	4,085
131.1	ND	7.71	118.81	136.57	20.28	3.13	27.6	40.5	ND	355

ND= not detected

Table B12.Nonylphenols and Nonylphenol Ethoxylates in Ambient Water – 2007 (ng/L)

RM	NP	NP1EO
50	0.8	ND
68.1	87.6	18.4
80	34.6	17.6
90	17.7	24.6
105.4	43.1	39.8
131.1	20.7	7.97

NP = nonylphenol
NPEO1 = nonylphenol monoethoxylate

Appendix C: Aquatic Toxicity Data

Table C1: Aquatic Toxicology Data for Pharmaceuticals and Personal Care Products						
Parameter	acute EC_x or LC_x mg/L	chronic NOEC or ChV mg/L	Assessment Factor	PNEC ng/L	Organism	Source
1,7-dimethylxanthine	100		1000	100,000	Scenedesmus subspicatus	MSDS
1,7-dimethylxanthine	178		1000	178,000	Daphnia magna	MSDS
1,7-dimethylxanthine	100		1000	100,000	Leucisus idus	MSDS
2-hydroxy-ibuprofen	NA	NA				
10-hydroxy-amitriptyline	NA	NA				
acetaminophen	378		1000	378,000	Brachydanio rerio	Cunningham et al., 2006
Albuterol		1.3	100	13,000	Daphnid	ECOSAR (phenol amine)
Albuterol		2.591	100	25,910	Daphnid	ECOSAR (aliphatic amine)
alprazolam		0.018	100	180	Daphnid	ECOSAR (triazoles)
amitriptyline		0.017	100	170	Daphnid	ECOSAR
amoxicillin	0.0037		1000	4	Microcystis aeruginosa	Schmitt et al 2009
amphetamine		11.871	100	118,710	Daphnid	ECOSAR
Atenolol		3.2	100	32,000	Pimephales promelas	Winter et al, 2008
Atenolol		1.8	100	18,000	Daphnia magna	Kuster et al, 2010
azithromycin	>120		1000	120,000	Daphnid	Cunningham et al., 2006
azithromycin		1.023	100	10,230	fish	ECOSAR
benzoylecgonine		1.531	100	15,310	fish	ECOSAR (esters)
benzoylecgonine		24.708	100	247,080	Daphnid	ECOSAR (esters)
benzoylecgonine		5.81	100	58,100	green algae	ECOSAR (esters)
caffeine	151		1000	151,000	Pimephales	Cunningham et al., 2006
carbadox		38.699	100	386,990	fish	ECOSAR
carbamazepine		0.377	100	3,770	Brachionus calyciflorus	Ferrari et al., 2003
carbamazepine		0.025	100	250	Ceriodaphnia	Ferrari et al., 2003

Parameter	acute EC_x or LC_x mg/L	chronic NOEC or ChV mg/L	Assessment Factor	PNEC ng/L	Organism	Source
carbamazepine	25.5		1000	25,500	Lemna minor	Cleuvers, 2003
ciprofloxacin		0.106	100	1,060	Lemna gibba	Crane et al., 2006
ciprofloxacin	0.005		1000	5	Microcystis aeruginosa	Schmitt et al 2009
clarithromycin	0.002		1000	2	algae	Cunningham et al., 2006
clarithromycin	18.66		1000	18,660	Ceriodaphnia	Cunningham et al., 2006
clarithromycin	0.002		1000	2	Pseudokirchneriella subcapitata	Schmitt et al. 2009
cocaine	5.482		1000	5,482	Daphnid	ECOSAR
codeine	7.438		1000	7,438	Fish	ECOSAR (vinyl/allyl alcohol)
codeine	0.976		1000	976	Daphnid	ECOSAR (vinyl/allyl alcohol)
codeine		18.345	100	183,450	green algae	ECOSAR (aliphatic amines)
cotinine		12.95	100	129,500	fish	ECOSAR (aliphatic amines)
cotinine		1.425	100	14,250	Daphnid	ECOSAR (aliphatic amines)
cotinine		5.732	100	57,320	green algae	ECOSAR (aliphatic amines)
cotinine		1000	100	10,000,000	Lemna gibba	Brain et al, 2004 (max test conc)
DEET		0.091	100	910	fish	ECOSAR
dehydronifedipine	NA	NA				
Desmethyl-diltiazem	NA	NA				
digoxigenin		70.837	100	708,370	Daphnid	ECOSAR
digoxin		<0.01	100	100	Hydra vulgaris	Crane et al., 2006
diltiazem		0.092	100	920	fish	ECOSAR (amines)
diphenhydramine		1.289	100	12,890	Daphnid	ECOSAR
enalapril		220	100	2,200,000	green algae	ECOSAR
enrofloxacine		123	100	1,230,000	green algae	ECOSAR
erythromycin hydrate	0.94		1000	940	Brachionus calcyciflous	Cunningham et al., 2006

Parameter	acute EC_x or LC_x mg/L	chronic NOEC or ChV mg/L	Assessment Factor	PNEC ng/L	Organism	Source
erythromycin hydrate	0.02		1000	20	Pseudokirchneriella subcapitata	Cunningham et al., 2006
fluoxetine	0.0001		1000	0.10	Gammurus pulex	Schmitt et al, 2009
fluoxetine		0.00064	100	6.4	Potamopyrgus antipodarum	Schmitt et al 2009
fluoxetine		0.0006	100	6	Desmodesmus subspicatus	Oakes et al., 2010
fluoxetine		0.089	100	890	Daphnid	Oakes et al., 2010
fluticasone propionate	NA	NA				
furosemide		1.216	100	12,160	fish	ECOSAR (amides - acids)
furosemide		38.677	100	386,770	Daphnid	ECOSAR (amides - acids)
furosemide		21.238	100	212,380	green algae	ECOSAR (amides - acids)
gemfibrozil	74.3		1000	74,300	Daphnia magna	CCEHBR
gemfibrozil	0.53		1000	530	Ceriodaphnia	CCEHBR
gemfibrozil	0.44		1000	440	Brachionus calyciflorus	CCEHBR
Hydrocodone		9.37	100	93,700	Daphnid	ECOSAR
ibuprofen	0.00001		1000	0.01	Gammarus pulex	Schmitt et al, 2009
ibuprofen	0.001		1000	1.00	Lemna minor	Schmitt et al 2009
ibuprofen				1,000.00		pers.com. Dan Caldwell
lincomycin	0.07		1000	70	Pseudokirchneriella subcapitata	Cunningham et al., 2006
lincomycin	0.68		1000	680	Brachionus calyciflorus	Cunningham et al., 2006
Meprobamate		10.674	100	106,740	fish	ECOSAR (esters)
Meprobamate		243.393	100	2,433,930	Daphnid	ECOSAR (esters)
Meprobamate		24.473	100	244,730	green algae	ECOSAR (esters)
Metformin	110		1000	110,000	Lemna	Cleuvers 2003
Metformin	64		1000	64,000	Daphnia magna	Cleuvers 2003
Metformin	130		1000	130,000	Daphnid	CCEHBR

Parameter	acute EC_x or LC_x mg/L	chronic NOEC or ChV mg/L	Assessment Factor	PNEC ng/L	Organism	Source
Metformin	110		1000	110,000	Daphnia magna	pers.com. Dan Caldwell
Metformin	110		1000	110,000	Pseudokirchneriella	pers.com. Dan Caldwell
Metformin		100	100	1,000,000	Daphnia magna	pers.com. Dan Caldwell recommended
Metformin		10.3	100	103,000	Brachydanio rerio	pers.com. Dan Caldwell
Methylprednisolone		39.231	100	392,310	fish	ECOSAR
Metoprolol	7.3		1000	7,300	Desmodesmus subspicatus	Cleuvers, 2003
naproxen	24.2		1000	24,200	Lemna minor	Cleuvers, 2003
naproxen	174		1000	174,000	Daphnia	Cleuvers, 2003
norfloxacin		0.206	100	2,060	Lemna gibba	Crane et al., 2006
norverapamil	NA	NA				
ofloxacin		0.005	100	50	Synechococcus (cyanobacteria)	Ferrari et al., 2004
oxycodone		42.895	100	428,950	fish	ECOSAR (aliphatic amines)
oxycodone		3.304	1000	3,304	Daphnid	ECOSAR (aliphatic amines)
oxycodone		15.584	1000	15,584	green algae	ECOSAR (aliphatic amines)
Propoxyphene		0.338	100	3,380	fish	ECOSAR
Ranitidine	150		1000	150,000	algae	MSDS
sertraline		0.034	100	340	fish	ECOSAR
sulfachloropyridazine	2.3		1000	2,300	Lemna minor	Schmitt et al 2009
sulfadiazine	221		1000	221,000	Lemna minor	Crane et al., 2006
sulfadimethoxine		0.1	100	1,000	Lemna gibba	ECOTOX
sulfadimethoxine	19.49		1000	19,490	Artemia	ECOTOX
sulfamethazine	>1.0		1000	1,000	Lemna gibba	Crane et al., 2006
sulfamethoxazole		0.25	100	2,500	Ceriodaphnia	Ferrari et al., 2004
sulfamethoxazole		0.0059	100	59	Synechococcus (cyanobacteria)	Ferrari et al., 2004

Parameter	acute EC_x or LC_x mg/L	chronic NOEC or ChV mg/L	Assessment Factor	PNEC ng/L	Organism	Source
sulfanilamide	14		1000	13,700	Daphnia magna	ECOTOX
sulfanilamide		1	100	10,000	Oryzia latipes	ECOTOX
sulfathiazole		0.923	100	9,230	fish	ECOSAR
theophylline	100		1000	100,000	Leuciscus idus	MSDS
theophylline	178		1000	178,000	Daphnia magna	MSDS
thiabendazole		0.012	100	120	rainbow trout	MSDS
thiabendazole		0.11	100	1,100	fathead minnow	MSDS
thiabendazole	0.55		1000	550	rainbow trout	MSDS
Triamterene		56	100	560,000	Daphnid	ECOSAR
triclocarban		0.000056	100	0.56	Americamysis bahia	ECOTOX
triclocarban		0.00025	100	2.50	Daphnid	ECOTOX
trimethoprim		1	100	10,000	Lemna gibba	ECOTOX
trimethoprim		6	100	60,000	Daphnia magna	ECOTOX
tylosin		22.4	100	224,000	Brachionus plicatilus	ECOTOX
tylosin		22.4	100	224,000	Brachionus calyciflorus	ECOTOX
tylosin		45	100	450,000	Daphnia magna	ECOTOX
tylosin		1	100	10,000	Lemna gibba	ECOTOX
valsartan		58	100	580,000	green algae	FDA Novartis EA 2009
valsartan		280	100	2,800,000	Daphnia magna	FDA Novartis EA 2009
valsartan		100	100	1,000,000	Salmo gairdneri	FDA Novartis EA 2009
verapamil		0.029	100	290	Daphnid	ECOSAR

EC_{50} – effective concentration of the tested chemical at which mortality or immobility occurs at 50 % of organisms

LC_{50} -lethal concentration of the tested chemical at which mortality occurs at 50 % of organisms

NOEC – no observed effect concentration

ChV – chronic value is the geometric mean of the no observed effect concentration (NOEC) and the lowest observed effect concentration (LOEC) as reported in ECOSAR

Aquatic Toxicity Source References

Databases used:

US EPA ECOTOX, which currently includes more than 520,000 test results on the effects of more than 8,500 chemicals, including PPCPs, on over 6,400 terrestrial and aquatic species (http://cfpub.epa.gov/ecotox/);

Center for Coastal Environmental Health and Bimolecular Research (CCEHBR) Pharmaceuticals in the Environment, Information for Assessing Risk (PEIAR) website. A site designed to provide available information for assessing risks to aquatic resources from drugs entering waterways from both point and non-point sources (http://www.chbr.noaa.gov/peiar/default.aspx);

ECOSAR (Ecological Structure Activity Relationship) a computerized predictive system that estimates the aquatic toxicity of chemicals. The program estimates a chemical's acute (short-term) toxicity and chronic (long-term or delayed) toxicity to aquatic organisms such as fish, aquatic invertebrates, and aquatic plants by using Structure Activity Relationships (SARs) (http://www.epa.gov/oppt/newchems/tools/21ecosar.htm);

FDA Novartis EA 2009 Environmental Assessment Report, NDA 22-217, Aliskiren/Valsartan Film-Coated Tablets. http://www.accessdata.fda.gov/drugsatfda_docs/nda/2009/022217s000ea.pdf

Material Safety Data Sheets (MSDS) prepared by the manufacturer of a product for the purpose of providing information on the safe use, handling and potential hazards of a product;

TCC Consortium. High Production Volume (HPV) Chemical Challenge Program Data Availablility and Screening Level Assessment for Triclocarban, CAS#:101-20-2. (http://www.epa.gov/hpv/pubs/summaries/tricloca/c14186tc.htm); and

USEPA PPCP Literature Citation Database includes published literature relevant to the issues surrounding PPCPs as environmental contaminants (http://www.epa.gov/ppcp/lit.html).

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Table C2. Risk Characterization of DRBC Contaminants of Emerging Concern 2007 Survey					
Parameter	MEC ng/L	PNEC ng/L	Hazard Quotient	Quotient > 0.1 Priority	Quotient >1.0 Higher Priority
azithromycin	4.96	120,000	0.00	FALSE	FALSE
azithromycin	4.96	10,230	0.00	FALSE	FALSE
caffeine	72.2	151,000	0.00	FALSE	FALSE
carbamazepine	60.4	3,770	0.02	FALSE	FALSE
carbamazepine	60.4	250	0.24	TRUE	FALSE
carbamazepine	60.4	25,500	0.00	FALSE	FALSE
clarithromycin	10.9	2	5.4500	TRUE	TRUE
clarithromycin	10.9	18,660	0.00	FALSE	FALSE
clarithromycin	10.9	2	5.45	TRUE	TRUE
codeine	159	7,438	0.02	FALSE	FALSE
codeine	159	976	0.16	TRUE	FALSE
codeine	159	183,450	0.00	FALSE	FALSE
dehydronifedipine	2.97	NA			
diltiazem	12.8	920	0.01	FALSE	FALSE
diphenhydramine	4.56	12,890	0.00	FALSE	FALSE
erythromycin hydrate	14.9	940	0.02	FALSE	FALSE
erythromycin hydrate	14.9	20	0.75	TRUE	FALSE
fluoxetine	8.02	0.1	80.20	TRUE	TRUE
fluoxetine	8.02	6	1.25	TRUE	TRUE
fluoxetine	8.02	6	1.34	TRUE	TRUE
fluoxetine	8.02	890	0.01	FALSE	FALSE
gemfibrozil	44.3	74,300	0.00	FALSE	FALSE
gemfibrozil	44.3	530	0.08	FALSE	FALSE
gemfibrozil	44.3	440	0.10	TRUE	FALSE
ibuprofen	15.9	0.01	1590.00	TRUE	TRUE
ibuprofen	15.9	1	15.90	TRUE	TRUE
ibuprofen	15.9	1,000	0.02	FALSE	FALSE
naproxen	27.9	24,200	0.001153	FALSE	FALSE
naproxen	27.9	174,000	0.00016	FALSE	FALSE
norfloxacin	9.7	2,060	0.00	FALSE	FALSE
ofloxacin	1.6	50	0.03	FALSE	FALSE
Parameter	MEC	PNEC	Hazard	Quotient	

	ng/L	ng/L	Quotient	> 0.1 Priority	Quotient >1.0 Higher Priority
sulfadiazine	2.91	221,000	0.00	FALSE	FALSE
sulfadimethoxine	1.64	1,000	0.00	FALSE	FALSE
sulfadimethoxine	1.64	19,490	0.00	FALSE	FALSE
sulfamethoxazole	150	2,500	0.06	FALSE	FALSE
sulfamethoxazole	150	59	2.54	TRUE	TRUE
sulfanilamide	16.6	13,700	0.001212	FALSE	FALSE
sulfanilamide	16.6	10,000	0.00166	FALSE	FALSE
triclocarban	6.54	0.56	11.67857	TRUE	TRUE
triclocarban	6.54	2.5	2.616	TRUE	TRUE
trimethoprim	16.6	10,000	0.00	FALSE	FALSE
trimethoprim	16.6	60,000	0.00	FALSE	FALSE

MEC = measured environmental concentration
PNEC = predicted no effect concentration most sensitive species
Hazard Quotient = MEC/PNEC
NA = not available

Table C3. Risk Characterization of DRBC Contaminants of Emerging Concern 2008 Survey

Parameter	MEC ng/L	PNEC ng/L	Hazard Quotient	Quotient > 0.1 Priority	Quotient >1.0 Higher Priority
1,7-dimethylxanthine	239	100,000	0.00239	FALSE	FALSE
1,7-dimethylxanthine	239	100,000	0.00239	FALSE	FALSE
1,7-dimethylxanthine	239	178,000	0.0013427	FALSE	FALSE
Albuterol	0.711	13,000	7.9888E-07	FALSE	FALSE
caffeine	166.1	151,000	0.0011	FALSE	FALSE
carbadox	7.48	386,990	1.9329E-05	FALSE	FALSE
carbamazepine	67.3	3,770	0.01785146	FALSE	FALSE
carbamazepine	67.3	250	0.2692	TRUE	FALSE
carbamazepine	67.3	25,500	0.00263922	FALSE	FALSE
clarithromycin	2.65	2	1.325	TRUE	TRUE
clarithromycin	2.65	18,660	0.00014202	FALSE	FALSE
codeine	72.7	7,438	0.01628584	FALSE	FALSE
codeine	72.7	976	0.0744877	FALSE	FALSE
codeine	72.7	183,450	0.00039629	FALSE	FALSE
codeine	72.7	129,500	0.00056139	FALSE	FALSE
cotinine	35.6	129,500	0.0002749	FALSE	FALSE
cotinine	35.6	14,250	0.00249825	FALSE	FALSE
cotinine	35.6	57,320	0.00062107	FALSE	FALSE
cotinine	35.6	10,000,000	0.00000356	FALSE	FALSE
dehydronifedipine	2.19	708,370	3.0916E-06	FALSE	FALSE
diltiazem	9.83	920	0.00076261	FALSE	FALSE
diphenhydramine	3.64	12,890	0.00028239	FALSE	FALSE
erythromycin hydrate	6.23	940	0.00662766	FALSE	FALSE
erythromycin hydrate	6.23	20	0.3115	TRUE	FALSE
fluoxetine	5.4	0	54	TRUE	TRUE
fluoxetine	5.4	6	0.84375	TRUE	FALSE
fluoxetine	5.4	6	0.9	TRUE	FALSE
fluoxetine	5.4	890	0.00606742	FALSE	FALSE
gemfibrozil	24.9	100,000	0.000249	FALSE	FALSE
lincomycin	37.4	70	0.53428571	TRUE	FALSE
lincomycin	37.4	680	0.055	FALSE	FALSE
Metformin	3590	110,000	0.03263636	FALSE	FALSE
Metformin	3590	64,000	0.05609375	FALSE	FALSE
Metformin	3590	130,000	0.02761538	FALSE	FALSE
Metformin	3590	110,000	0.03263636	FALSE	FALSE
Metformin	3590	110,000	0.03263636	FALSE	FALSE
Metformin	3590	1,000,000	0.00359	FALSE	FALSE
Metformin	3590	103,000	0.03485437	FALSE	FALSE

Parameter	MEC ng/L	PNEC ng/L	Hazard Quotient	Quotient > 0.1 Priority	Quotient >1.0 Higher Priority
naproxen	26.2	24,200	0.00108264	FALSE	FALSE
naproxen	26.2	174,000	0.00015057	FALSE	FALSE
Ranitidine	0.922	1,000	0.000922	FALSE	FALSE
sulfadimethoxine	0.485	1,000	0.000485	FALSE	FALSE
sulfadimethoxine	0.485	19,490	2.4885E-05	FALSE	FALSE
sulfamethoxazole	2.35	2,500	0.00094	FALSE	FALSE
sulfamethoxazole	2.35	59	0.03983051	FALSE	FALSE
thiabendazole	73.6	120	0.61333333	TRUE	FALSE
thiabendazole	73.6	1,100	0.06690909	FALSE	FALSE
thiabendazole	73.6	550	0.13381818	TRUE	FALSE
triclocarban	8.53	1	15.2321429	TRUE	TRUE
triclocarban	8.53	3	3.412	TRUE	TRUE
trimethoprim	13.1	10,000	0.03983051	FALSE	FALSE
trimethoprim	13.1	60,000	0.03983051	FALSE	FALSE

MEC = highest measured environmental concentration
PNEC = predicted no effect concentration most sensitive species
Hazard Quotient = MEC/PNEC
NA = not available

Table C4. Risk Characterization of DRBC Contaminants of Emerging Concern 2009 Survey

Parameter	MEC ng/L	PNEC ng/L	Hazard Quotient	Quotient > 0.1 Priority	Quotient >1.0 Higher Priority
2-hydroxy-ibuprofen	346	NA			
10-hydroxy-amitriptyline	0.382	NA			
acetaminophen	105	100	1.05	TRUE	TRUE
Albuterol	0.996	13,000	0.00	FALSE	FALSE
Alprazolam	0.612	180	0.00	FALSE	FALSE
Amitriptyline	1.39	170	0.01	FALSE	FALSE
Amphetamine	5.53	118,710	0.00	FALSE	FALSE
Atenolol	58.8	32,000	0.00	FALSE	FALSE
Atenolol	58.8	18,000	0.00	FALSE	FALSE
azithromycin	14.1	120,000	0.0001175	FALSE	FALSE
azithromycin	14.1	10,230	0.0013783	FALSE	FALSE
Benzoylecgonine	39.6	15,310	0.00258654	FALSE	FALSE
caffeine	238	151,000	0.00	FALSE	FALSE
carbadox	7.48	386,990	1.9329E-05	FALSE	FALSE
carbamazepine	39.2	3,770	0.01	FALSE	FALSE
carbamazepine	39.2	250	0.16	TRUE	FALSE
carbamazepine	39.2	25,500	0.00	FALSE	FALSE
clarithromycin	11.6	2	5.80	TRUE	TRUE
clarithromycin	11.6	18,660	0.00	FALSE	FALSE
clarithromycin	11.6	2	5.80	TRUE	TRUE
cocaine	2.58	5,482	0.00	FALSE	FALSE
codeine	38.2	7,438	0.01	FALSE	FALSE
codeine	38.2	976	0.04	FALSE	FALSE
codeine	38.2	18,345	0.00	FALSE	FALSE
cotinine	38.2	1,000	0.04	FALSE	FALSE
DEET	42.8	900	0.05	FALSE	FALSE
dehydronifedipine	1.41	NA			
Desmethyldiltiazem	3.35	NA			
diltiazem	9.51	920	0.01	FALSE	FALSE
diphenhydramine	7.68	12,890	0.00	FALSE	FALSE
Enalapril	0.343	2,200,000	0.00	FALSE	FALSE
erythromycin hydrate	9.24	940	0.01	FALSE	FALSE
erythromycin hydrate	9.24	20	0.46	TRUE	FALSE
Fluticasone propionate	2.69	NA			
gemfibrozil	53.9	440	0.12	TRUE	FALSE

Parameter	MEC ng/L	PNEC ng/L	Hazard Quotient	Quotient > 0.1 Priority	Quotient >1.0 Higher Priority
Hydrocodone	16.2	93,700	0.00	FALSE	FALSE
ibuprofen	76.6	0.01	7660.00	TRUE	TRUE
ibuprofen	76.6	1	76.60	TRUE	TRUE
ibuprofen	76.6	1,000	0.08	FALSE	FALSE
Meprobamate	38.2	106,740	0.00	FALSE	FALSE
Meprobamate	38.2	244,730	0.00	FALSE	FALSE
Metformin	1140	110,000	0.01	FALSE	FALSE
Metformin	1140	64,000	0.02	FALSE	FALSE
Metformin	1140	130,000	0.01	FALSE	FALSE
Metformin	1140	110,000	0.01	FALSE	FALSE
Metformin	1140	110,000	0.01	FALSE	FALSE
Metformin	1140	1,000,000	0.00	FALSE	FALSE
Metformin	1140	103,000	0.01	FALSE	FALSE
Methylprednisolone	0.8	392,310	0.00	FALSE	FALSE
Metoprolol	42.4	7,300	0.01	FALSE	FALSE
naproxen	67.5	24,200	0.00	FALSE	FALSE
Norverapamil	0.172	NA			
oxycodone	53.1	3,304	0.02	FALSE	FALSE
Propoxyphene	2.96	3,380	0.00	FALSE	FALSE
Ranitidine	3.18	150,000	0.00	FALSE	FALSE
Sertraline	1.16	340	0.00	FALSE	FALSE
sulfadimethoxine	1.42	1,000	0.00	FALSE	FALSE
sulfamethoxazole	88.8	2,500	0.04	FALSE	FALSE
sulfamethoxazole	88.8	59	1.51	TRUE	TRUE
sulfathiazole	2.35	9,230	0.00	FALSE	FALSE
theophylline	145	116,750	0.00	FALSE	FALSE
thiabendazole	3.66	10,000	0.00	FALSE	FALSE
thiabendazole	3.66	1,000	0.00	FALSE	FALSE
Triamterene	4.47	560,000	0.00	FALSE	FALSE
triclocarban	10.7	0.56	19.11	TRUE	TRUE
triclocarban	10.7	2.50	4.28	TRUE	TRUE
trimethoprim	20.3	10,000	0.00	FALSE	FALSE
trimethoprim	20.3	60,000	0.00	FALSE	FALSE
valsartan	97.6	90,000		FALSE	FALSE
Verapamil	0.852	290	0.00	FALSE	FALSE

MEC = measured environmental concentration
PNEC = predicted no effect concentration most sensitive species
Hazard Quotient = MEC/PNEC
NA = not available

Appendix D: Bioassays

Short-term Chronic Toxicity Tests

Bioassays were included in the study because they assess chemical mixtures and possible additive effects as well as assess toxicants with no specific analytical detection method or chemicals that are not being monitored by chemical methods used in the study. Concurrent with sampling for contaminants of emerging concern in years 2007 and 2008, short-term chronic toxicity tests were conducted with ambient water from the six sampling stations in the main-stem river as described in the contaminants of emerging concern sampling . Samples were split and transported on the day collected to the respective laboratories for toxicity testing and physical-chemical analysis. Samples for toxicity testing were transported to American Aquatic Testing Laboratory Inc., Allentown, PA. Following USEPA Methods, short-term chronic toxicity tests were performed using *Pimephales promelas*, *Americamysis bahia*, *Menidia beryllina*, and *Ceriodaphnia dubia* in 7-day tests; *Pseudokirchneriella subcapitata* in a 96-hour test; and Hyalella azteca in a 10-day water-only test. Test organism survival, growth, and when possible, reproduction were measured (USEPA 2000, 2002a and 2002b) (Table C1). Results from this study indicate that water collected from six main-stem sites in the tidal Delaware River Basin caused little or no significant adverse effects for the endpoints measured in short-term chronic toxicity tests for the species tested. Survival, growth and reproduction results indicated the lack of effects (MacGillivray et al., 2011). Bioassays can provide a cost effective approach for prioritization of monitoring surface water quality in a large watershed providing information for environmental management over the largest time scale and spatial coverage with limited resources. Using bioassays, sites that exhibit harmful effects can be targeted for additional evaluation using more expensive chemical analysis, toxicity identification evaluation and toxicity reduction evaluation.

Table D1. Mainstem toxicity bioassays[a]

Site	River Mile	Latitude Longitude	Salinity ppt	2007	2008
E1	50	39.455 -75.56	11.4 – 15.5	Ab, Mb, Ha	Ab, Mb, Ha
E4	68.1	39.65472 -75.54667	4.3 – 4.9	Ab, Mb, Ha	Pp, Cd, Ps
E7	80	39.81336 -75.39058	0.9 – 1.6	Pp, Cd, Ps	Pp, Cd, Ps
E9	90	39.8835 -75.18616	<1	Pp, Cd, Ps	Pp, Cd, Ps
E12	105.4	39.99478 -75.05978	<1	Pp, Cd, Ps	Pp, Cd, Ps
E16	131.1	40.18156 -74.74505	<1	Pp, Cd, Ps	Pp, Cd, Ps

[a]Abbreviations for bioassays are Ab (*A. bahia),* Mb (*M. beryllina), Ha (H. azteca), Pp (P. promelas), Cd (C. dubia), and Ps (P. subcapitata)*
Sampling occurred on October 15 and 17, 2007 and August 4, 6, 8 and 11, 2008.

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MacGillivray, AR, DE Russell, SS Brown, TJ Fikslin, R Greene, RA Hoke , C Nally and L O'Donnell. 2011. Monitoring the Tidal Delaware River for Ambient Toxicity. Integr. Environ. Assess. Manag.: 7 (3) 466-477.

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Assays for Estrogenic Compounds

A number of the compounds detected in the 2007 pilot study have been proven or suspected to be estrogenic including hormones and nonylphenols. Therefore, as part of a weight of evidence approach to environmental assessment, the 2008 study included both chemical analysis for contaminants of emerging concern and bioassays for estrogenicity. The bioassays were included because they assess chemical mixtures and possible additive effects as well as assess toxicants with no specific analytical detection method or chemicals that are not being monitored by chemical methods used in the study. Affordable bioassays integrated with more costly analytical testing can provide a cost effective approach for monitoring surface water quality for endocrine disrupting activity (Quiros. *et al*., 2005). Samples were collected for estrogenicity bioassays at six sites. Ambient water samples were split and transported on the day collected to the respective laboratories for bioassays and physical-chemical analysis. Samples for estrogenic compounds assays were shipped to the University of Pittsburgh. The extraction process described in Soto et al. (2004) was followed. Each water sample was processed in 250 mL fractions. The fraction was poured onto a 1 liter separatory funnel. Fifteen mLs of dichloromethane (DCM) was added to each fraction. The separatory funnel was vigorously shaken for 2 minutes and allowed to settle for 15 minutes. The DCM is heavier than water and sinks to the bottom of the funnel where it is removed. This process was repeated two more times for a total of three extractions for each fraction. The DCM from each water sample was combined and concentrated using nitrogen and an NEVAP evaporator (Organomation Associates, Berlin, MA, USA) maintained at 40°C. The residue was suspended in 1 mL ethanol: glycerol (70:30) and stored at -20C, under nitrogen, until tested in the both assays. The efficiency of this extraction procedure was tested by adding a known quantity of tritiated estradiol to distilled water. Following the above procedure, recoveries of 88 to 92% of the tritiated estradiol was obtained. The ambient water was tested in two types of bioassaysE-screen assay and estrogen receptor binding assay (Soto *et al*, 2004; Eagon *et al*. 1980; Porter *et al*., 1983; Rogerson and Eagon, 1986).

E-Screen Assay

The E-Screen assay utilized three human breast cancer cell lines, MCF-7 which is mostly estrogen receptor (ER)-alpha positive, T47D which is mostly ER-beta positive and BT-20 which is ER-negative as described in Soto et al, (2004). This assay was performed in phenol-red free RPMI supplemented with charcoal-dextran stripped fetal bovine serum. After 72 hours of exposure to various concentrations (1/4000, 1/3000, 1/1500, 1/1000, 1/500, 1/200, and 1/100) of ambient river water water in steroid-free medium, the 96-well plates were stained using sulforhodamine B and absorbance at 564 nm was measured

using a plate reader. In the E-screen assay, none of the cell lines exhibited a proliferative response to extracts derived from water samples RM 50, RM 68.1, RM 80, RM90, and Blank. MCF-7 did exhibit a weak response, at higher concentrations (1/200 and 1/100) of extract derived from water samples RM 105.4 and RM 131.1. This response was muted with 1x10-6M 4-hydroxytamoxifen, an ER blocker, suggesting this is an estrogenic response. MCF-7 exhibited an antagonistic response, again at higher concentrations, to sample RM 131.1 in the presence of 1x10-9M E2. T47D exhibited an antagonistic response at higher concentrations (1/200, and 1/100) to samples RM 105.4 and RM 131.1 in the presence of 1x10-9M E2. BT-20, the negative control cell line, did not respond to any of the test conditions. This indicates the absence of non-specific growth factors and cytotoxic compounds (Table C2)

Table D2. Summary of E-Screen Assay

	RM 50	RM 68.1	RM 80	RM 90	RM 105.4	RM 131.1	Blank
MCF-7	-	-	-	-	-/+	-/+	-
MCF-7+E2	-	-	-	-	-	*	-
T47D	-	-	-	-	-	-	-
T47D+E2	-	-	-	-	*	*	-
BT-20	-	-	-	-	-	-	-
BT-20+E2	-	-	-	-	-	-	-

Key:
-: No Response
-/+: Weak Response
+: Moderate Response
++: Strong Response
*: Antagonistic Response

Competitive ER-Binding Assay

The competitive in vitro estrogen receptor (ER) binding assay, previously described by Porter et al. (1983), Rogerson et al. (1986), and Eagon et al. (1980), is used to identify the presence of estrogenic compounds that can bind to the ER. Aliquots of cytosol were prepared using either mature rabbit uteri as a source of ER-alpha or male rat prostate as a source of ER-beta. The cytosols were incubated with 5nM [3H]-E2 in the absence (control) and presence of ambient river water extracts along with standards of known estrogenic potency such as estradiol (E2) and diethylstilbestrol (DES), a potent estrogen. The cytosol, [3H]-E2, and various concentrations (1/20, 1/5, 1/1) of sample were combined and allowed to incubate over night at 4^0C. The next morning, the bound ligand was separated from the free ligand using P6 resin spin columns. The effluent passing through the spin column was added to scintillation vials containing 8 mLs of Biosafe II counting cocktail. The disintegrations per minute (DPMs) was measured using a beta counter. The mean DPMs for each test condition were calculated. The lower the DPMs the more displacement that has taken place suggesting that the test agent is estrogenic. Generally, the greater the competition of the water, as expressed relative to the results of control binding in the absence of river water, the greater the likelihood the sample contains an estrogenic compound. The Competitive ER-alpha binding assay measures the displacement of tritiated estradiol ([3H]-E2) from estrogen receptor. The cell proliferation assay quantitating growth of hormone-sensitive cells based on three human breast cancer cell lines BT-20, MCF-7 and T47D in the presence and absence of estradiol as described in Soto et al., (2004). The screening level assays for estrogenic compounds

indicated either low concentrations or weak effects for the ambient water sampled from the tidal Delaware River. All of the river water samples tested were at least weak estrogen competitors and that some of the samples were strong competitors (Table C3). In addition, the samples are arranged based on the strength of competition in Table C4. At the 1/1 dilution of the water sample, the samples fall into three groups. Samples from RM 68.1 and the blank were weak estrogen competitors, while samples from RM 131.1, RM 105.4 and RM 50 were moderate estrogen competitors and finally, E7 was a strong competitor. Future monitoring should include assays for estrogenic compounds in fish tissue where bioaccumulation of estrogenic compounds may occur causing a stronger response to be observed.

Table D3. Summary of Competitive ER-alpha Binding Assay (DPM)

River Mile	1/20 Dilution	1/5 Dilution	1/1 Dilution
50	0.80 (-/+)	0.76 (+)	0.58 (+)
68.1	0.80 (-/+)	0.86 (-/+)	0.84 (-/+)
80	0.81 (-/+)	0.68 (+)	0.54 (+/++)
90	0.72 (+)	NR	NR
105.4	0.86 (-/+)	0.76 (+)	0.68 (+)
131.1	0.79 (+)	0.82 (-/+)	0.74 (+)
Blank	0.86 (-/+)	0.83 (-/+)	0.80 (-/+)

- : No Competition (100% - 90% of Control)
-/+: Weak Competition (89% - 80% of Control)
+: Moderate Competition (79% - 55% of Control)
++: Strong Competition (<=55% of Control)
NR – not reported
DPM – disintegrations per minute

Table D4. Samples Arranged by Concentration and Increasing ER-alpha Competition (DPM)

1/20 Dilution	1/5 Dilution	1/1 Dilution
105.4 0.86 (-/+)	RM 68.1 0.86 (-/+)	RM 68.1 0.84 (-/+)
Blank 0.86 (-/+)	Blank 0.83 (-/+)	Blank 0.80 (-/+)
RM 80 0.86 (-/+)	RM 131.1 0.82 (-/+)	RM 131.1 0.74 (+)
RM 50 0.80 (-/+)	RM 50 0.76 (+)	RM 105.4 0.68 (+)
RM 68.1 0.80 (-/+)	RM 105.4 0.76 (+)	RM 50 0.58 (+)
RM 131.1 0.79 (+)	RM 80 0.68 (+)	RM 80 0.54 (++)

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MILITARY MUNITIONS RESPONSE PROGRAM

REMEDIAL INVESTIGATION WORK PLAN/UNIFORM FEDERAL POLICY-QUALITY ASSURANCE PROJECT PLAN (UFP-QAPP):
RIVER ROAD TRAINING SITE
DELAWARE ARMY NATIONAL GUARD NEW CASTLE, DELAWARE

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111 S. George Mason Drive
Arlington, Virginia 22204

Submitted by

URS Group, Inc.
12420 Milestone Center Drive, Suite 150
Germantown, MD 20876

Contract No. W912DR-09-D-0003
Delivery Order No. 0009

March 2014

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REMEDIAL INVESTIGATION WORK PLAN/ UNIFORM FEDERAL POLICY-QUALITY ASSURANCE PROJECT PLAN (UFP-QAPP): RIVER ROAD TRAINING SITE DELAWARE ARMY NATIONAL GUARD NEW CASTLE, DELAWARE

FINAL

Submitted to:

USACE, Baltimore District
10 South Howard Street
Baltimore, MD 21201

and

Army National Guard Directorate
Arlington Hall Station
111 S. George Mason Drive
Arlington, VA 22204

Submitted by:

URS Group, Inc.
12420 Milestone Center Drive, Suite 150
Germantown, MD 20876

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LIST OF ACRONYMS AND ABBREVIATIONS

%R	Percent Recovery
ADR	Automated Data Review
AES	Atomic Emission Spectrometry
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
AUF	Area Use Factor
AVS	Acid Volatile Sulfide
BAF	Bioaccumulation Factor
BAZ	Biologically Active Zone
BERA	Baseline Ecological Risk Assessment
BLS	Below Land Surface
BTAG	Biological Technical Assistance Group
BW	Body Weight
CA	Corrective Action
CAR	Corrective Action Report
CAS	Chemical Abstract Service
CBR	Critical Body Residue
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CD	Compact Disc
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CoC	Chain-of-Custody
COC	Chemical of Concern
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
COR	Contracting Officer Representative
CRDL	Contract Required Detection Limit
CSM	Conceptual Site Model
CTT	Closed, Transferring, and Transferred
CWM	Chemical Warfare Material
DEARNG	Delaware Army National Guard
DI	Deionized
DL	Detection Level
DMM	Discarded Military Munitions
DNREC	Delaware Department of Natural Resources and Environmental Control
DOD	U.S. Department of Defense

DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPS	Distinct Population Segment
DQA	Data Quality Assessment
DQCR	Daily Quality Control Report
DQI	Data Quality Indicator
DQO	Data Quality Objective
DRR	Document Review Record
DVD	Digital Versatile Disc
DVR	Data Validation Report
EDD	Electronic Data Deliverable
EFA	Engineering Field Activity
ELAP	Environmental Laboratory Accreditation Program
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
ERED	Environmental Residue-Effects Database
ESA	Endangered Species Act
EU	Exposure Unit
FR	Federal Register
FS	Feasibility Study
GPS	Global Positioning System
HASP	Health and Safety Plan
HDPE	High-Density Polyethylene
HHRA	Human Health Risk Assessment
HQ	Hazard Quotient
I.D.	Identification
ICAL	Initial Calibration
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICV	Initial Calibration Verification
IDQTF	Intergovernmental Data Quality Task Force
IDW	Investigation-Derived Waste
IndCB	Industry Classified Benchmark
IS	Internal Standard
ITR	Independent Technical Review
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Level of Detection

LOQ	Level of Quantitation
LOR	Letter-of-Receipt
LUC	Land Use Control
MB	Method Blank
MC	Munitions Constituent
MDL	Method Detection Limit
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
MRL	Method Reporting Limit
MRS	Munitions Response Site
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	Not available
NCA	National Coastal Assessment
NCR	Noncompliance Report
NFA	No Further Action
NGB	National Guard Bureau
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NS&T	National Status and Trends
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PDE	Partnership for the Delaware Estuary
POC	Point of Contact
PORTS	Physical Oceanographic Real Time Station
PPE	Personal Protective Equipment
ppt	Parts Per Thousand
PQL	Practical Quantitation Limit
PQO	Project Quality Objective
PST	Project Screening Threshold
psu	Practical Salinity Unit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual

RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RL	Reporting Limit
RPD	Relative Percent Difference
RRTS	River Road Training Site
RSD	Relative Standard Deviation
RSL	Regional Screening Level
RTC	Response to Comment
SAIC	Science Applications International Corporation
SDG	Sample Delivery Group
SDZ	Surface Danger Zone
SEM	Simultaneously Extracted Metals
SHSO	Site Health and Safety Officer
SI	Site Inspection
SLERA	Screening-Level Ecological Risk Assessment
SLHHRA	Screening-Level Human Health Risk Assessment
SOP	Standard Operating Procedure
SOW	Statement of Work
SQB	Sediment Quality Benchmark
SQT	Sediment Quality Triad
SWAT	Special Weapons and Tactics
T&E	Threatened and Endangered
TCEQ	Texas Commission of Environmental Quality
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total Organic Carbon
TPP	Technical Project Planning
TRV	Toxicity Reference Value
TSV	Tissue Screening Value
U.S.C.	United States Code
UCL	Upper Confidence Limit
UFP	Uniform Federal Policy
URS	URS Group, Inc.
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventative Medicine
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

UTL	Upper Tolerance Limit
UXO	Unexploded Ordnance
VSP	Visual Sample Plan
WBS	Work Breakdown Schedule
WOE	Weight-of-Evidence
WQC	Water Quality Criteria

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EXECUTIVE SUMMARY

This Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) has been prepared to support the Remedial Investigation (RI) field activities for munitions constituents (MCs) sampling at the Former Small Arms Range Water Area Munitions Response Site (MRS) at the River Road Training Site (RRTS) in New Castle, Delaware. The RI is being performed to determine whether there was a release of MC into the Delaware River due to activities at a former 1,000-yard rifle range. The principal objectives of the RI at the RRTS are to gather sufficient environmental data to identify the presence, nature, and extent of MC in sediment at the Former Small Arms Range Water Area; evaluate whether MCs are present at concentrations that pose a potential risk to human and ecological receptors; and guide further management decisions as to whether a remedial action is required. This QAPP, which constitutes the Work Plan for the RI, was written using guidance from the UFP-QAPP Manual (IDQTF 2005) and the U.S. Department of Defense (DOD) Quality Systems Manual (QSM), Version 5.0 (DOD 2013).

Site History and Potential Release Mechanisms—This MRS was in operation from 1910 to 1940 as a 1,000-yard rifle range featuring small arms fire. A unique feature of this range is an earthen and concrete embankment that may have been used to elevate targets or as a backstop and is located adjacent to the bank of the Delaware River in the southeastern portion of the RRTS property. Fired bullets that missed their target would have traveled across open and wooded wetland portions of the facility toward and into the Delaware River. The MRS boundary is defined as the portion of the above historical firing fan that excludes the Surface Danger Zones (SDZs) for active RRTS ranges. The resulting MRS comprises 212 acres and is limited to the wide, south end of the 1,000-yard range firing fan, as illustrated in Figure ES-1.

The most common weapon used on the former 1,000-yard range was the M1903 Springfield rifle. Most of the training at the former 1,000-yard range took place at the 100- and 500-yard firing points as these were the optimal combat firing range for this rifle. Training at the 1,000-yard distance was for shooting competitions and occurred much less frequently. The M1903 rifle at the time of active range operations fired the .30-caliber ball cartridge with a bullet composed of a lead core and a cupro-nickel jacket.

The MRS has not been investigated or surveyed previously to determine if a release of MCs has occurred. RRTS personnel reported in a 2007 Site Inspection (SI) that it is common to find spent bullets along the shoreline of the property (URS 2007). Since bullets are present on the shore, bullets were presumed as likely to be present in the river sediments, although no sampling of the MRS has been conducted. The MRS, being entirely contained within the Delaware River Estuary, is accessible to the public and also provides habitat for a wide variety of ecological resources. Therefore, an agreement among the Army National Guard (ARNG) and stakeholders was reached in regard to conducting an RI. Because the former 1,000-yard range was used only for small arms, the only concern is for small arms- related MCs in the Delaware River. Field work and analyses to be conducted upon execution of this RI Work Plan will provide the data necessary to delineate the nature and extent of MCs, evaluate the potential risk to human health and ecological receptors, and guide further management decisions.

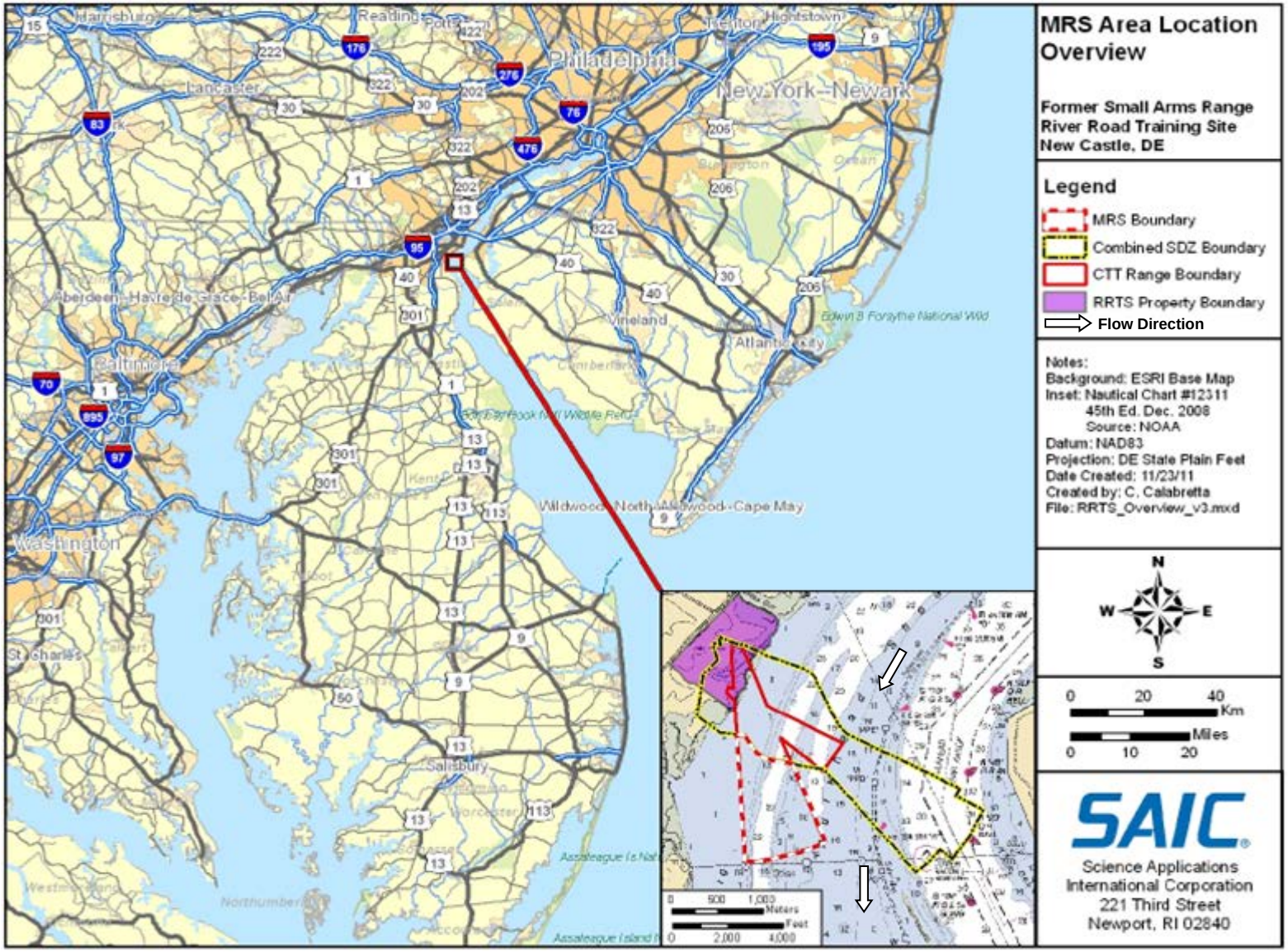

Figure ES-1. Location of the RRTS MRS, New Castle, Delaware

Conceptual Site Model—The conceptual site model (CSM) for the MRS assumes that sediments containing bullets is the source medium from where subsequent release of MCs would occur, and the subsequent transport and fate of MCs in relation to the MRS boundary is primarily influenced by the pattern of initial bullet deposition and local sediment dynamics. Bullets missing their shoreside target would hit the water and rapidly sink intact to the seafloor and become integrated into the surface sediment, a process that is enhanced by the shape and high mass density of the bullets. Bullet density is expected to decrease with increasing distance from the RRTS shoreline. Bathymetric trends over the past 19 years (and presumably over the period since range usage began) showed that erosion, transport, and redeposition of sediments is occurring and allows the possibility for contamination of the MRS by upstream sources as well as the migration and dilution of MCs downstream. Whereas nearshore sediments are relatively stable, further offshore there are notable deposits of thick sediments that may have deeply buried bullets such that associated MCs may be beyond the reach of sediment-dwelling organisms and/or casual disturbance by recreational use (e.g., boat anchors).

Based on this understanding of MC fate and transport, the MRS was divided into three subareas (exposure units [EUs]) according to the relative likelihood for exposure (Figure ES-2). EUs were used in order to weight the sampling activities in a manner that accounts for variability in exposure potential. EU 1 has the highest likelihood for MC exposure, with undisturbed sediment and a location closest to the firing point of the former 1,000-yard rifle range. EU 2 has a moderate risk for MC exposure; although farther from the firing point than EU 1, EU 2 is bisected by Bulkhead Shoal Channel, which may serve to concentrate bullets that have landed in this area. Finally, EU 3 represents the portion of the MRS with the least likelihood of MC exposure as it is located farthest from shore, with disturbed sediments and a high likelihood for MC burial.

The CSM developed for the MRS illustrates the potential pathways for environmental transport of MCs from the source of potential contamination to human and ecological receptors. To determine potential human receptors, the land use of the site was evaluated. Based on current and likely future land use, potential human receptors at the MRS are limited to recreational fishermen accessing the site by boat, hence the primary route of exposure to the recreational fisherman involves the ingestion of fish. Due to the water depths throughout the MRS and the absence of a wading and/or bathing scenario, exposure of recreational users to sediments was considered an incomplete pathway. Aquatic ecological receptors may be exposed to potential contaminants in the sediments through dermal contact, ingestion of sediment, and ingestion of prey items. Classes of aquatic ecological receptors that may be exposed to potential contaminants in the MRS sediments include benthic invertebrates, demersal aquatic organisms (e.g., bottom-feeding fish), and avian piscivores (e.g., black-crown night heron). In contrast, exposure via the dissolved phase was deemed insignificant because any MCs released from sediment into surface water would be rapidly diluted by the high river flow as well as scavenging by particulates in suspension.

Sampling Design and Rationale—Because of the nature of the potential MC source, transport, and fate processes that lead to unlikely chemical exposures of significance, field work for the MSR RI will be divided into two phases. Phase 1 sampling will focus on lead and is designed to obtain data that will allow for a screen against background concentrations as well as risk-based

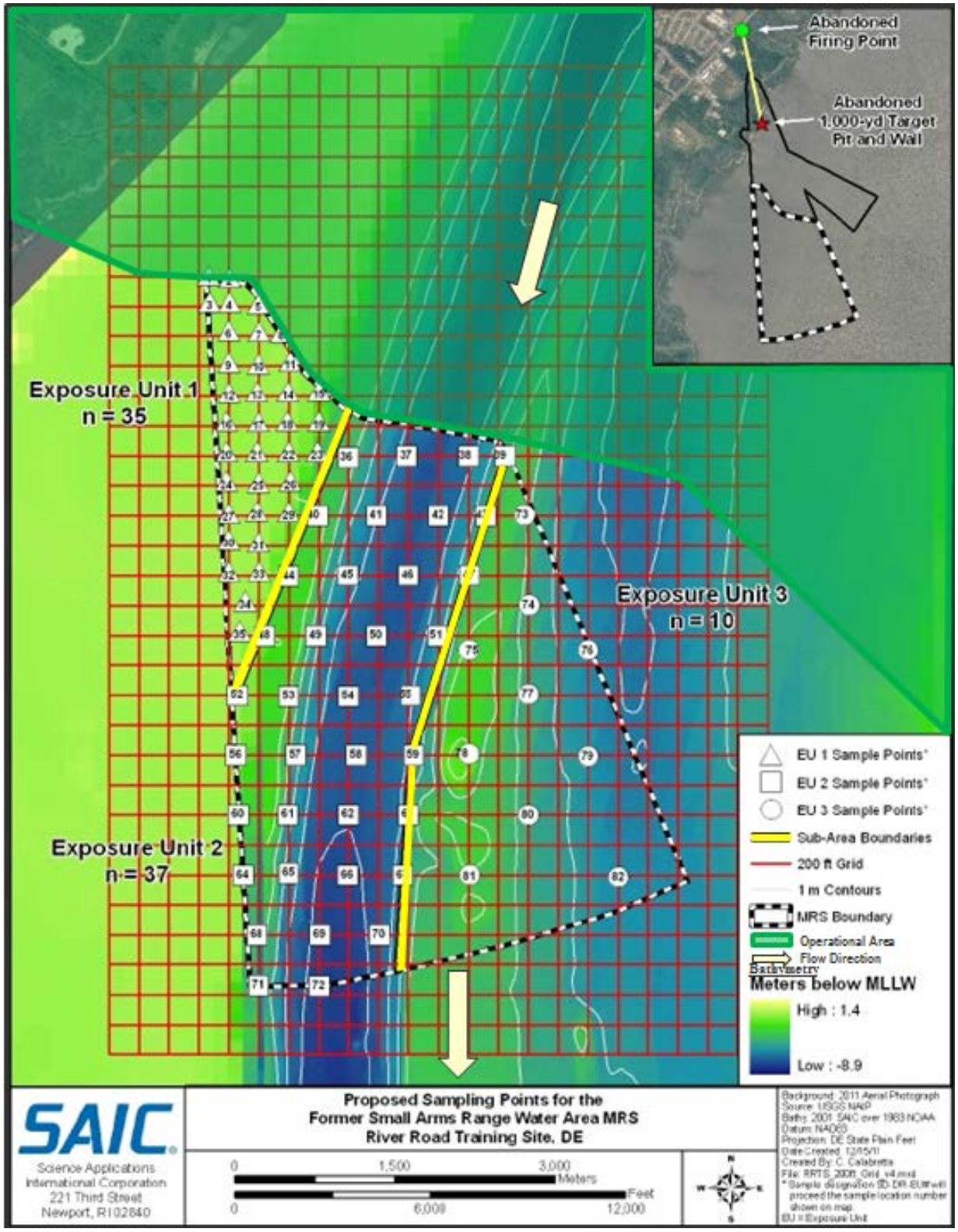

Figure ES-2. Proposed RI Sampling Locations for MRS

concentration thresholds to confirm that the spatial extent of potential MC-related contamination is contained within the MRS boundaries. Lead was chosen as the representative MC for Phase 1 analysis because it was the major component (greater than 85% by weight) of the dominant bullets in use at the time of active range operations. If elevated lead levels are observed in the Phase 1 data relative to background concentrations and screening level toxicity thresholds, Phase 2 sampling will be performed. The objective of Phase 2 sampling is to evaluate potential MC-related risk to both human health and ecological receptors based on more rigorous lines of evidence, including an expanded metals target analyte list (lead, copper, nickel, zinc, tin, iron, and manganese) that focuses on the broader composition of the dominant cupro-nickel bullets used during active range operations, biological tests for benthic impact assessment, and upper-level exposure through food-web modeling.

Phase 1 Sampling—During Phase 1, 82 shallow (0- to 6-inch depth) sediment samples will be collected from within the boundary of the MRS and 20 sediment samples, including both sand and silty sediments, will be collected from a background (reference) area located upstream of the MRS (Figure ES-3). Each Phase I sediment sample will be sent to ALS Laboratory for lead analysis.

As a result of the CSM evaluation, sediment sample distribution for Phase 1 will be weighted such that sample density will be approximately one station per acre for EU 1, 0.5 stations per acre for EU 2, and 0.1 stations per acre for EU 3. To facilitate comparison with the variable sediment grain size composition of the MRS, background sample locations (SD-BKG-001 to SD-BKG-020) from the upstream reference area will target an even distribution between sandy and silty sediments (10 sand and 10 silt/clay).

Additional step-out sampling will be performed during Phase 1 in the event that individual lead results exceeding the Phase 1 risk screening criteria in addition to the background upper tolerance limit (UTL) are found along any portion of the MRS perimeter that does not border an active SDZ. The purpose of the step-out sampling will be to further define the spatial extent of potential MC contamination and confirm that the MRS is properly delineated. If required, step-out sampling is planned to include two to three adjacent samples for each boundary location having an individual UTL and screening-level exceedance. If these additional samples are still found to exceed the background UTL and Phase 1 risk screening criteria on an individual basis, step-out sampling may continue or ARNG may re-evaluate this approach in consultation with the Delaware Department of Natural Resources and Environmental Control (DNREC). If there are no lead background and screening level exceedances at the perimeter of the MRS, no additional step-out sampling (i.e., MRS delineation) will be required.

Phase 2 Sampling—Phase 2 sampling will occur if the lead exposure point concentration (EPC) for one or more of the EUs exceeds both the background concentration and the screening-level toxicity threshold. Phase 2 sampling will occur under a separate mobilization and will consist of collecting up to 10 additional sediment samples from each MRS EU and 6 additional sediment samples from the background area. The Phase 2 sediment samples will be collected following the Phase 1 sampling procedures and will be analyzed for sediment chemistry, sediment toxicity (survival and growth), benthic community structure, simultaneously extracted metals-acid volatile sulfide (SEM-AVS), and hydrogen sulfide (H_2S). Chemical analysis of Phase 2 samples will be performed by ALS Laboratory and will again target lead, as well as the additional MCs copper and nickel contained in bullet jacket materials. Phase 2 samples within

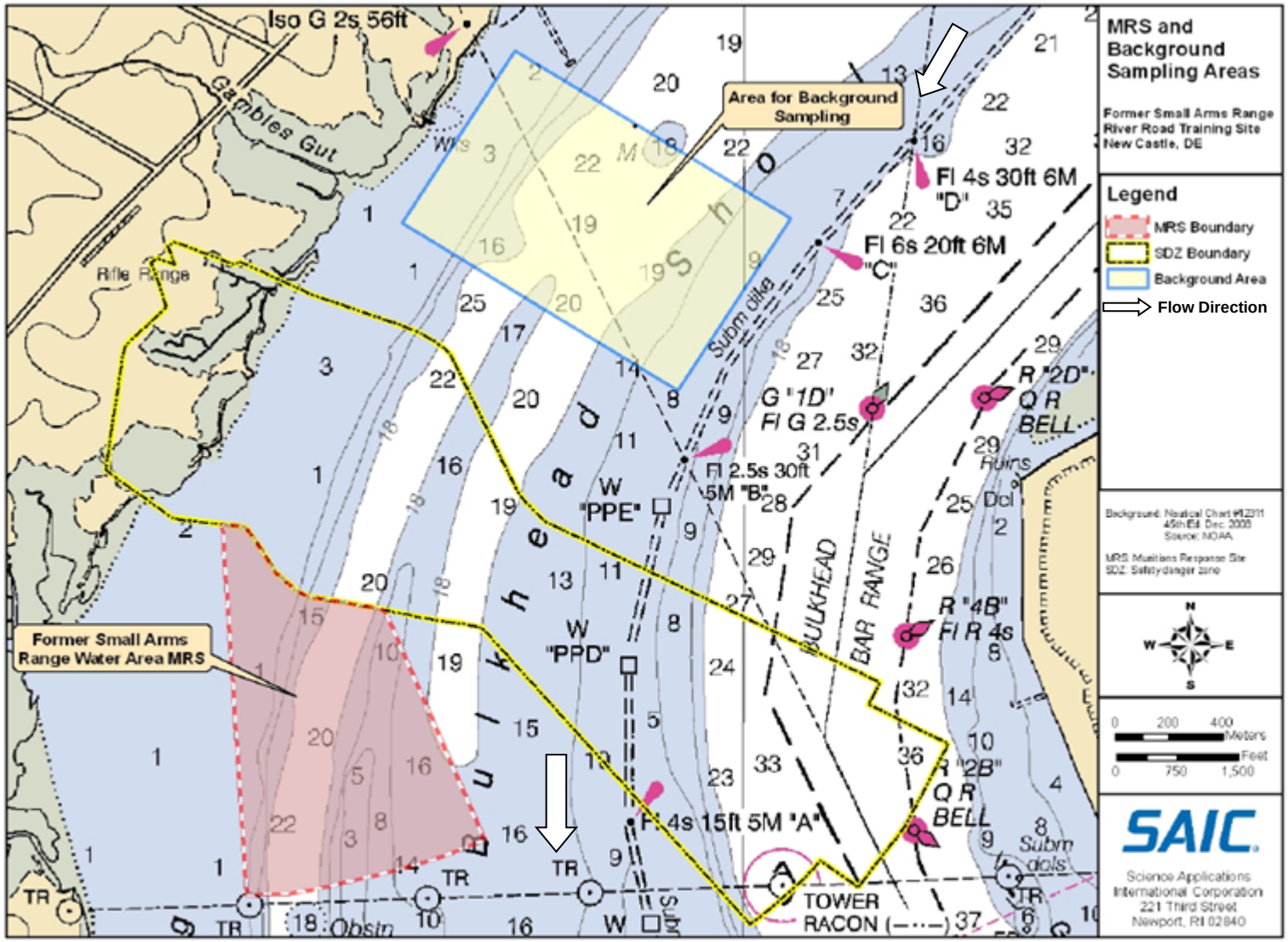

Figure ES-3. Overview of MRS and Background Sampling Areas

an affected EU will be collocated within lead hotspots that were identified during Phase 1. Phase 2 background samples will be of comparable sediment types to those of the Phase 1 MRS samples and will span the range of the Phase 1 background results. As the location of Phase 2 samples will depend on the Phase 1 results, sample locations are not known at this time but are expected to be distributed across one or more of the MRS subareas shown in Figure ES-2.

Risk Assessment Approach—The overall risk assessment approach for the MRS will involve a background screen and both screening-level human health and ecological risk assessments performed following the Phase 1 sampling and, if necessary, baseline human health and ecological risk assessments performed following the Phase 2 sampling. Results of the screening-level human health and ecological risk assessments will be used to identify preliminary risks at the MRS to human recreational fishermen and the benthic community, which will in turn determine the need for Phase 2 sampling. Results of the baseline risk assessments will be used to identify upper-level risks at the MRS and determine the need for further action. The baseline results will be evaluated using a weight-of-evidence (WOE) approach for risk characterization, which will consider the number of chemicals of concern (COCs) identified, the magnitude of screening value exceedances, and the results of additional biological testing (e.g., sediment bioassays, benthic macroinvertebrate community assessment). If adverse risks are apparent, more quantitative modeling of MC exposures incorporating site-specific exposure models will be needed.

The EPC for each EU will be used as the point of comparison for both the background screen and the risk screen (as opposed to the maximum detected concentration) such that any decisions made for the EU are based on the overall data distribution for the EU and not one single value. During the EPC calculation process, a statistical outlier analysis will be performed to identify any anomalous values. If suspected outliers are determined to be driving decisions whether to conduct risk screening and ultimately Phase 2 sampling, management input will be sought before proceeding.

Phase 1 Human Health Screening—The Phase 1 human health screening process will constitute a screening-level human health risk assessment (SLHHRA). The first step of the risk assessment will be to compare the lead concentrations measured in the Phase 1 samples from the MRS to the lead concentrations measured in the Phase 1 samples from the background area upstream of the MRS in order to distinguish whether the observed concentrations are site related or naturally occurring relative to the Delaware River. For this comparison, the lead data will be grouped by EU and the EPCs for each EU will be compared to the UTL of the background area. As the background area is expected to have a mixture of sandy and silty sediments, which in turn would have natural markedly different concentrations of metals because the clay mineralogy of soft sediments tends to contain metals, EU to background comparisons will be made only for like sediments. If the lead EPC for a particular EU is found to exceed the background UTL, then the presence of lead will be considered site related. The EPC for that EU then will be translated into tissue-based concentrations in order to assess dietary exposure to recreational fishermen due to the ingestion of fish tissue. This conversion will be accomplished by applying metal-specific bioaccumulation factors (BAFs) (USEPA 1997c) to the sediment data. Predicted contaminant residues in fish then will be compared to established risk-based regional screening level (RSL) criteria for fish ingestion (USEPA 2011b). In the absence of a USEPA RSL for lead, a surrogate value was selected from the Texas Commission

of Environmental Quality (TCEQ) guidance (TCEQ 2003). If the corresponding maximum tissue-based concentration exceeds the RSL, then lead will be considered a human health chemical of potential concern (COPC) and a Phase 2 sampling effort will be conducted as described above to further determine whether unacceptable human health risks exist at the MRS.

Phase 1 Ecological Screening—The Phase 1 ecological screening process will constitute a screening-level ecological risk assessment (SLERA). If the lead concentrations for a particular EU are determined to be site-related based on the background comparison described above, the lead EPC concentration for that EU will be compared to the U.S. Environmental Protection Agency (USEPA) Region 3 Biological Technical Assistance Group (BTAG) toxicity-based screening value for lead in marine sediments protective of the benthic community. If the lead EPC exceeds the screening value for the benthic community, then lead will be considered a chemical of potential ecological concern (COPEC) and a Phase 2 sampling effort will be conducted as described above to further determine whether unacceptable ecological risks exist at the MRS.

Phase 2 Human Health Screening—The Phase 2 human health screening process will constitute a baseline human health risk assessment (HHRA). Only Phase 2 data will be used for the baseline HHRA. Following Phase 1 procedures, the analytical results from the Phase 2 sampling for the selected metals in each EU will first be compared to corresponding background concentrations for the upstream reference area. If the metals concentrations in the Phase 2 sediment samples are determined to be potentially site related based on the background comparison, they then will be compared to the appropriate screening- level RSL following the same process as described for Phase 1. Any metals deemed to pose a sufficient site-related human health risk following this toxicity assessment will be considered human health COCs for the MRS. A WOE evaluation then will be performed as part of the risk characterization process to assess the magnitude of the screening criteria exceedances and evaluate uncertainty in the risk findings based on comparative lines of evidence and the need for more site-specific exposure modeling.

Phase 2 Ecological Risk Screening—The Phase 2 ecological risk screening process will constitute a baseline ecological risk assessment (BERA). Only Phase 2 data will be used for the BERA. Following Phase 1 procedures, the analytical results from the Phase 2 sampling for the select metals in each EU will first be compared to corresponding background concentrations for the upstream reference area. If the metals concentrations in the Phase 2 sediment samples are determined to be potentially site related based on the background comparison, they then will be screened against the appropriate BTAG marine sediment screening-level criteria following the same process as described for Phase 1 to identify COPECs. The results of the additional biological and chemistry analyses to be performed as part of the Phase 2 sampling will also be incorporated into the ecological risk evaluation for the benthic community. If a metal is identified as a COPEC from the Phase 2 data and its corresponding concentration is positively correlated with bioavailability (i.e., SEM/AVS > 1 for lead, copper, and nickel), sediment toxicity (survival < 80% of reference), and benthic community degradation (diversity, abundance < 80% of reference), then that metal will be identified as a COC for the MRS.

Food-chain pathway analysis for fish and avian receptors also will be performed. For fish, screening values will consist of literature-based critical body residues (CBRs), which are defined as the threshold concentration of a contaminant in the tissue of an organism above

which adverse effects would occur. Predicted fish tissue concentrations for comparison to the CBRs will be calculated by applying metal-specific BAFs (USEPA 1997c) to the sediment data. For avian receptors, screening values will consist of dose-based avian toxicity reference values (TRVs) compiled by the Navy/USEPA Region 9 BTAG (Engineering Field Activity West 1998, as reported in DTSC 2000). Predicted avian chemical intake rates will be calculated using a conservative exposure model for the black-crowned night heron. Any metals deemed to pose a sufficient site-related baseline ecological risk following these upper-level exposure assessments will be considered ecological COCs for the MRS.

If COCs are identified and the baseline analyses indicate a potential unacceptable risk to the ecological receptors, a WOE evaluation will be performed as part of the risk characterization process to assess the magnitude of the screening criteria exceedances and evaluate uncertainty in the risk findings based on comparative site-specific analyses. The WOE evaluation will rely on the sediment quality triad (SQT) approach, which will integrate the results of the physical (grain size), chemical (SEM-AVS), toxicological (amphipod survival), and biological (taxonomic diversity) properties of the affected location(s) to draw conclusions about the potential for adverse effects to the food chain from exposures to site contaminants. If two or more of these endpoints indicate adverse effects at the site, then it will be concluded that the chemical exposure pathway is complete and adverse ecological risks are likely with a low degree of uncertainty. If these impacts are occurring at the MRS but not at the reference location, then these ecological risks will be deemed site related.

Although exposure analyses for upper-level fish and avian receptors can be included in the SLERA using the most conservative exposure parameters, these analyses will not be performed following the Phase 1 sampling because only the results of the screening-level comparison (i.e., potential toxicity to the benthic community) will serve as the decision point for proceeding to Phase 2 sampling.

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1. INTRODUCTION

This Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) constitutes the Work Plan developed specifically for the Former Small Arms Range at the River Road Training Site (RRTS) in New Castle, Delaware and describes in detail the quality assurance (QA), quality control (QC), and additional technical activities that must be implemented to ensure that data collected are of sufficient quality to support the Remedial Investigation (RI) objectives. In addition, this plan summarizes the project management and reporting structure and field sampling procedures, as well as describes the ways in which QA and QC are applied to analytical results. Science Applications International Corporation (SAIC) originally prepared this plan in accordance with the statement of work (SOW) requirements under National Guard Bureau (NGB) Contract No. DAHA92-01-D-0008, Delivery Order No. 0195. URS Group, Inc. (URS) was awarded the RI under a separate contracting action. URS completed this document by updating the work plan, contactor-specific information, and information regarding the analytical laboratory.

The principal objective of the RI at the RRTS Former Small Arms Range is to gather environmental data needed to identify the presence, nature, and extent of munitions constituents (MCs) in sediment at the Former Small Arms Range Water Area (i.e., the site), evaluate whether MCs are present at concentrations that are both site related relative to the Delaware River background and pose a potential risk to human and/or ecological receptors, and guide further management decisions as to whether a remedial action is required.

This QAPP was written using guidance from the UFP-QAPP Manual (IDQTF 2005). The UFP-QAPP Manual is a set of consensus documents prepared by the Intergovernmental Data Quality Task Force (IDQTF) to provide instructions for preparing QAPPs for any environmental data collection operation. The UFP was developed as a joint initiative by the U.S. Environmental Protection Agency (USEPA), the U.S. Department of Defense (DOD), and the U.S. Department of Energy (DOE) to ensure that environmental data are of known and documented quality and suitable for their intended uses and environmental data collection and technology programs meet stated requirements. Other guidance documents used during the preparation of this QAPP include the DOD Quality Systems Manual (QSM), Version 5.0 (DOD 2013).

This QAPP is organized into the following sections:

- Section 1. Introduction
- Section 2. Project Management and Objective Elements
- Section 3. Measurement and Data Acquisition Elements
- Section 4. Assessment and Oversight Elements
- Section 5. Data Review Elements
- Section 6. References
- Appendices:
  - Appendix A. Field and Quality Assurance Standard Operating Procedures (SOPs)
  - Appendix B. Laboratory Analytical Standard Operating Procedures
  - Appendix C. TPP1 Meeting Minutes

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2. PROJECT MANAGEMENT AND OBJECTIVE ELEMENTS

The Site Inspection (SI) conducted by URS (URS 2007) identified the Former Small Arms Range Water Area Munitions Response Site (MRS) (herein referred to as the MRS) at RRTS as a site requiring further investigation. A principal objective of the RI is to gather sufficient information to determine if a remedial action is necessary due to site-specific contamination or to determine if the level of contamination is below background for the Delaware River and/or within acceptable risk levels so as to warrant no further action (NFA). This section discusses the following aspects of the RI being conducted at the RRTS: the document format and table of contents, document control, distribution of the QAPP, project organization, project planning/problem definition, project quality objectives (PQOs) and performance criteria, secondary data evaluation, and the project schedule.

2.1 TITLE AND APPROVAL PAGE

The Title and Approval Page of the RRTS RI QAPP contains the identifying information for the project and the approval signatures of all entities and organizations involved in project oversight and implementation and are included as Worksheet #1.

2.2 DOCUMENT FORMAT AND TABLE OF CONTENTS

The following sections describe the document format and document control as required by the UFP-QAPP Manual (IDQTF 2005). In addition, these sections describe requirements regarding the crosswalk to UFP-QAPP worksheets and UFP-QAPP elements.

2.2.1 Document Control Format

The footer of each page in this document provides the following information:

- Title of the document
- Document status (e.g., draft, final)
- The revision date
- The page number in relation to the total number of pages.

2.2.2 Document Control Numbering System

The project manager will maintain a Document Control Numbering System as specified in SOP-13 (Appendix A). This system accounts for all copies of the QAPP provided to project personnel and helps to ensure that the most current version is in use.

2.2.3 QAPP Identifying Information

The identifying information and crosswalk to related documents, tables, figures, and worksheets for this QAPP are provided on Worksheet #2.

2.3 DISTRIBUTION LIST AND PROJECT PERSONNEL SIGN-OFF SHEET

The QAPP distribution list and personnel sign-off sheet are discussed below.

2.3.1 Distribution List

The Distribution List documents entities and individuals to whom copies of the approved QAPP and any revisions, amendments, or addenda will be sent. The distribution list is located on Worksheet #3.

2.3.2 Project Personnel Sign-Off Sheet

The Project Personnel Sign-Off Sheet documents that all project personnel performing work have read the applicable sections of the QAPP and will perform the tasks as described. The Project Personnel Sign-Off Sheet is provided on Worksheet #4.

2.4 PROJECT ORGANIZATION

The following sections identify the organizational setup, pathways to communication, personnel roles, qualifications, and relevant training.

2.4.1 Project Organizational Chart

The organizational structure for the RI shown on Worksheet #5 indicates the interactions between the Program Manager, Independent Technical Review (ITR) Team, Project Manager, QA Manager, Health and Safety Officer, Site Manager/Site Health and Safety Officer (SHSO), and technical and support staff within the investigative organization, as well as the interactions between the prime investigative organization and subcontractors.

The Project Manager will implement the plan and conduct the RI sampling activities for RRTS using an integrated team of engineering, technical, and support personnel. In addition, the Project Manager will oversee the performance of subcontractors in the following roles:

- Analytical Laboratory
- Benthic Laboratory
- Bioassay Laboratory

2.4.2 Communication Pathways

Communication pathways and modes of communication are delineated on Worksheet #6. These pathways include the points of contact (POCs) for resolving sampling and analysis problems and for distributing preliminary, screening, and definitive data to managers, users, and the public.

2.4.3 Personnel Responsibilities and Qualifications

The roles, responsibilities, and qualifications of project personnel are included on Worksheet #7.

2.4.4 Special Training Requirements and Certification

All personnel scheduled for field work at RRTS must be trained in accordance with Hazardous Waste Operations 29 Code of Federal Regulations (CFR) 1910.120, 29 CFR 1926.65, and the Occupational Safety and Health Administration (OSHA) Interim Final Standard 51 Federal Register (FR) 45654 issued December 12, 1986. In addition, the procedures contained on Worksheet #21, Section 3.5, and Section 4.1.2 will be assigned to

QAPP Worksheet #1. Title and Approval Page

Site Name/Project Name: River Road Training Site Remedial Investigation
Site Location: River Road National Guard Training Site, New Castle, Delaware
Document Title: Uniform Federal Policy Quality Assurance Project Plan
Lead Organization: Army National Guard (ARNG)
Prepared by: SAIC/ updated by URS

Investigative Organization's Program Manager:

Signature
Scott McClelland, URS, Date

Investigative Organization's Project Manager:

Signature
Laurie Stenberg, URS, Date

Investigative Organization's Office QA Manager:

Signature
Rosa Gwinn, URS, Date

Lead Organization's Project Manager:

Signature
John Haines, ARNG Directorate, Date

Lead Organization's Environmental Program Manager:

Signature
Major Marc Orndorff, DEARNG, Date

Lead Organization's Environmental Program Manager

Signature
James Bynum/Sal Van Wert, USACE-Baltimore District, Date

U.S. Army Corps of Engineers Chemist:

Signature
Scott Chang, USACE-Baltimore District, Date

QAPP Worksheet #2. QAPP Identifying Information

Site Name/Project Name:	**RRTS Remedial Investigation**
Site Location:	**RRTS, New Castle, Delaware**
Contractor Name:	**URS Group, Inc.**
Contract Number:	**W912DR-09-D-0003**
Contract Title:	**RRTS RI/FS**

1. Regulatory Program: **Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)**
2. Approval Entity: **Delaware Department of Natural Resources and Environmental Control (DNREC)**
3. The QAPP is: **Project Specific**
4. Dates of scoping sessions: **November 3, 2011 and December 4, 2013**
5. Dates and titles of QAPP documents written for previous site work: **None**
6. Organizational partners (stakeholders) and connection with lead organization: See Worksheet #9.
7. Data Users: **ARNG, DNREC, USACE**
8. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below:

   All required elements are applicable.

Identify where each required QAPP element is located in the QAPP (provide section, worksheet, table, or figure number) or other project planning documents (provide complete document title, date, section number, page numbers, and location of the information in the document). Type "not available" (NA) for the QAPP elements that are not applicable to the project. Provide an explanation in the QAPP.

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to UFP-QAPP Worksheet #
Project Management and Objectives		
2.1 Title and Approval Page	Title and Approval Page	1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	Table of Contents QAPP Identifying Information	2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	Distribution List Project Personnel Sign-Off Sheet	3 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	Project Organizational Chart Communication Pathways Personnel Responsibilities and Qualifications Table Special Personnel Training Requirements Table	5 6 7 8

QAPP Worksheet #2. QAPP Identifying Information (Continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to UFP-QAPP Worksheet #
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	Project Planning Session Documentation (including Data Needs Tables) Project Scoping Session Participants Sheet Problem Definition, Site History, and Background Site Maps (Historical and Present)	9 10
2.6 PQO and Measurement Performance Criteria 2.6.1 Development of PQOs Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	Site-Specific PQOs Measurement Performance Criteria Table	11 12
2.7 Secondary Data Evaluation	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	Summary of Project Tasks Reference Limits and Evaluation Table Project Schedule/Timeline Table	14 15 16
Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	Sampling Design and Rationale Sample Location Map Sampling Locations and Methods/SOP Requirements Table Analytical Methods/SOP Requirements Table Field QC Sample Summary Table Sampling SOPs Project Sampling SOP References Table Field Equipment Calibration, Maintenance, Testing, and Inspection Table	17 18 19 20 21 22
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	Analytical SOPs Analytical SOP References Table Analytical Instrument Calibration Table Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	23 24 25

QAPP Worksheet #2. QAPP Identifying Information (Continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to UFP-QAPP Worksheet #
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	Sample Collection Documentation Handling, Tracking, and Custody SOPs Sample Container Identification (I.D.) Sample Handling Flow Diagram Example Chain-of-Custody (CoC) Form and Seal	26 27
3.4 QC Samples 3.4.1 Sampling QC Samples 3.4.2 Analytical QC Samples	QC Samples Table Screening/Laboratory Analysis Decision Tree	28
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	Project Documents and Records Table Analytical Services Table Data Management SOPs	29 30
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action (CA) Responses	Assessments and Response Actions Planned Project Assessments Table Audit Checklists Assessment Findings and CA Responses Table	31 32
4.2 QA Management Reports	QA Management Reports Table	33
4.3 Final Project Report		NA
Data Review		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	Verification (Step I) Process Table Validation (Steps IIa and IIb) Process Table Validation (Steps IIa and IIb) Summary Table Usability Assessment	34 35 36 37
5.3 Streamlining Data Review 5.3.1 Data Review Steps to Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		NA

NA = No Assessment required

QAPP Worksheet #3. List of QAPP Recipients

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number
John Haines	Project Manager	ARNG Directorate	(703) 607-7986	john.b.haines@us.army.mil	Final_March 2014 (SharePoint upload*)
Major Marc Orndorff	Environmental Program Manager	DEARNG	(302) 326-7488	marc.orndorff@us.army.mil	Final_March 2014 (SharePoint upload*)
James Bynum	Project Manager	USACE Baltimore District	(410) 962-6803	James.O.Bynum@usace.army.mil	Final_March 2014 (SharePoint upload*)
Sal Van Wert	Project Manager	USACE Baltimore District	(410) 962-0674	Sallie.L.Van-Wert@usace.army.mil	Final_March 2014 (SharePoint upload*)
Scott Chang	Project Chemist	USACE Baltimore District	(410) 962-2522	scott.h.chang@usace.army.mil	Final_March 2014 (SharePoint upload*)
Kristen Thornton	Project Manager	DNREC	(302) 395-2650	kristen.thornton@state.de.us	Final_March 2014 (SharePoint upload*)
Scott McClelland	Program Manager	URS	(301) 820-3453	Scott.mcclelland@urs.com	Final_March 2014 (SharePoint upload*)
Laurie Stenberg	Project Manager	URS	(301) 820-3123	Laurie.stenberg@urs.com	Final_March 2014 (SharePoint upload*)
Rosa Gwinn	Office QA Manager	URS	(301) 820-3131	Rosa.gwinn@urs.com	Final_March 2014 (SharePoint upload*)
Joshua Collins	Field Manager	URS	(215) 367-2456	Joshua.collins@urs.com	Final_March 2014 (SharePoint upload*)
Janice Jaeger	Analytical Laboratory Project Manager	ALS	(585) 672-7472	janice.jaeger@alsglobal.com	
Nancy Mountford	Benthic Laboratory Project Manager	Cove Corporation	(410) 326-4577	covelab@chesapeake.ne	
Petra Karber	Bioassay Laboratory Project Manager	EnviroSystems, Inc.	(603) 926-3345		

*Paper copies provided upon request.

employees depending on their tasks. These specialized training requirements and certifications are located on Worksheet #8.

All personnel are experienced on hazardous waste site work, use of personal protective equipment (PPE), and emergency response procedures. Additional details regarding specialized training are provided in the Health and Safety Plan (HASP). Field personnel assigned to the RRTS RI field effort will receive the work plans in a timely manner to allow for sufficient review period. A field staff orientation and briefing will be held before site sampling begins to acquaint personnel with the site, assign field responsibilities, and provide refresher training in the operation of site-specific field equipment and procedures.

All personnel are experienced on hazardous waste site work, use of personal protective equipment (PPE), and emergency response procedures. Additional details regarding specialized training are provided in the HASP. Field personnel assigned to the RRTS RI field effort will receive the work plans in a timely manner to allow for sufficient review period. A field staff orientation and briefing will be held before site sampling begins to acquaint personnel with the site, assign field responsibilities, and provide refresher training in the operation of site-specific field equipment and procedures.

2.5 PROJECT PLANNING/PROBLEM DEFINITION

This section addresses project planning, the historical context for the project, and the site background.

2.5.1 Project Planning (Scoping)

A project planning and data quality objective (DQO) scoping session was held on November 3, 2011. An additional Technical Project Planning (TPP) 1 meeting was held on December 4, 2013. Participants in both project planning sessions are listed on Worksheet #9. The planning and execution of RI sampling at the MRS were discussed at the scoping meetings. This document also reflects additional scoping decisions that may have occurred during the review and finalization with ARNG and DNREC. TPP1 meeting minutes are provided in Appendix C.

2.5.2 Problem Definition, Site History, and Background

This section provides site background information (site location, history, and characteristics in Sections 2.5.2.1 through 2.5.2.3, respectively) that is used to support the development of the conceptual site model (CSM) (Section 5.4.1) upon which a description of the problem to be solved is based. This problem description is then summarized as the problem statement, which is formally established in the first section of Worksheet #10. The information provided herein also is used as the basis to establish DQOs and to develop the plan for obtaining the appropriate data based on systematic planning process statements that are also provided on Worksheet #11.

QAPP Worksheet #4. Project Personnel Sign-Off Sheet

Organization: **ARNG Directorate**

Project Personnel	Title	Telephone Number	Date QAPP Read/Understood/Agreed to
John Haines	ARNG Project Manager	(703) 607-7986	

Organization: **Joint Forces Headquarters – DEARNG**

Project Personnel	Title	Telephone Number	Date QAPP Read/Understood/Agreed to
Major Marc Orndorff	DEARNG Environmental Program Manager	(302) 326-7488	

Organization: **USACE Baltimore District**

Project Personnel	Title	Telephone Number	Date QAPP Read/Understood/Agreed to
James Bynum	USACE Project Manager	(410) 962-6803	
Sal Van Wert	USACE Project Manager	(410) 962-0674	
Scott Chang	USACE Project Chemist	(410) 962-2522	
Cliff Opdyke	USACE Risk Assessor	(410) 962-6765	

Organization: **DNREC**

Project Personnel	Title	Telephone Number	Date QAPP Read/Understood/Agreed to
Kristen Thornton	DNREC Project Manager	(302) 395-2650	

Organization: **URS**

Project Personnel	Title	Telephone Number	Date QAPP Read/Understood/Agreed to
Scott McClelland	URS Program Manager	(301) 820-3453	
Laurie Stenberg	URS Project Manager	(301) 820-3123	
Theresa Allinger	Task Manager	(310) 820-3631	
Joshua Collins	Field Manager	(215) 367-2456	
Rosa Gwinn	QA Manager	(301) 820-3131	
Andrea Sansom	Project Chemist	(443) 737-1291	

QAPP Worksheet #4. Project Personnel Sign-Off Sheet (Continued)

Organization: **ALS Analytical (Analytical Laboratory)**

Project Personnel	Title	Telephone Number	Date QAPP Read/Understood/Agreed to
Janice Jaeger	Laboratory Project Manager	(585) 672-7472	

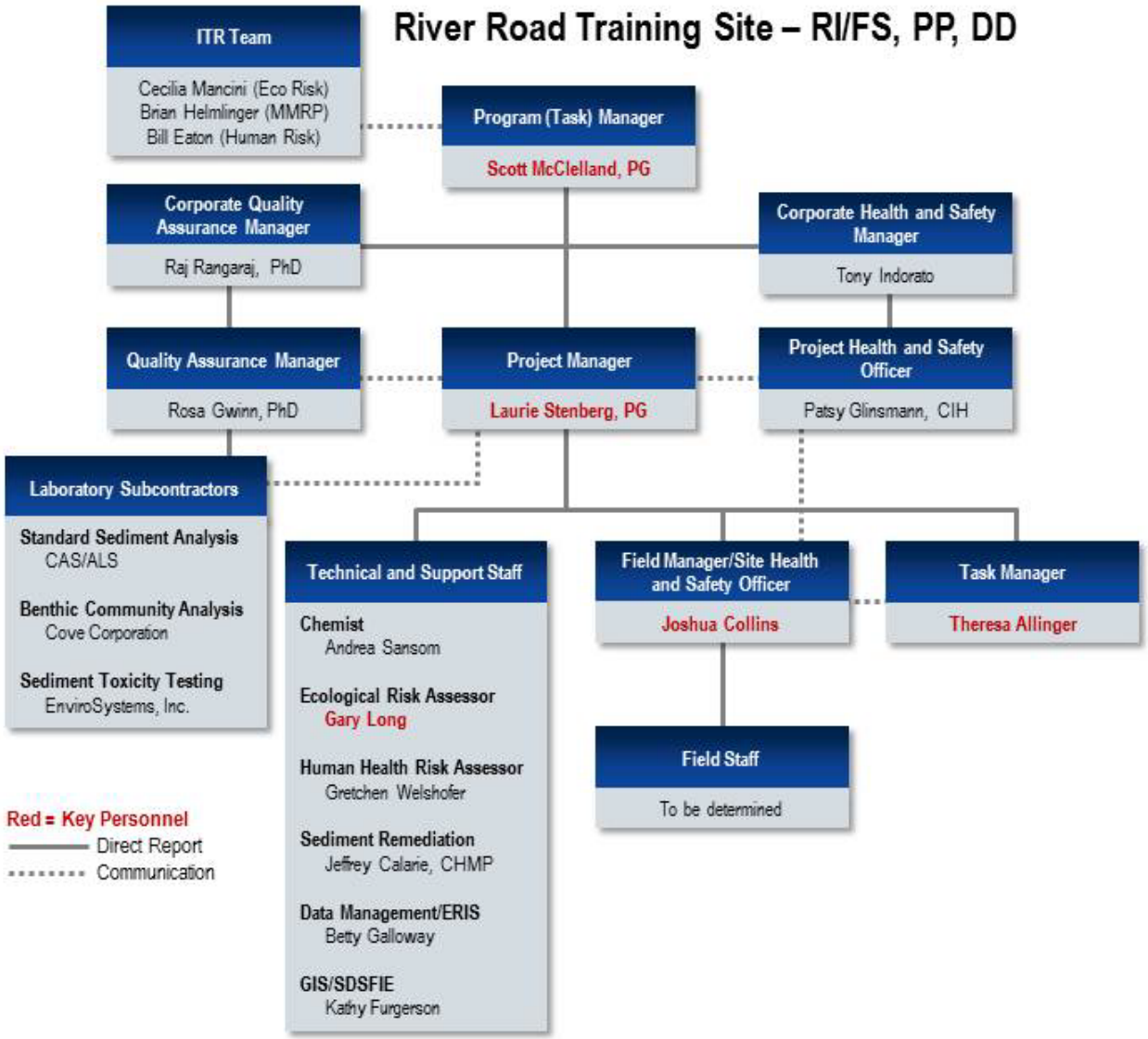
Organization: **Cove Corporation (Benthic Laboratory)**

Project Personnel	Title	Telephone Number	Date QAPP Read/Understood/Agreed to
Nancy Mountford	Laboratory Director	(410) 326-4577	

Organization: **EnviroSystems, Inc. (Bioassay Laboratory)**

Project Personnel	Title	Telephone Number	Date QAPP Read/Understood/Agreed to
Petra Karber	Laboratory Director	(603) 926-3345	

QAPP Worksheet #5. Project Organizational Chart



QAPP Worksheet #6. Communication Pathways

Communication Drivers	Responsible Entity	Name	Telephone Number	Procedure (Timing, Pathway, etc.)
POC for ARNG	ARNG Project Manager	John Haines	(703) 607-7986	All materials and information about the project will be forwarded to regulatory agencies by John Haines.
POC for DNREC	DNREC Project Manager	Kristen Thornton	(302) 395-2650	All materials and information about the project will be forwarded to Kristen Thornton as needed by John Haines.
POC for USACE-Baltimore District	USACE Project Manager	James Bynum Sal Van Wert	(410) 962-6803 (410) 962-0674	All materials and information about the project will be forwarded to James Bynum and/or Sal Van Wert as needed by John Haines.
POC for Chemistry	USACE Chemist	Scott Chang	(410) 962-2522	All information regarding data quality issues will be communicated from the QA Manager to Scott Chang.
Manage all Project Phases	URS Project Manager	Laurie Stenberg	(301) 820-3123	All materials and information about the project will be forwarded from Laurie Stenberg to John Haines.
Reporting Data Quality Issues	URS Project Chemist	Andrea Sansom	(443) 737-1291	The need for CAs or flagging of analytical results will be reported by the Project Chemist.
Changes to QAPP Field Sampling Procedures	Field Manager	Joshua Collins	(215) 367-2456	Notify Project Manager by phone and/or e-mail of field related problems and/or requested changes to field sampling or screening procedures.
Stopping Work Due to Health and Safety Issues or Unexpected Field Conditions	URS Field and Task Managers	Joshua Collins Theresa Allinger	(215) 367-2456 (301) 820-3631	Follow Health and Safety Plan (HASP) procedures.
Reporting Sample Receipt Issues/Data Quality Issues	Analytical Laboratory Project Manager	Janice Jaeger	(585) 672-7472	All sample receipt issues and data quality issues will be reported to the Project Chemist by telephone or e-mail as soon as possible after issues are identified.
Reporting Sample Receipt Issues/Data Quality Issues	Benthic Laboratory Project Manager	Nancy Mountford	(410) 326-4577	All sample receipt issues and data quality issues will be reported to the Project Chemist by telephone or e-mail as soon as possible after issues are identified.

QAPP Worksheet #6. Communication Pathways (Continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway, etc.)
Reporting Sample Receipt Issues/Data Quality Issues	Bioassay Laboratory Project Manager	Petra Karber	(603) 926-3345	All sample receipt issues and data quality issues will be reported to the Project Chemist by telephone or e-mail as soon as possible after issues are identified.

QAPP Worksheet #7. Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Laurie Stenberg	Project Manager	URS	Oversee project and serves as single POC for communications with ARNG	BA, Geology Professional Geologist (PA) ARNG ORA Phase II Installation Team Leader at Auburn TS, ME, Fort Pickett, VA, and Camp Ripley, MN. Helped develop QAPP for ORA Phase IIs at ARNG Installations under existing task orders. Experience executing MMRP projects at ARNG installations.
Theresa Allinger	Task and ITR Lead	URS	Coordinate implementation of the independent review of all deliverables.	BA, Geology MS, Environmental Science and Policy (in Progress) Experience as a task leader at multiple ARNG ORA Phase II and other military installations.
Susan Patton	Technical Editor	URS	Coordinate review of all deliverables to ensure consistency and proper syntax, grammar, and punctuation.	BS, Geology MS, Geology Professional Geologist (CA) 15 years of experience in technical editing and report writing. Serves as office Editing Team Lead.
Tony Indorato	Corporate Health and Safety Manager	URS	Corporate health and safety oversight	BS, Medical Technology MS, Risk Management JD, Law Certified Workzone Safety Manager Certified Environmental Safety Compliance Officer 35 years of experience in health and safety and risk management.
Rosa Gwinn	Office QA Manager	URS	Corporate QA oversight	BA, Geological Sciences MS, Geological Sciences PhD, Geological Sciences Professional Geologist (WA, UT) 20+ years of experience performing and managing environmental investigations and remediation projects; experience simultaneously managing multiple military range investigations.

QAPP Worksheet #7. Personnel Responsibilities and Qualification Table (Continued)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Andrea Sansom	URS Project Chemist / Analytical Laboratory Coordinator	URS	Completion of QAPP, review of CAs, data verification, data validation, and preparation of data quality summary Report. Ensure all resources of contract laboratories are available on an as-required basis; select appropriate analytical methodologies to meet project requirements, and secure and schedule sample analyses; assist in preparation of analytical reports for data verification / validation; report all modifications and deviations in the QAPP to the Project QA Manager; resolve issues concerning analytical work. Coordinate independent data validation.	BS, Microbiology 20+ years of experience, experience developing UFP-QAPPs to guide field investigations at ranges, PQAPPs to address work at multiple installations, working with analytical laboratories to ensure DQOs are achieved; Senior Chemist on multiple ORA and MMRP investigations and military restoration projects.
Joshua Collins	Field Manager/ Site Health and Safety Officer/ Marine Field Technician	URS	Coordinate and manage onsite operations in accordance with the QAPP/ Implement and enforce compliance with the HASP/ Lead collection of sediment samples	BA, Psychobiology 10+ years of experience in environmental field work; experience managing various monitoring programs including ecological risk assessments and benthic invertebrate assessments.
Janice Jaeger	Analytical Laboratory Project Manager	*ALS Environmental	Communicate with QA Manager regarding all analytical laboratory issues	BA, Pre-Veterinary Medicine 20+ years of experience in environmental laboratory work.
Nancy Mountford	Benthic Laboratory Project Manager	*Cove Corporation	Communicate with QA Manager regarding all analytical laboratory issues	
Petra Karber	Bioassay Laboratory Project Manager	*EnviroSystems	Communicate with QA Manager regarding all analytical laboratory issues	

* Subcontractor

QAPP Worksheet #8. Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Site Operations	U.S. Coast Guard Auxiliary Boating Skills and Seamanship Course	U.S. Coast Guard Auxiliary	June 2, 2003	Joshua Collins	Field Manager/ Site Health and Safety Officer URS	All training certificates are located at investigator facility and are available upon request. Copies of certificates are also available in the site Accident Prevention Plan.
Site Operations	40-hour HAZWOPER Site Supervisor Training CPR First Aid	Various	Various	Joshua Collins Theresa Allinger	Field Staff URS	All training certificates are located at investigator facility and are available upon request. Copies of certificates are also available in the site Accident Prevention Plan.

2.5.2.1 Site Location

The RRTS is located adjacent to the Delaware River in the city of New Castle in New Castle County, Delaware, approximately 10 miles south of Wilmington (Figure 1). This investigation is focused on MRS NCDE-002-R-01, located offshore and to the southeast of the RRTS. The MRS was originally described during the Closed, Transferring, and Transferred (CTT) Range Inventory (Malcolm Pirnie 2003) as a composite of the firing fans from a former 1,000-yard range and another shorter former rifle range (Figure 2). The Surface Danger Zones (SDZs) for active RRTS ranges overlap the historical firing fans and only the portion of the MRS that falls outside the footprint of the SDZs is eligible for inclusion in the Military Munitions Response Program (MMRP) (URS 2007). The 212-acre MRS boundary is limited to the wide, south end of the 1,000-yard range firing fan (Figure 2).

2.5.2.2 Site History and Potential Release Mechanisms

The 190-acre RRTS property was purchased in 1908 with Federal funds authorized under the 1903 Dick Act. The early history of the facility is not well-documented due to the loss or destruction of early DEARNG records. Known as the New Castle Rifle Range until 2005, the RRTS historically has been used for field exercises, training encampments, and live-fire exercises (USACHPPM 2004). The current mission of the RRTS is to provide training, administrative, and logistical support to the DEARNG and its customers, which include the New Castle City and County police, Special Weapons and Tactics (SWAT) teams, and related military and paramilitary police organizations.

This MRS was in operation from 1910 to 1940 as a 1,000-yard rifle range featuring small arms fire (Malcolm Pirnie 2003). According to the RRTS SI Report (URS 2007), a feature of this range is an earthen and concrete embankment that may have been used to elevate targets or as a backstop and is located adjacent to the bank of the Delaware River in the southeastern portion of the property. The current small arms ranges have remained in the same relative positions since the 1940s and are located north (upstream) of the former range. In addition, the private Ommelanden Trap and Skeet Range is located along River Road to the southwest of the RRTS. Prior to 1970, the small arms rifle ranges at the RRTS did not have target berms or backstops to intercept and trap bullets (Malcolm Pirnie 2003). Fired bullets were allowed to travel across open and wooded wetland portions of the facility toward and into the Delaware River.

The most common weapon used on the former 1,000-yard range was the Model 1903 Springfield rifle; no evidence was found for any other type of weapon. Most of the training at the former 1,000-yard range took place at the 100- and 500-yard firing points as these were the optimal combat firing ranges for this rifle. Training at the 1,000-yard distance was for shooting competitions and occurred much less frequently. The M1903 rifle at the time of active range operations fired the .30-caliber model 1906 ball cartridge (.30-06 cartridge) with a bullet composed of a lead core and a jacket of cupro-nickel containing copper, nickel, iron, and manganese. The rifle was “sighted” for a target up to 2,500 yards, although the maximum range of the ball cartridge, when elevated at an angle of 45 degrees, was 4,890 yards. Given that the firing purpose was for tournaments, the actual range of fire would be expected to be far closer to the 1,000-yard mark than the 4,890-yard maximum.

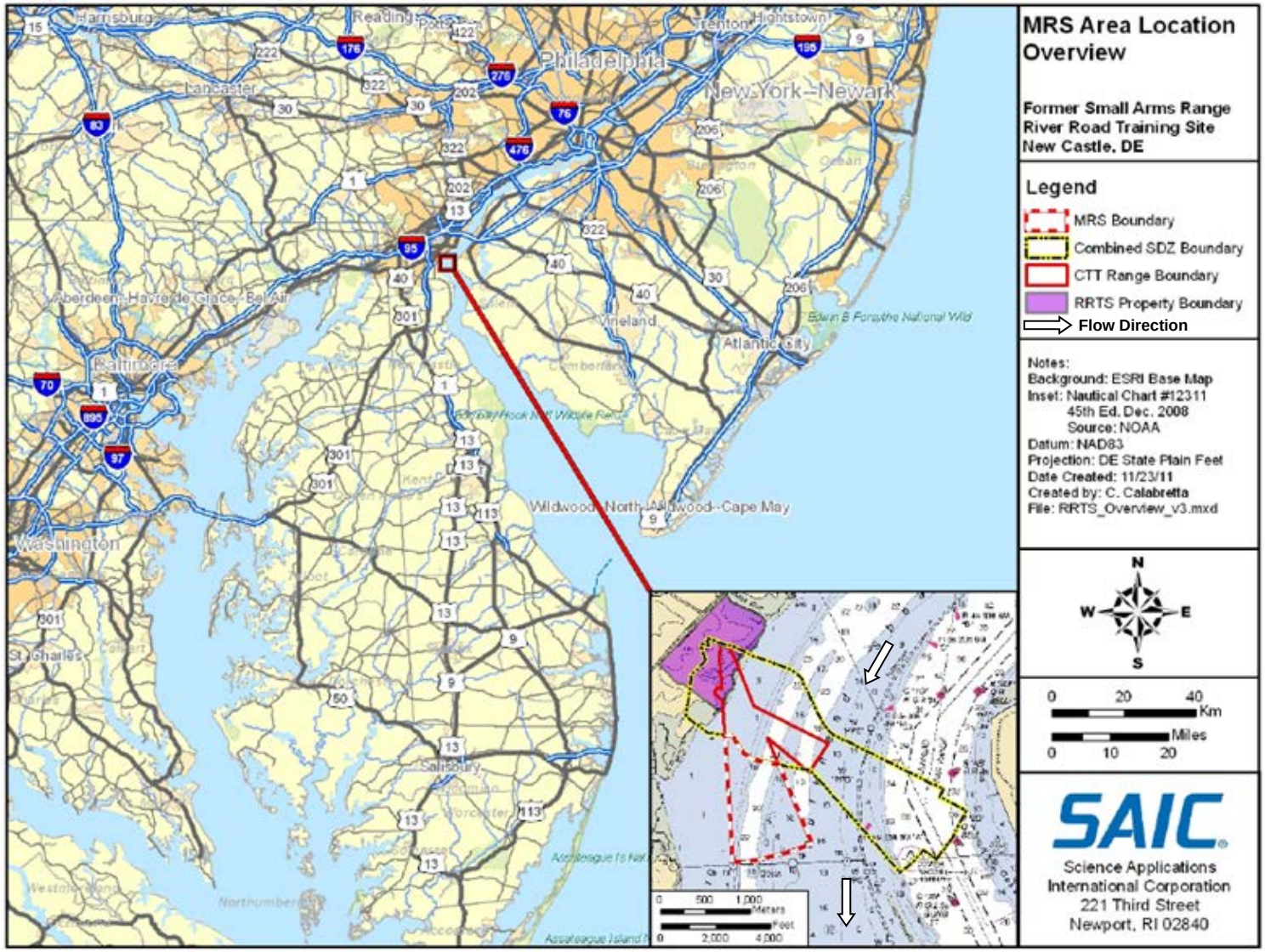


Figure 1. Location of the RRTS MRS, New Castle, Delaware

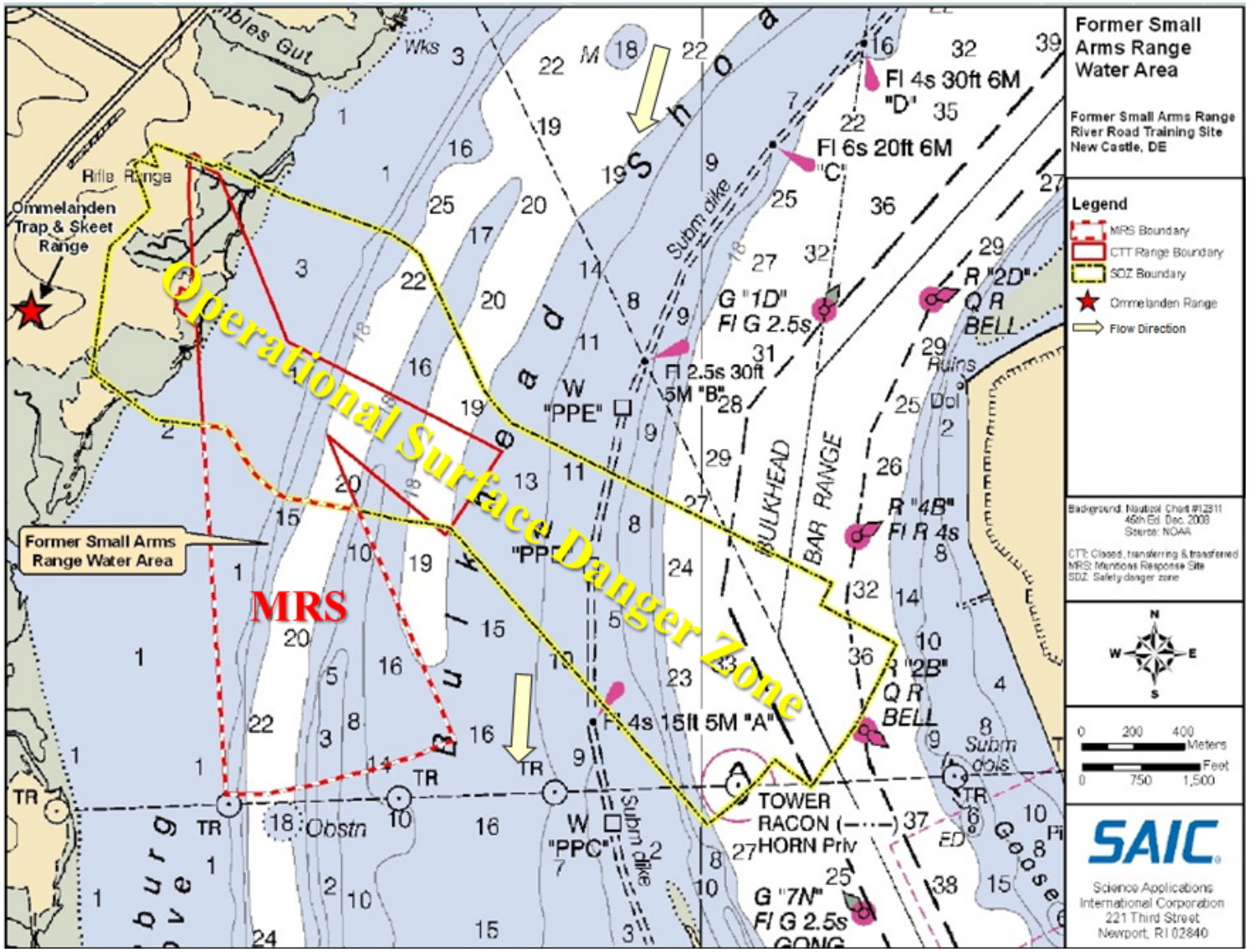


Figure 2. Location of Active Water Ranges and the MRS at the RRTS

QAPP Worksheet #9. Project Scoping Session Participants Sheet

Project Name: River Road Training Site MRS RI **Projected Date(s) of Sampling:** **Project Manager: Lisa Jones-Bateman**	**Site Name: DEARNG River Road Training Site** **Site Location: New Castle, Delaware**

Date of Session: November 3, 2011
Scoping Session Purpose: Discuss DQOs for the MRS RI to include discussions about appropriate sample parameters, locations, and numbers.

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Kim Harriz	Project Manager	ARNG Directorate	(703) 607-7991	Kim.Harriz@us.army.mil	Project Manager
Captain Kimberly Lindgren	Environmental Program Manager	ARNG	(302) 326-7132	kimberly.lindgren@us.army.mil	Project Manager
Emily Schiffmacher	Project Manager	USACE Baltimore District	(410) 962-6731	emily.n.schiffmacher@usace.army.mil	Project Manager
Kristen Thornton	Project Manager	DNREC	(302) 395-2650	kristen.thornton@state.de.us	Project Manager
Lisa Jones-Bateman	Project Manager	SAIC	(703) 676-7387	batemanl@saic.com	SAIC Project Manager
Greg Tracey	Project Manager	SAIC	(401) 848-4631	gregory.a.tracey@saic.com	SAIC Lead Scientist
Joe Peters	QA Manager	SAIC	(703) 676-8731	petersj@saic.com	SAIC QA Manager
Vickie Reddick	Community Specialist	SAIC	(865) 481-4736	vickie.m.reddick@saic.com	SAIC Community Specialist

Project Name: MMRP RI/FS at River Road Training Site, DE **Projected Date(s) of Sampling: Spring-Summer 2014** **Project Manager: Laurie Stenberg, URS Group, Inc. (URS)**	**Site Name: River Road Training Site (RRTS)** **Site Location: DNREC's offices, New Castle, DE**

Date of Session: 4 December 2013
Scoping Session Purpose: TPP1 Meeting

Name	Title/Role	Affiliation	Phone #	E-mail Address
John Haines	Project Manager	ARNG-Directorate	703-607-7986	john.b.haines.ctr@mail.mil
MAJ Marc Orndorff	Environmental Program Manager	DEARNG	302-326-7488	marc.a.orndorff.mil@mail.mil
Travis McCoun	Contracting Officer's Rep. (COR)	USACE	410-962-6728	travis.mccoun@usace.army.mil
James Bynum	Project Manager	USACE	410-962-6803	james.o.bynum@usace.army.mil
Garrett Wood	Intern	USACE		
Kristen Thornton	Project Manager	DNREC-SIRS	302-395-2650	kristen.thornton@state.de.us
Laurie Stenberg	Project Manager	URS	301-820-3123	laurie.stenberg@urs.com
Theresa Allinger	Geologist	URS	301-820-3631	theresa.allinger@urs.com
Josh Collins	Project Field Lead	URS	215-367-2456	joshua.collins@urs.com

QAPP Worksheet #10. Problem Definition

The problem to be addressed by the project: Historical records review performed during the RRTS SI indicated the possibility that small arms bullets may have entered the Delaware River Estuary, creating an elevated human health and ecological risk in the sediments due to metals. Environmental data are needed to identify the presence, nature, and extent of MCs (metals) in sediment at the Former Small Arms Range Water Area, evaluate whether MCs are present at concentrations that pose a potential risk to human and ecological receptors, and guide further management decisions.
The environmental questions being asked: Are metals concentrations at the MRS above background concentrations for the Delaware River? What are the COPCs at the subject range? What is the vertical and horizontal extent of the lead and other COPCs in the environment? What are the concentrations of the COPCs across the affected area? What environmental media are impacted (e.g., surface water, sediment)? Are the impacted areas limited to locations where bullets and fragments were initially deposited or has there been vertical/horizontal migration of the COPCs? If migration has occurred, what are the likely routes of migration? What are existing or potential human or environmental exposure pathways?
Observations from any site reconnaissance reports: See Sections 2.5 and 2.7.
A synopsis of secondary data or information from site reports: See Section 2.7.
The possible classes of contaminants and the affected matrices: See Worksheet #18 and Worksheet #19.
The rationale for inclusion of chemical and nonchemical analyses: The site history, as described in Section 2.5, reporting use of lead core/metal jacket bullets. From this history, the expected COPCs include lead as well as bullet jacket materials copper and nickel (Hatcher 1966).
Information concerning various environmental indicators: The results of various regional sampling efforts, which provide information on the condition of sediment at the RRTS, are discussed in Section 2.7. Maps depicting the site features are provided in Figures 3 through 6.
Project decision conditions ("If..., then..." statements): If concentrations of lead detected at the site during Phase 1 sampling exceed background concentrations and screening values, then a Phase 2 sampling effort will be conducted to determine whether unacceptable ecological or human health risks exist. If the Phase 2 data indicate an unacceptable risk, then further action including conduct of a FS will be recommended, otherwise No Further Action (NFA) will be recommended. See Worksheet #11, Step 5 (Analytic approach) for detailed if/then statements.

QAPP Worksheet #11. Project Quality Objectives/ Systematic Planning Process Statements

This worksheet documents the seven steps of the USEPA DQO process (USEPA 2006c) for the MC sediment sampling to evaluate risk to human and ecological receptors.

DQO Step	Description
Step 1 **State the Problem**	The site was part of an active range from 1910 to 1940, and is thus likely to contain spent bullets containing metals. As a result, MCs may have been released to the offshore environment through dissolution of the metals. An investigation is required to delineate the nature and extent of MCs, evaluate the potential risk to human health and ecological receptors, and guide further management decisions.
Step 2 **Identify the Goal of the Study**	The principal study questions for this project are: ▪ What is the general nature and extent of MCs in sediment of the site overall? ▪ Are the MC concentrations in the MRS within the representative background concentrations for the Delaware River? ▪ Is there an unacceptable risk to human health as a result of the MCs? ▪ Is there an unacceptable risk to ecological receptors as a result of the MCs? ▪ Is a Feasibility Study (FS) required? The alternative actions for this project are: ▪ MCs are not present in the MRS sediment above background concentrations for the Delaware River; therefore, MC concentrations are not site related and NFA is required. ▪ MCs are not present in the MRS sediment above project screening values; therefore, NFA is required. ▪ MCs are present in the MRS sediment above the project screening thresholds (PSTs); therefore, evaluation of the risk to human health and wildlife is warranted and will be performed. Subsequent actions would either warrant performance of an FS or recommendation for NFA. Based on the principal study questions and the alternative actions that may result in response to these questions, the following decision statements have been generated: ▪ Evaluate whether the concentrations of MCs in the MRS sediment are equal to or greater than background concentrations for the Delaware River and, therefore, are site related. ▪ Evaluate whether the concentrations of MCs in the MRS sediment are equal to or greater than the project screening values (Worksheet #15) and, therefore, additional assessment is required or NFA is warranted. ▪ Evaluate whether concentrations of MCs in the MRS sediment pose an unacceptable risk to human health and wildlife and, therefore, recommend whether an FS is warranted or an NFA decision document should be prepared.
Step 3 **Identify Information Inputs**	Inputs to the project decision are as follows: ▪ Analytical laboratory lead results for targeted Phase 1 locations within the MRS. Laboratory results will undergo full validation according to National Functional Guidelines for Inorganic Data Review (USEPA 2010). Phase I laboratory analysis will be done using USEPA SW-846 Method 6010C. ▪ Background laboratory lead results for reference locations in the Delaware River upstream of the MRS. ▪ Analytical chemistry results for all metals targeted at Phase 2 locations within the MRS and reference area per USEPA Method SW-846 and Method 6010C. ▪ Human health and ecological screening values for MCs (Table 4) ▪ Regional MRS conditions (grain-size specific) based on upstream background comparisons. ▪ Benthic community and bioassay assessment of toxicity for COPCs with supporting grain size and metal bioavailability (SEM-AVS) measurements. ▪ Life history information for the receptors selected for the baseline ecological risk assessment (BERA).

QAPP Worksheet 11. Project Quality Objectives/ Systematic Planning Process Statements (Continued)

DQO Step	Description
Step 3 **Identify Information Inputs** (Continued)	▪ Regulatory and DOD guidance for conducting human health and ecological risk assessments.
Step 4 **Define the Boundaries of the Study**	The boundaries of the study are defined as follows: ▪ The horizontal boundaries of the study includes the MRS area on the Delaware River within the former SDZ (described on Worksheet #10) but excluding the SDZs of operational ranges as shown on Figure 2. A background area upstream of the RRTS active ranges also is identified. ▪ The vertical boundaries of the study are limited to surface sediments within the biologically active zone extending down to 6 inches below the mudline. ▪ Temporal boundaries are limited to the representativeness of the collected data at the time of investigation relative to seasonality and any other temporal issues related to sediment dynamics that may impact surface sediment MC concentration/distribution. ▪ Chemical boundaries for the investigation are limited to MCs (lead, copper, and nickel).
Step 5 **Develop the Analytic Approach**	The decision rules for the evaluation of MC sampling data to be evaluated during Phase 1 and Phase 2 are provided below. The principal decisionmakers regarding these rules and potential further action are ARNG and DNREC. **Phase 1:** 1. **IF** 90 percent of the laboratory metals results for sediment samples are validated as usable data (not rejected), **THEN** it will be concluded that enough data exist to conduct the human health risk assessment (HHRA)/BERA and to subsequently make risk management decisions for individual EUs. **IF** quality issues for any of the laboratory analytical data lead to rejection of >10 percent of results from one or more sampling locations, **THEN** the question of whether enough data exist to conduct the HHRA/ecological risk assessment (ERA) and make risk management decisions will be reassessed and reanalysis of some of the laboratory samples may be needed. 2. **IF** the aggregate lead EPC for a given EU is above the background Delaware River UTL concentration (determined for sediments of similar grain size), **THEN** it will be concluded that lead may represent a site-related EU-specific risk to human health or ecological receptors, hence screening-level risk assessment will be required. **IF** the lead EPC does not exceed the background UTL, **THEN** it will be concluded that lead concentrations for the EU represent ambient risks and no screening-level risk assessment will be performed. An outlier analysis will be performed when calculating the EPC and **IF** suspected outliers are determined to be driving the decisionmaking for the EU, **THEN** additional management input will be sought before proceeding. 3. **IF** the lead concentration is found to exceed the background UTL along any portion of the MRS perimeter that does not border an active SDZ, **THEN** additional step-out sampling will be conducted to further define the spatial extent of potential MC contamination and confirm that the MRS is properly delineated.

DQO Step	Description
Step 5 **Develop the Analytic Approach** (Continued)	4. **IF** the lead EPC in a given EU exceeds the corresponding human health or ecological sediment screening value, **THEN** it will be concluded that lead (and by extension other MCs) may pose an unacceptable risk to human health as a COPC or to ecological receptors as a COPEC and, thus, Phase 2 sampling will be performed for that EU. **IF** lead is not detected or the EPC is less than or equal to the corresponding sediment screening values, **THEN** it will be concluded that lead (and by extension other MCs) are not human health COPCs or COPECs and no further evaluation is required. **IF Phase 2 sampling is required, THEN** additional sampling of the EU for all suspected MCs will be conducted, laboratory analyses performed, data validation completed, background screen performed, and COPCs/COPECs identified as described in Steps 1-4 above. Potential site-specific risks then will be evaluated through baseline human health and ecological risk evaluations on an EU basis, as described below: 5. **IF** one or more site-specific COPCs for **human health** are identified, **THEN** potential risks for fish ingestion by recreational fishermen utilizing the MRS will be further evaluated through a baseline HHRA incorporating a conservative exposure scenario. **IF** certain COPCs are found to pose risk to human health through this conservative approach, **THEN** these metals will be identified as human health COCs and more site-specific exposure assessment will be performed. **IF** no site-specific human health COCs are identified, **THEN** NFA for addressing human health risks will be required. **IF** one or more site-specific COPECs for ecological risks to the **benthic community** are identified, **THEN** a WOE evaluation utilizing these hazard quotients (HQs) in conjunction with concurrent sediment toxicity (10-day amphipod test), bioavailability (SEM-AVS), and benthic community diversity (taxonomy) results will be performed to identify ecological COCs for the benthic community. **IF** no site-specific ecological COCs are identified, **THEN** NFA for addressing benthic community risks will be required. The magnitude of potential trophic transfer risk for a sediment COPEC will be evaluated for **fish** via a food-chain bioaccumulation factor (BAF) model predicting tissue concentrations for comparison to published Critical Body Residues (CBR). **IF** the BAF-predicted fish tissue concentration for a COPEC (based on the EPC) exceeds the corresponding CBR, **THEN** it will be concluded that sediment at the site may pose an unacceptable risk to fish and that metal will be considered a COC for fish. **IF** the BAF-predicted fish tissue concentration for a COPEC is less than the CBR, **THEN** it will be concluded that sediment does not pose an unacceptable risk to the fish and NFA for addressing risks to fish will be required. The magnitude of potential trophic transfer risk for a sediment COPEC will be evaluated for **birds** via a food-chain model predicting the COPEC dose for comparison to published toxicity reference values (TRVs). **IF** the predicted dose for a COPEC exceeds the corresponding TRV, **THEN** it will be concluded that sediment at the site may pose an unacceptable risk to avian receptors and that metal will be considered a COC for birds. **IF** the predicted dose for a COPEC is less than the TRV, **THEN** it will be concluded that sediment does not pose an unacceptable risk to avian receptors and NFA for addressing risks to birds will be required. **IF** potential site-specific risks are identified for benthic invertebrates or upper-level receptors for multiple COCs, **THEN** overall ecological risks for the site will be evaluated using a WOE approach incorporating all lines of evidence from the Phase 2 sampling. **IF** the WOE evaluation confirms that unacceptable ecological risks are present for the site, **THEN** the site will require the development of remedial alternatives in an FS.

QAPP Worksheet #11. Project Quality Objectives/ Systematic Planning Process Statements (Continued)

DQO Step	Description
Step 6 **Specify Performance or Acceptance Criteria**	Worksheet #12 provides the performance criteria to be used for acceptance of the data. Sediment sampling locations will be selected utilizing a stratified sampling design based on the CSM. Although methodology for estimating sampling errors for the proposed sampling design exists (i.e., USEPA 2006c), due to a lack of previous data for the MRS it is not possible to realistically specify quantitative limits for Type I and Type II decision errors. The error tolerance for distribution of samples is related to the accuracy of achieving desired sampling locations with the precision Global Positioning System (GPS) navigation system, which is ±6.6 feet (2.0 m).
Step 7 **Describe the Plan for Obtaining Data**	The nature and extent of MCs in sediments of the site will be assessed during Phase 1 sampling at 82 sample locations over 3 EUs at the MRS and 20 background locations. The boundaries of each EU will be determined based on a stratified design where sampling density is based on the proximity to the source (i.e., firing area) and sediment stability (i.e., depositional), both parameters of which increase the likelihood of MC exposure. Because the goal of the MC sampling is to address gaps due to a lack of any focused investigation having been previously performed, the locations of the sediment samples within each EU will be evenly distributed with sample density correlated to the likelihood of MC exposure based on distance from the source and site characteristics. If the background comparison and screening-level risk assessment identify site-specific COPCs from the Phase 1 data (as described in Step 5), then Phase 2 sampling will be conducted. Phase 2 sampling will consist of collecting up to 10 additional sediment samples from each EU and 6 additional sediment samples from the background reference area. The locations of Phase 2 samples within an affected EU will be collocated with lead hotspots that were identified during Phase 1. Phase 2 data will be treated separately from Phase 1 data for statistical calculations and only Phase 2 data will be used for the baseline risk assessments. Worksheet #17 presents the justification for selecting the quantity and location of the samples. Worksheet #18 provides the sampling methodology.

2.5.2.3 Site Physical Characteristics

This section summarizes the general and site-specific physical characteristics of the MRS such as the environmental setting; topography, elevation, and surface; wildlife and vegetation; geology; hydrology and hydrodynamics; previous environmental investigations; chemicals of potential concern (COPCs); and land use considerations.

2.5.2.3.1 Environmental Setting

The MRS is located in a transition zone between the saline waters of Delaware Bay and the tidal freshwater portion of the Delaware River that is characterized by low salinity (3 to 5 practical salinity units [psus]) and high turbidity (>100 mg/L total suspended solids) (Frithsen, Killam, and Young 1991) (Figure 3). The climate of New Castle, Delaware is influenced by its close proximity to the Atlantic Ocean. Average air temperatures at New Castle range from 32°F (0°C in January) to 75°F (24°C in July) and total annual precipitation averages 41.1 inches (based on 51 years of data as reported by www.weatherbase.com).

2.5.2.3.2 Topography, Elevation, and Surface

The MRS lies entirely below sea level. Bathymetry for the site was last collected during a 2001 National Oceanic and Atmospheric Administration (NOAA) multibeam sonar survey (SAIC 2001) (National Ocean Service [NOS] Hydrographic Survey H11023). Water depth ranges from 1.4 to 23.4 feet (0.4 to 7.1 m). The most notable feature is the well-defined, 20- to -23-foot (6- to 7-m) deep Bulkhead Shoal Channel, which bisects the site from approximately north to south (Figure 4). The shoreline adjacent to the site consists of open and wooded tidal wetlands that are subject to river flooding. Sandy beaches intermittently fringe the tidal wetlands, particularly along shoreline features conducive to sediment deposition.

2.5.2.3.3 Wildlife and Vegetation

The estuarine habitat of the MRS supports diverse communities of algae, invertebrates, fishes, and birds. Although wildlife and vegetation specific to the MRS have not been described previously, a general description of the biological resources present at the RRTS was included in the instillation SI (URS 2007). In addition, a complete description of the biological resources and ecology of the Delaware River Estuary was provided in a review by Frithsen, Killam, and Young (1991) and in the environmental assessment completed for the Delaware River Main Stem and Channel Deepening Project (USACE 2009). The following subsections describe noteworthy ecological conditions surrounding the MRS.

Benthic Community—Benthic community composition within the Delaware River Estuary is primarily controlled by salinity, with sediment type and water/sediment quality secondarily influencing the distributional patterns imposed by the estuarine salinity gradient (Frithsen, Killam, and Young 1991). Stations in the vicinity of the MRS that were sampled during the 2008 Partnership for the Delaware Estuary (PDE) Bay Bottom Inventory had between 4 and 11 species and from 950 to 4,350 individuals per square meter (Figure 5). Dominant fauna in this region of the estuary include Oligochaetes and Arthropods (Frithsen, Killam, and Young 1991).

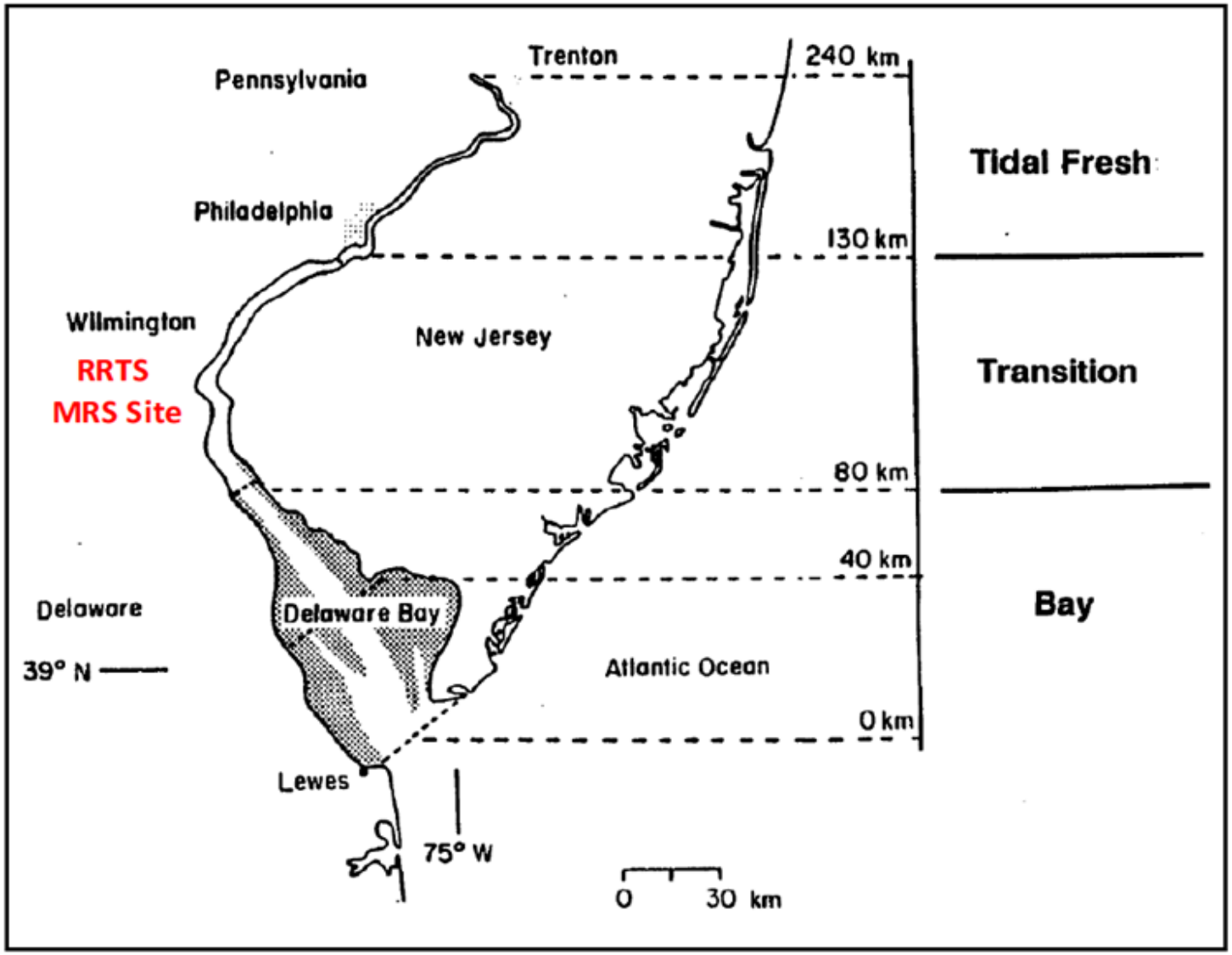


Figure 3. Delaware River Estuary Salinity Regions (from Frithsen, Killam, and Young 1991)

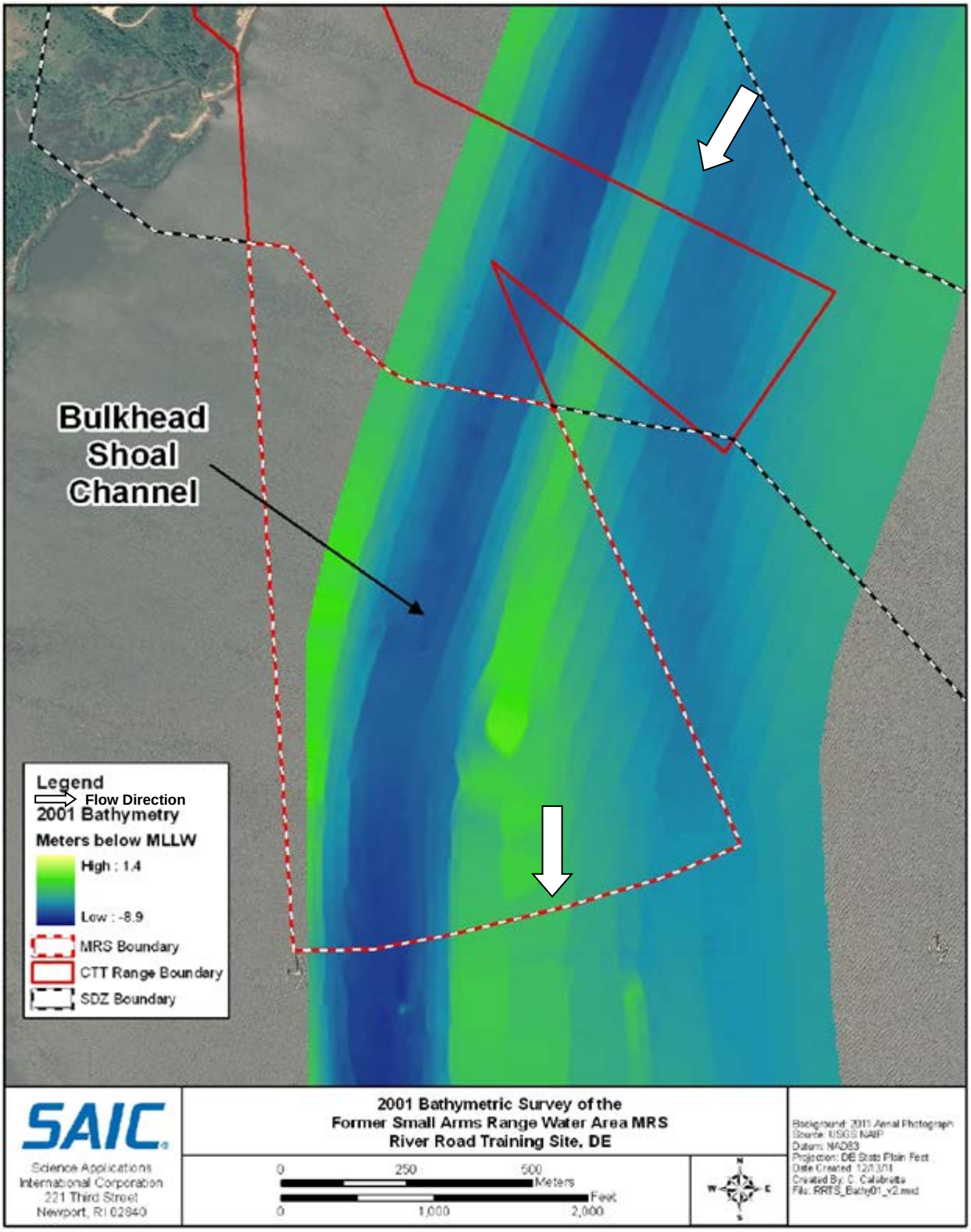


Figure 4. 2001 Bathymetric Survey of Areas Adjacent to the MRS

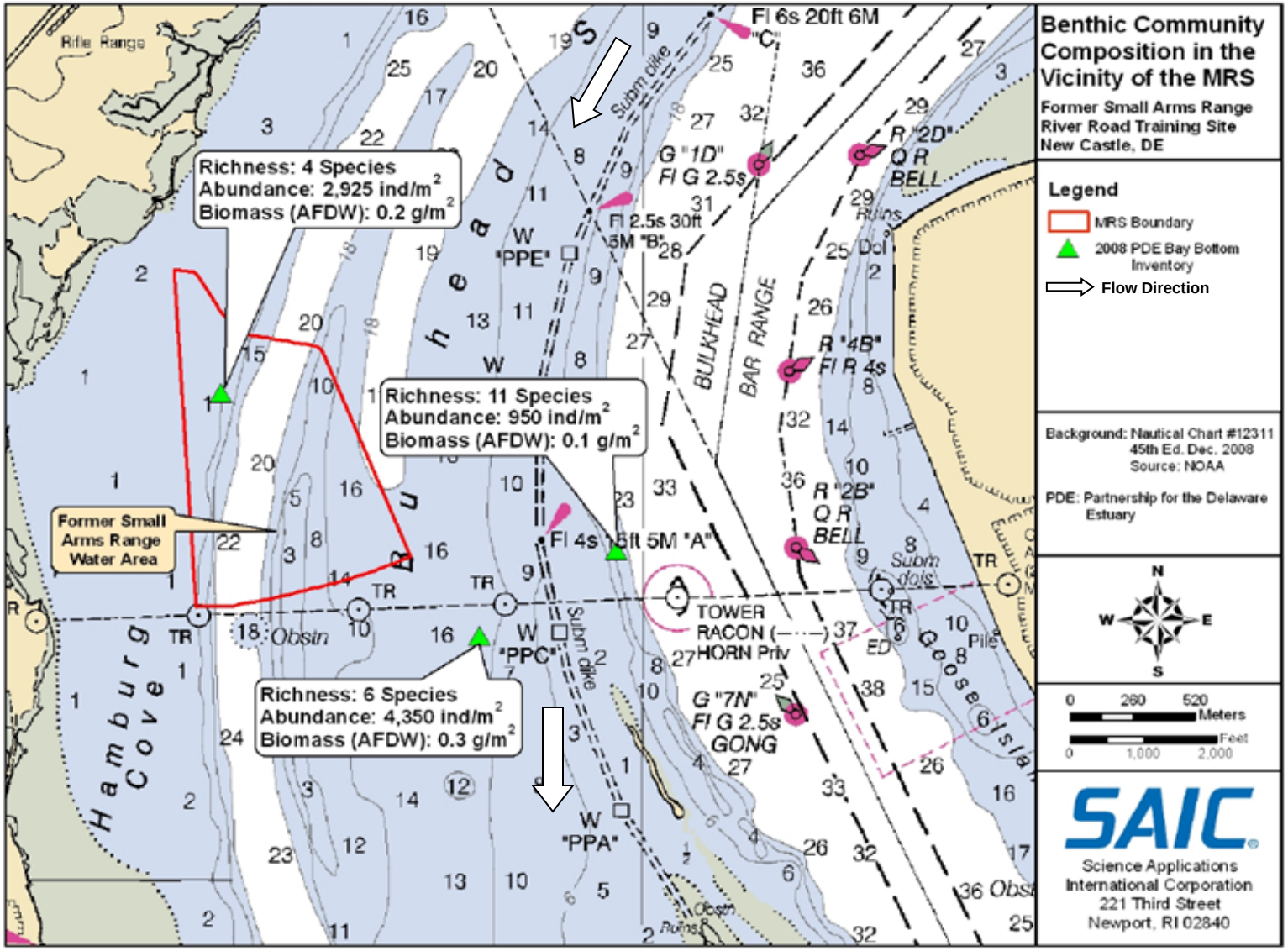


Figure 5. Benthic Community Composition in the Vicinity of the MRS

Aquatic Vegetation—Subtidal aquatic vegetation is not present in the subtidal waters off of the RRTS because the high turbidity of these waters prevents sufficient light to reach the bottom for plant growth.

Significant Wildlife Species—The following wildlife species have been identified in the vicinity of the MRS and are deemed significant to the current investigation:

- ***Invertebrates***—Shrimps, crabs (blue crab, *Callinectes sapidus* in particular), snails, ostracods, oligochaetes, polychaetes, clams, and mussels.
- ***Fishes***—Atlantic sturgeon (*Acipenser oxyrhynchus*), shortnose sturgeon (*Acipenser brevirostrum*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), gizzard shad (*Dorosoma cepedianum*), striped bass (*Morone saxatillis*), weakfish (*Cynoscion regalis*), spot (*Leiostomous xanthurus*), Atlantic menhaden (*Brevoortia tyrannus*), white perch (*Morone americana*), bay anchovy (*Anchoa mitchilli*), hogchoker (*Trinectes maculates*), channel catfish (*Ictalurus punctatus*), common carp (*Cyprinus carpio*), fallfish (Semotilus corporalis), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), rock bass (*Ambloplites rupestris*), suckers (*Catostomidae*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), and walleye (*Sander vitreus*).
- ***Aquatic or Semiaquatic Birds***—Black duck (*Anas rubripes*), blue-winged teal (*Anas discors*), mallard (*Anas platyrhynchos*), mottled duck (*Anas fulvigula*), northern pintail (*Anas acuta*), brant (*Branta bernicla*), Canada goose (*Branta Canadensis*), rail/king clapper (*Rallus longirostris*), common merganser (*Mergus merganser*), red-breasted merganser (*Mergus serrator*), hooded merganser (*Lophodytes cucullatus*), fulvous whistling/tree duck (*Dendrocygna bicolor*), canvasback (*Aythya valisineria*), greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), redhead (*Aythya Americana*), and wood duck (*Aix sponsa*).
- ***Raptors***—Bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrines*).

Pea Patch Island, located 1.3 miles (2.1 km) downriver from the MRS, contains the largest multispecies nesting colony of wading birds found on the eastern seaboard north of Florida (USACE 2009). According to annual population surveys conducted since 1993 (DNREC 2001), nine species of wading birds nest on the island, including great blue heron (*Ardea Herodias*), great egret (*Casmerodius albus*), snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), cattle egret (*Bubulcus ibis*), black-crowned night heron (*Nycticorax nycticorax*), yellow-crowned night heron (*Nyctanassa violacea*), and glossy ibis (*Plegadis falcinellus*).

Threatened and Endangered Species—According to the final SI (URS 2007), a protected species survey conducted between 1993 and 1994 at the RRTS found no state- or federally listed or endangered species. However, threatened and endangered (T&E) species and other species of concern were compiled for the Delaware River Estuary as part of the Delaware River Main Stem and Channel Deepening Project Environmental Assessment (USACE 2009). The Delaware River Estuary is within the historical range of 13 federally listed threatened or

endangered species, including five species of sea turtles, six species of whales, and two species of fish.

The five federally listed threatened or endangered sea turtles that occasionally enter the Delaware River Estuary include the endangered Kemp's ridley turtle (*Lepidochelys kempii*), leatherback turtle (*Dermochelys coriacea*), and hawksbill turtle (*Eretmochelys imbricata*), and the threatened green turtle (*Chelonia mydas*) and loggerhead turtle (*Caretta caretta*). All but the hawksbill turtle are listed in the State of Delaware.

The six species of federally listed endangered whales that have been observed along the Atlantic coast and occasionally within the Delaware Bay include the sperm whale (*Physeter catodon*), fin whale (*Balaenoptera physalus*), humpback whale (*Megapter novaeangliae*), blue whale (*Balaenoptera musculus*), sei whale (*Balaenoptera borealis*), and right whale (*Balaena glacialis*). None is listed in the State of Delaware. Due to the transient nature of sea turtles and whales within the Delaware River Estuary and the remote location of the RRTS in the brackish waters of the Delaware River Estuary, these species were deemed not to be of concern for the MRS area.

The two federally listed threatened or endangered fish species that can be found in the Delaware River Estuary include the shortnose sturgeon (*Acipenser brevirostrum*) and the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). The shortnose sturgeon is listed in New Jersey and Pennsylvania, but not in Delaware. The New York Bight Distinct Population Segment (DPS) of Atlantic sturgeon has recently been listed as a federally threatened species under the Endangered Species Act (ESA). The Delaware River Estuary is within the New York Bight DPS. The final rule for this listing was effective on April 6, 2012. Atlantic sturgeon is a state-listed species in Pennsylvania, New Jersey, and Delaware.

In addition to the marine species described above, four additional avian species of special concern to the MRS. The bald eagle was listed as an threatened or endangered species throughout the United States in 1978. Bald eagles in the project area are included as part of the Chesapeake Bay Region bald eagle population, which was determined to be threatened in 1995. Based on improvements in bald eagle population figures for the contiguous United States, the U.S. Fish and Wildlife Service (USFWS) removed the bald eagle from the endangered species list in June 2007. Although the bald eagle has been removed from the endangered species list, the bird is still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The bald eagle remains a state-listed species in New Jersey, Pennsylvania, and Delaware.

Peregrine falcons were listed as a federally endangered species in 1984 and removed from the endangered species list in 1999. The Peregrine falcon continues to be protected by the Migratory Bird Treaty Act and is a state-listed bird in New Jersey and Pennsylvania. This bird is not a listed species in Delaware. The black-crowned night heron (Nycticorax nycticorax) and the yellow-crowned night heron (Nyctanassa violacea) are both state-listed species in Delaware.

2.5.2.3.4 Geology

Based on the available data (Figure 6), sediment type within the boundary of the MRS appears to vary depending on location with respect to the Bulkhead Shoal Channel. Sediments within

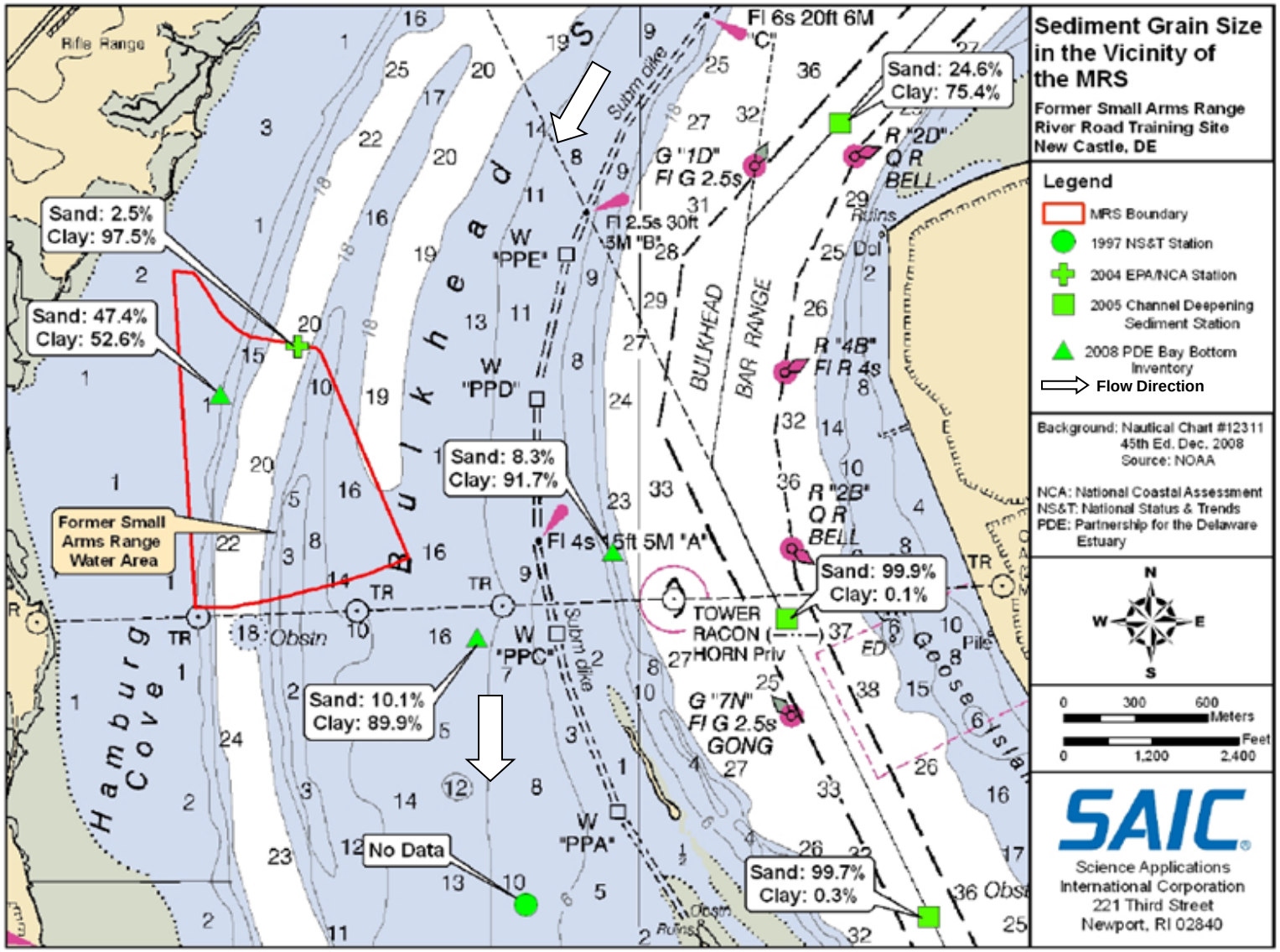


Figure 6. Sediment Grain Size in the Vicinity of the MRS

the channel itself tend to be muddy and dominated by fines (97.5% clay). Courser material was observed along the slope of Bulkhead Shoal Channel, where sediments were nearly equal parts sand (47.4%) and clay (52.6%).

2.5.2.3.5 Hydrology and Hydrodynamics

The mean tidal range in the vicinity of the MRS is 5.4 feet (1.6 m) (Delaware City NOAA Physical Oceanographic Real Time Station [PORTS] station #8551762). Current velocity for this region of the Delaware River reaches a maximum of 2.3 knots in the channels (NOAA 2011). Comparisons of bathymetric change over time reveal dynamic sediment transport conditions (see Section 5.4.1, Figure 17). These processes have resulted in highly variable sediment lithology types (i.e., "sand versus clay," as discussed in Section 2.5.2.3.4).

2.5.2.3.6 Previous Environmental Investigations

The MRS has not been investigated or surveyed previously to determine if a release of MCs occurred. RRTS personnel reported that it is common to find spent bullets along the shoreline (URS 2007). Since they are present on the shore, they were presumed as likely to be present in the river sediments. Because the SI shows there is evidence that small arms bullets may have entered the Delaware River and as the river is accessible to the public and also provides habitat for a variety of ecological resources, an agreement among ARNG and stakeholders was reached that an RI was warranted. As the former 1,000-yard range was used only for small arms, the only concern is for MCs in the Delaware River. There is no evidence that munitions and explosives of concern (MEC) or chemical warfare material (CWM) exists at this site.

Although field work in support of MC characterization within the MRS has not been performed, the results from a number of regional sampling efforts provide information useful to CSM development. Regional sampling efforts include the:

- USEPA National Coastal Assessment (NCA) (USEPA 2011a)
- NOAA National Status and Trends (NS&T) Program (Hartwell, Hameedi, and Harman 2001)
- USACE Delaware River Main Channel Deepening Project (Versar 2003 and 2005)
- PDE Bay Bottom Inventory (PDE 2011).

Lead concentrations at two stations sampled during prior surveys (USEPA NCA 2004 and PDE Bay Bottom Inventory 2008) within the MRS boundary (13.8 and 20.7 µg/g) did not exceed the USEPA Region 3 screening value for marine sediments (30.2 µg/g) (Figure 7). Benchmark exceedance was observed for lead in sediments (39.5µg/g) at a station 0.9 miles south of the MRS boundary.

2.5.2.3.7 Chemicals of Potential Concern

COPCs are defined as chemicals that are potentially site related and found to be present at concentrations that may pose risk to human health or wildlife following a screening-level risk assessment. COPCs will be selected by a risk-based screen in accordance with *Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening* (USEPA 1993a). If

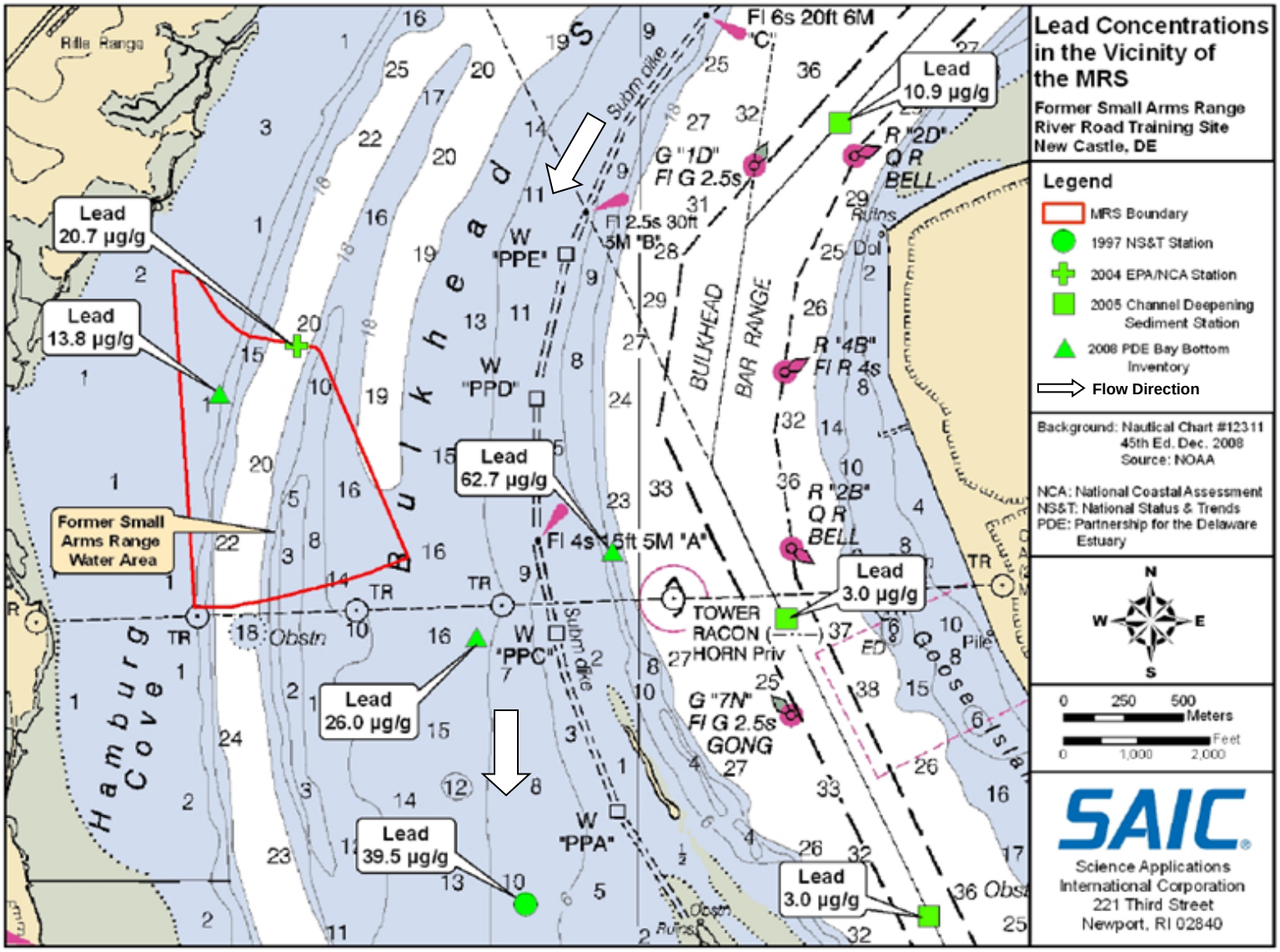


Figure 7. Historical Lead Concentrations in the Vicinity of the MRS

any COPCs are found to be elevated at the site (i.e., above background concentrations) and exceed baseline risk thresholds for upper-level exposure pathways, then these specific COPCs will be further identified as chemicals of concern (COCs).

For the present investigation, as for all MMRP investigations, only MCs will be considered for analysis and COPC screening. MCs are defined as any material originating from unexploded ordnance (UXO), discarded military munitions (DMM), or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions (10 United States Code [U.S.C.] § 2710). At the RRTS, the MRS site was part of an active range from 1910 to 1940, and it is thus likely to contain spent bullets containing metals. As a result, MCs may have been released to the offshore environment through degradation/dissolution of the bullets. The selection of target MCs that will be considered for analysis and COPC screening is described in the following paragraphs.

The most common weapon used on the former 1,000-yard range was the Model 1903 Springfield rifle, which at the time of active range operations fired the .30-caliber model 1906 ball cartridge (.30-06 cartridge) with a bullet composed of a lead core and a cupro-nickel jacket. U.S. riflery underwent tremendous change with the advent of the Model 1903 rifle chambered for the Model 1906 .30 caliber cartridge. With the advent of the second generation of smokeless powder cartridges, typified by the .30-06 and the Spitzer tipped variants of the Mauser family (6.5x55mm, 7x57mm, 7.65x54mm, and 7.92x57mm) came the problem of metal fouling. Although the bullets were always lead core, prior to 1922 the standard bullet jacketing alloy had been cupro-nickel coated steel with trace amounts of iron and manganese as strengthening (1893-1902), followed by solid cupro-nickel (1902-1921), which was an amalgam of copper (60%) and nickel (40%) agents (Hatcher 1966). In 1922, a jacketing material alloy was introduced by the Western Cartridge Company under the trade name “Lubaloy,” or lubricating alloy. Lubaloy was an alloy of copper (90%), zinc (8%), and tin (2%). Lubaloy was found to be a suitable jacketing material that when it was used, the lumpy metal fouling that was the trademark of earlier cupro- nickel clad bullets disappeared entirely. This so called “gilding metal” remains the jacketing material for U.S. service bullets. From this history, the expected metals at the MRS would include lead (Pb) as well as jacket materials including, in order of abundance, copper, nickel, zinc, and tin, as well as iron and manganese agents (Hatcher 1966). Because of bullet core composition, lead will serve as the primary target MC for Phase 1 of the MRS investigation. Copper and nickel, in addition to lead, also will be included in Phase 2 sampling based on the percent composition of the bullet jackets, as described above.

All small arms ammunition contains propellants: smokeless powder is/was single- or double-base propellant containing ~90 percent nitrocellulose. Double-base propellant also includes nearly 10 percent nitroglycerin depending on the specific propellant mixture. However, the propellant would have been consumed when the rounds were fired. Hence, they only are detectable if large quantities of unfired ammunition were discarded in or near the river. Even in that case, each round of .30 caliber ammunition contains <1 to 3 grams of propellant, and since the range has not been used since 1940, it would be difficult to detect any remnant nitrocellulose or nitroglycerin (even if test methods were available for these compounds). As no evidence of explosive and/or propellant use in large quantities exists at the RRTS, these compounds will not be analyzed in samples collected during this investigation.

The release of MCs into offshore sediments is expected to be mitigated by several factors related to the nature of the bullets commonly used at the former 1,000-yard range and the environment into which they were deposited. For example, the cupro-nickel jacket material encasing the bullets that were typically fired at the former 1,000-yard range is highly resistant to corrosion in seawater because its electrode potential is adjusted to be neutral with regard to seawater. In addition, bullets deposited into the MRS will have impacted water prior to reaching the sediment surface and are likely to be intact with minimal deformation; a premise which is supported by the absence of impact deformation on most of the bullets found along the beach and in near shore sediments of the RRTS (Duffield 1995). This will minimize the surface area available to corrosion and dissolution. Finally, deposition of the bullets in the buffered sediment environment (pH 7 to 8) limits the potential for conditions conducive to oxidation (at pH < 4) or reduction (at pH > 11) that are needed for lead dissolution.

2.5.2.3.8 Land Use Considerations

Current and potential future uses of the MRS include general recreation and recreational fishing. In addition, the site is bisected by the Bulkhead Shoal channel and, as such, is likely used for commercial and recreational navigation. Other land use considerations of potential importance to this evaluation include the proximity of the MRS to currently active firing ranges. The MRS is located downrange from the private Ommelanden Trap and Skeet Range and downstream from the SDZs for the active ranges at the RRTS facility (Figure 2). Also of importance to this evaluation is the location of the site downstream from numerous industrial sources such as oil refineries, petrochemical plants, and the DuPont Edgemoor Titanium Dioxide production facility. Such processing activities may have resulted in metals being present in wastewater effluent (possibly in high levels if the plant operated prior to the promulgation of the Clean Water Act). These potential sources will be addressed in the sampling design through evaluation of chemical concentration trends near the upstream and downstream border of the MRS where impacts of these operational ranges would most likely be evident.

2.5.2.4 Problem to be Solved

Environmental data are needed to identify the presence, nature, and extent of MCs in sediment at the Former Small Arms Range Water Area, evaluate whether MCs are present at concentrations that pose a potential risk to human and ecological receptors, and guide further management decisions as to whether a remedial action is required.

2.6 PROJECT QUALITY OBJECTIVES AND MEASUREMENT PERFORMANCE CRITERIA

This section discusses the project decisions that will be made and the data quality required for good decisionmaking.

2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process

RI scoping meeting discussions, which resulted in the sampling strategy detailed in Section 3.1, used the USEPA DQO process (USEPA 2006c) to ensure enough data of sufficient quality will be collected to enable accurate decisionmaking. The RI scoping meeting was held

on November 3, 2011 and the TPP1 meeting was held on December 4, 2013. TPP1 minutes are included in Appendix C. A list of participants from both meetings is included on Worksheet #9. Worksheet #10 summarizes the development of the problem definition for RI field work activities at the RRTS. Worksheet #11 summarizes the systematic planning process used to develop DQOs for the RI being conducted at the RRTS. The analytical approach to interpretation of the field data is presented in Figure 8.

As agreed upon in the original DQO scoping meeting, the MRS for data interpretation purposes will be divided into three subareas, called exposure units (EUs), reflecting varying degrees of potential contamination from former firing range usage (Figure 10). These EUs (EU 1, EU 2, and EU 3) were delineated subjectively based on the location of the Bulkhead Shoal channel, distance from the potential source (i.e., the firing point of the Former Small Arms Range), and the presence of various bottom features that would affect MC exposure (e.g., likelihood of burial). EU 1 is 31 acres and has the highest likelihood for MC exposure, with undisturbed sediment and a location closest to the firing point. EU 2 is 99 acres and has a moderate risk for MC exposure due to the presence of the Bulkhead Shoal Channel, which may serve to concentrate bullets that have landed in this area. EU 3 is 82 acres and represents the portion of the MRS with the least likelihood of MC exposure, since it is located farthest from shore and features disturbed sediments and a high likelihood for MC burial.

The investigation approach is to be separated into two phases. In Phase 1, sediment samples across all three EUs and an upstream background area will be collected and sent to a laboratory for lead analysis. Depending on Phase 1 findings, a Phase 2 sampling program may be implemented under a subsequent mobilization that would involve further sediment sampling and analysis for additional MCs as well as chemical, bioavailability, geotechnical, and biological parameters to support ecological risk assessment.

Lead (only) is proposed for analysis to support Phase 1 screening of the site to document if an MC release has occurred, as it is the major component of the Spitzer bullets (greater than 85% by weight). Upon completion of sampling and analysis, the concentration of lead in sediment from the MRS will be compared to the concentration of lead in sediment from a background reference area located upstream of the MRS (sampled concurrently) to determine whether the concentrations observed at the MRS are site related or similar to the rest of the river. If the exposure point concentration (EPC), defined as the 95 percent upper confidence limit (UCL) of the mean, of lead for each EU exceeds the UTL, defined as the upper 95 percent UCL on the 95th percentile, for the background reference area for sediments of similar grain size, the associated concentrations will be deemed potentially site specific. At that point, the lead EPC for each EU will be compared to appropriate human health and ecological screening-level risk criteria. If the lead EPC exceeds the selected screening values, then lead will be considered a COPC and Phase 2 sampling activities will be initiated. If the EPC for each EU does not exceed the background UTL, then no screening-level risk assessment or Phase 2 sampling will be performed for that EU. If the lead concentration is found to exceed the background UTL and screening-level risk criteria at an individual location along any portion of the MRS perimeter that does not border an active SDZ, additional step-out sampling will be conducted to further define the spatial extent of potential MC contamination and confirm that the MRS is properly delineated.

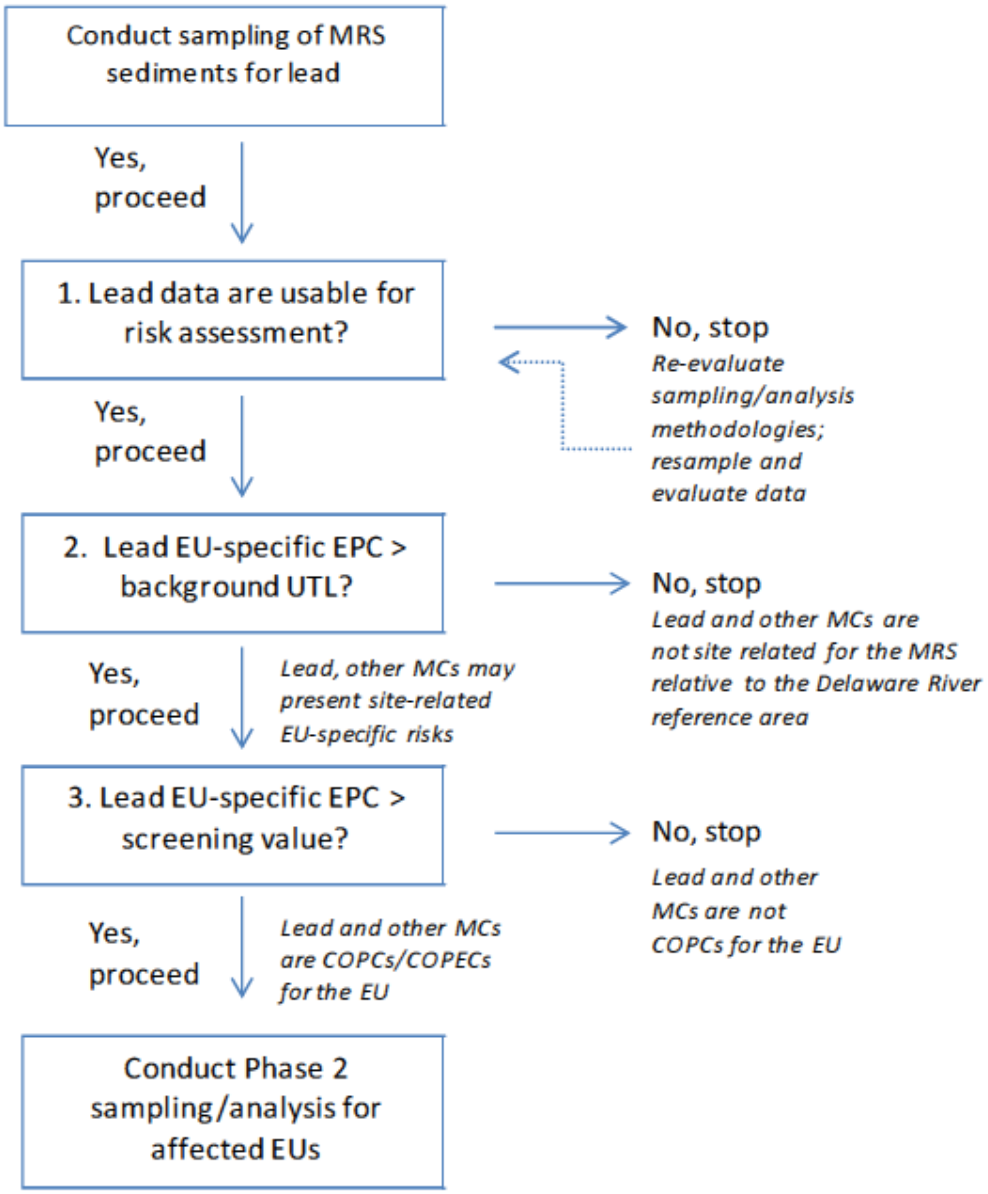


Figure 8. Analytic Approach Flow Chart for the RRTS MRS RI: Phase 1 Evaluations

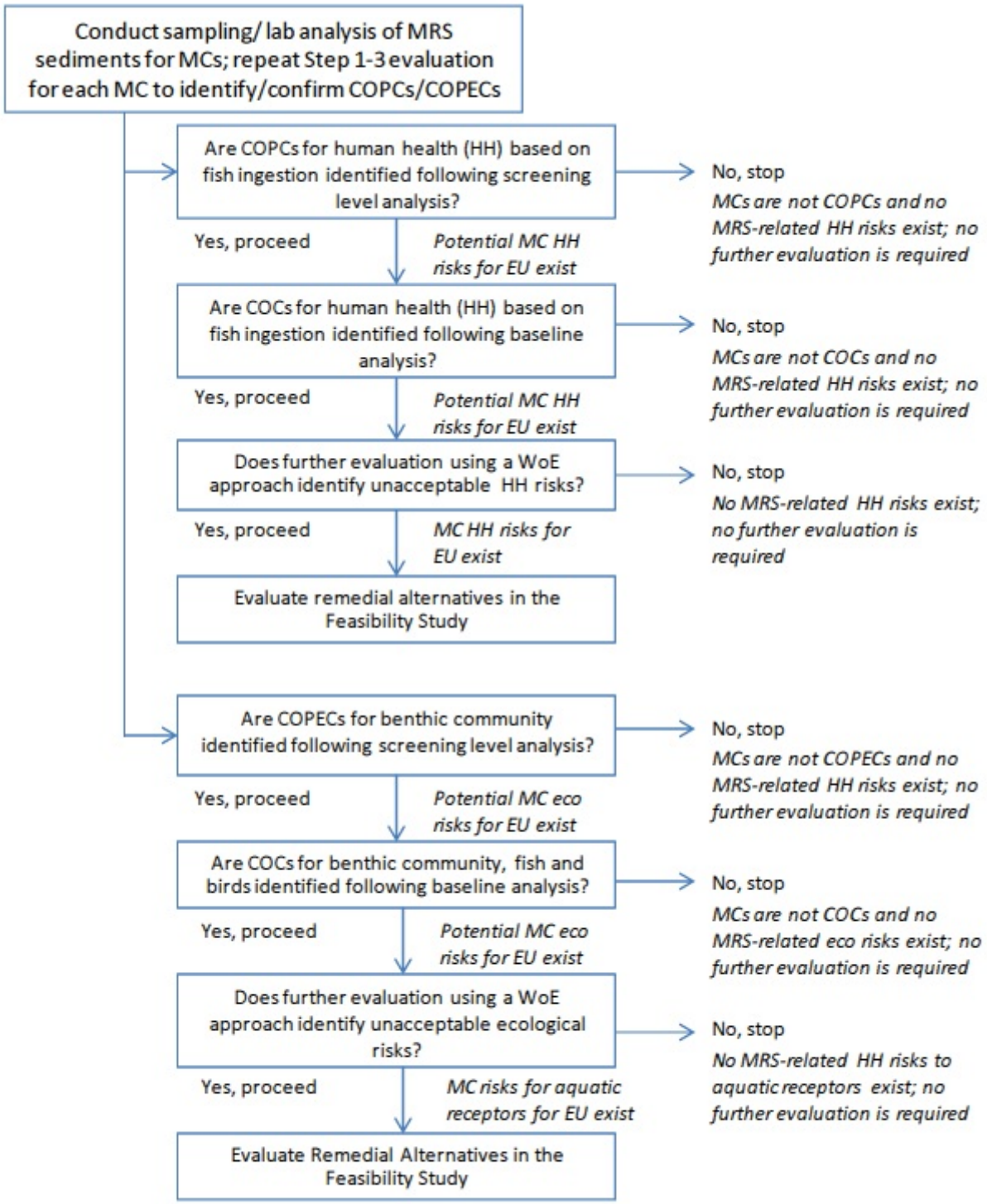


Figure 8. Analytic Approach Flow Chart for the RRTS MRS RI: Phase 2 Evaluations (Continued)

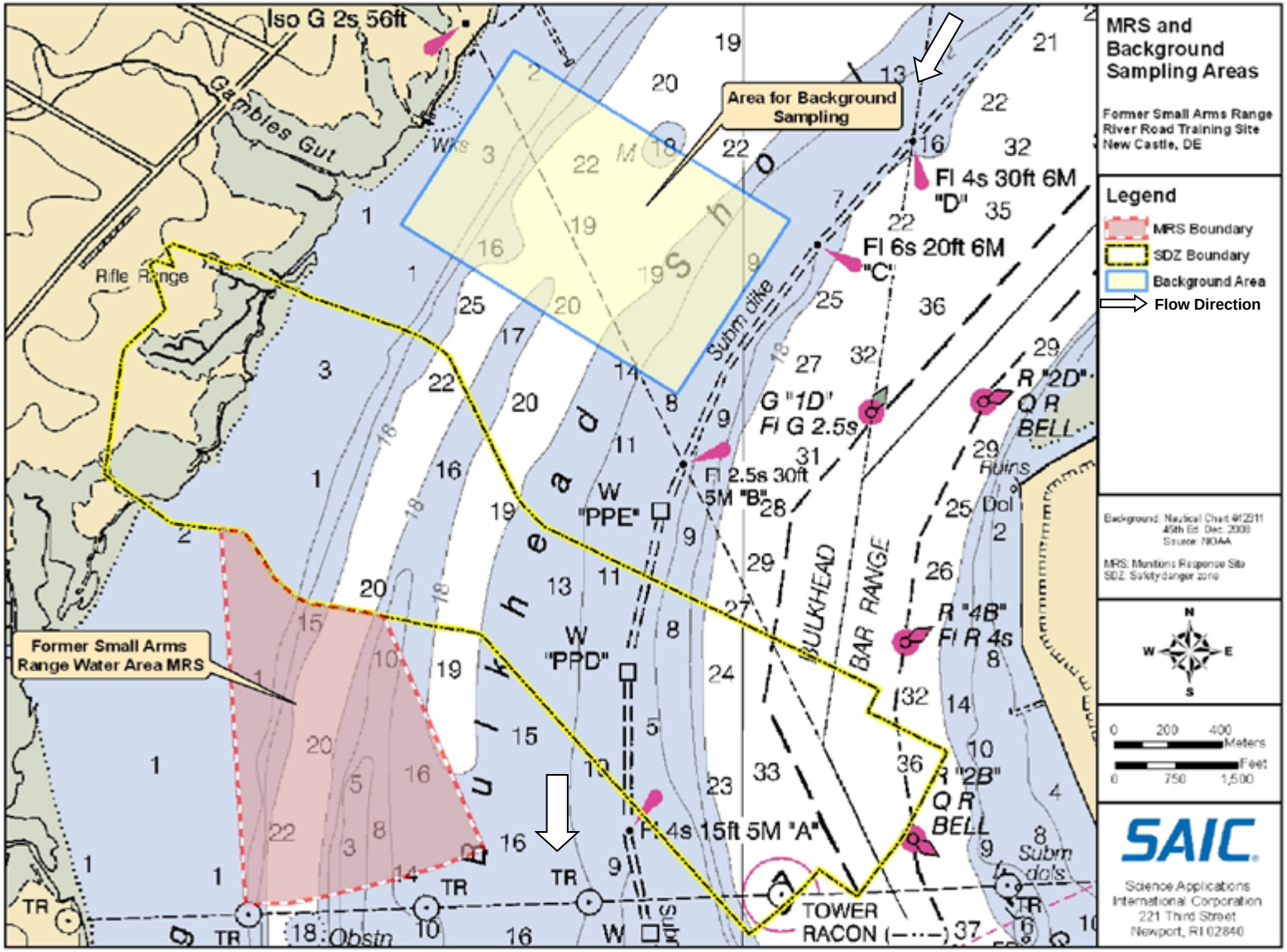


Figure 9. Overview of MRS and Background Sampling Areas

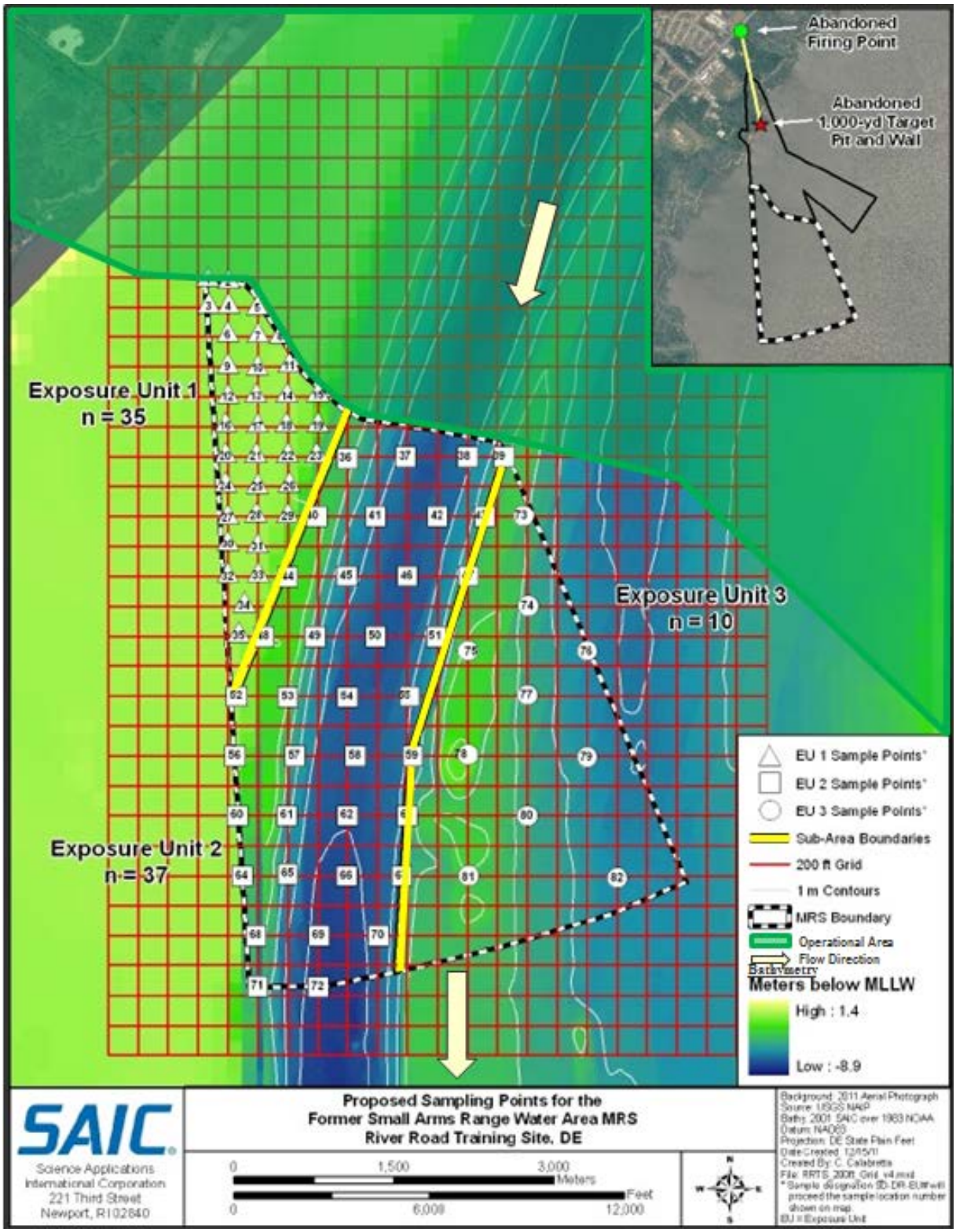


Figure 10. Proposed RI Sampling Locations for the RRTS MRS

In Phase 2, additional sediment sampling and laboratory analysis for lead, copper, and nickel will be conducted to support baseline human health and ecological risk assessments. Additional biological analyses (e.g., sediment toxicity testing, benthic community analysis) and chemistry analysis (e.g., SEM-AVS, hydrogen sulfide) also will be conducted to support baseline risk characterization. The background comparison and screening-level analyses performed for lead in Phase 1 will be repeated for all target metals in Phase 2 to identify human health COPCs and chemicals of potential ecological concern (COPECs). Upper-level exposure assessments then will be performed to identify both human health and ecological COCs. A weight-of-evidence (WOE) evaluation will be conducted on the study findings to assess the magnitude of the screening-level exceedances and determine the need for more site-specific exposure modeling.

2.6.2 Measurement Performance Criteria

Measurement performance criteria for laboratory lead analysis are discussed below and presented in Worksheet #12.

2.6.2.1 Precision – Laboratory Metals Analysis

Precision is the measure of the degree of reproducibility exhibited by a set of replicate results or the agreement among repeat observations made under the same conditions. Precision is usually expressed as standard deviation, relative percent difference (RPD), or range, in either absolute or relative terms. Precision will be determined through the use of spike analyses conducted on duplicate pairs of laboratory and environmental samples (matrix spike/matrix spike duplicates [MS/MSDs]) or comparison of laboratory duplicate responses. The RPD between two positive results will be calculated and used as a QC indication of the field procedures, matrix effects, and precision of the analyses conducted.

The precision of the laboratory analytical processes will be determined through evaluation of laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) analyses. The standard deviation of these measurements over time will provide confidence that implementation of the analytical protocols was consistent and acceptable. These measurements will establish the precision of the laboratory analytical process. Precision of the field sampling process will be determined through the evaluation of field duplicate samples. Field duplicates will be collected at a rate of 10 percent (1:10) of the number of environmental samples. Field duplicate acceptance criteria will be set at 50 RPD.

Environmental sample matrix precision will be assessed by comparing the analytical results between MS/MSD analyses, and laboratory duplicates and field duplicates for each analytical parameter. The RPD will be calculated for each pair of duplicate analysis using Equation (1) and will produce an absolute value for RPD. This precision measurement is impacted by variables associated with the analytical process, influences related to sample matrix interferences, consistent implementation of sampling procedures, and degree of sample homogeneity.

$$RPD = \frac{|S - D|}{\frac{(S + D)}{2}} \times 100 \qquad (1)$$

Where:

S = First sample value (original value)
D = Second sample value (duplicate value).

Worksheet #12 provides sampling and analytical measurement performance criteria for precision for each method and matrix to be sampled during the RI at the RRTS.

2.6.2.2 Accuracy/Bias – Laboratory Analysis

Accuracy is the nearness of a result, or the mean of a set of results, to the true or accepted value; *bias* describes the systematic or persistent distortion associated with a measurement process. Analytical accuracy is expressed as the percent recovery (%R) of an analyte that has been added to a blank sample or environmental sample, at a known concentration, during or after sample preparation. Accuracy will be determined in the laboratory through the use of MS and MSD analyses, post-digestion spike analyses, and, if necessary, LCS analyses, serial dilution analyses, and blank spike analyses. The %Rs for specific target analytes will be calculated and used as a QC indication of the field procedures, matrix effects, and accuracy of the analyses conducted.

The accuracy of the laboratory analytical measurement process and analytical equipment accuracy will be determined by analyzing LCS and continuing calibration verification (CCV) samples. The %R of blank spike samples (e.g., LCS, CCV) will be calculated using Equation (2). One LCS sample will be analyzed for every matrix and analytical batch. The rate of CCV samples will differ depending on the analytical method.

$$\%R = \frac{A}{B} \times 100 \tag{2}$$

A = The analyte concentration determined experimentally from the spiked sample
B = The true or accepted value of the spiked sample.

Environmental sample accuracy will be assessed for compliance with the established QC criteria that are described on Worksheet #12 using the analytical results of MBs, MS/MSDs, LCSs, and field blanks. All MBs, initial calibration blanks (ICBs), and CCBs must be at or below the method reporting limit (MRL). The %R of MS samples will be calculated using Equation (3). This accuracy measurement is impacted by variables associated with the analytical process, influences related to sample matrix interferences, consistent implementation of sampling procedures, and degree of sample homogeneity.

$$\%R = \frac{A - B}{C} \times 100 \tag{3}$$

Where:

A = The analyte concentration determined experimentally from the spiked sample
B = The background level determined by a separate analysis of the unspiked sample
C = The amount of spike added.

Worksheet #12 provides the sampling and analytical measurement performance criteria for accuracy/bias for each method and matrix to be sampled during the RI at the RRTS.

QAPP Worksheet #12. Measurement Performance Criteria Table

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Sediment/Aqueous					
Field Duplicates	Inductively Coupled Plasma (ICP) Metals	1 per 10	Precision	<50% RPD	S & A
Method Blank (MB), Industry Classified Benchmark (IndCB), and Continuing Calibration Blank (CCB)	ICP Metals	MB – Once per batch IndCB/CCB – 1 per 10	Accuracy/Bias Contamination	No analyte detected >1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater	A
Equipment Blanks Field Blanks	ICP Metals	Equipment Blanks – Once per day Field Blanks – Once per event	Accuracy/Bias Contamination	<LOQ	S & A
MS/MSD (Not applicable for aqueous EQB) & LCS/LCSD	ICP Metals	MS/MSD – 1 in 20 LCS/LCSD – Once per batch	Precision – Laboratory	RPD <20%	S & A
MS/MSD(Not applicable for aqueous EQB) & LCS/LCSD	ICP Metals	MS/MSD – 1 in 20 LCS/LCSD – Once per batch	Accuracy/Bias	Aqueous: Lead : 86-113% Copper: 86-114% Nickel: 88-113% Sediment: Lead : 81-112% Copper: 81-117% Nickel: 83-113%	S & A
Serial Dilution (for ICP)	ICP Metals	1 in 20	Accuracy/Bias	<10% Difference	A

2.6.2.3 Sensitivity and Quantitation Limits

The sensitivity of an analytical method/instrumentation is a measure of the ability of the test method/instrumentation to meet prescribed minimum levels for reporting. Sensitivity is a significant consideration in the selection of an analytical method(s) that can achieve project-specific DQOs. For this project, analytical requirements for sensitivities are represented by laboratory-specific LOQs, levels of detection (LODs), and detection levels (DLs). The LOQ is the lowest concentration that produces a quantitative result within specified limits of precision and bias. For DOD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration (ICAL) standard. The LOD is defined as the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate is 1 percent. The DL is smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99 percent level of confidence. At the DL, the false negative rate is 50 percent. Laboratory LOQs, LODs, and DLs will be provided by the laboratory subcontracted to perform analytical chemistry analyses.

2.6.2.4 Representativeness

Representativeness is the term most associated with the proper design of the sampling program. Representativeness qualitatively expresses the degree to which data accurately reflect site conditions.

Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences. If it is suspected that data are not representative, then how the lack of representativeness affects decisionmaking will be assessed and additional sampling may be needed.

2.6.2.5 Comparability

Comparability is a qualitative term that relates a project data set to other data sets. This investigation will employ narrowly defined sampling methodologies, use of standard sampling procedures and equipment, uniform training, documentation of sampling, standard analytical protocols/procedures, QC checks with standard control limits, and universally accepted data reporting units to ensure comparability to other data sets. Through proper implementation and documentation of these standard practices, the project will establish confidence that data will be comparable to other project and programmatic information by following all procedures in this QAPP throughout the entire project.

2.6.2.6 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data expected under normal conditions. It is expected that laboratories will provide data meeting system QC acceptance criteria for all samples tested. Overall project completeness goals take into account the potential for sample losses (e.g., due to breakage) and potential data losses (e.g., due to severe matrix interferences). Project completeness will be determined by evaluating the planned versus actual quantities of data. Adjustments will be made if project field changes alter planned numbers of samples during the

implementation of the RI sampling activities at the RRTS. All data not flagged as rejected by the review, verification, validation, or assessment processes will be considered valid. The sample data quality completeness goal is 90 percent. The sample collection completeness goal is 95 percent. If sample data quality or sample collection completeness goals are not met, then recollection of samples or reanalysis of samples will be considered, as necessary.

2.7 SECONDARY DATA EVALUATION

Sediments within the MRS have not been previously sampled to determine if MCs have been released to the environment as a result of historical site activities. Prior investigations of the MRS have been limited to historical records review and interviews with RRTS personnel and included a CTT Range Inventory Report (Malcolm Pirnie 2003) and an SI of the RRTS (URS 2007). These investigations were conducted under CERCLA in order to satisfy the Preliminary Assessment (PA)/SI requirement for the MRS at the RRTS.

The Army completed the CTT Range Inventory Report for the RRTS in March 2003 (Malcolm Pirnie 2003), which formally identified the MRS as a potential MRS. A review of current RRTS activities performed during the subsequent SI (URS 2007) revised the areal extent of the offshore MRS to exclude the area overlapping SDZs associated with operating ranges.

The results of the SI provided clear evidence that the MRS was an SDZ for a former 1,000-yard rifle range at the RRTS used from approximately 1910 to 1940. Further, the SI determined that small arms fire from the former 1,000-yard range likely reached the Delaware River. As a result of these findings, a consensus was reached between all stakeholders that sufficient evidence existed to warrant an RI in order to complete MC characterization. In addition, a programmatic decision was made to advance all water-related MRSs directly to the RI phase. Since it had already been determined that small arms were fired into the Delaware River Estuary, sediment sampling as part of the SI was deemed unnecessary to support a recommendation for further action (URS 2007).

2.8 PROJECT OVERVIEW AND SCHEDULE

The following sections provide a general overview of the RI activities that will be performed and a project schedule.

2.8.1 Project Overview

Tasks assigned under the project work breakdown schedule (WBS) as identified in the SOW for the RI will include conducting field sampling and developing reports. A principal objective of the RI is to gather sufficient information to determine if a remedial action is necessary, including assessment of human health and ecological risk, or to determine if the level of contamination, if present, is within acceptable risk levels to warrant NFA or manage through land use controls (LUCs). The project tasks are summarized on Worksheet #14. The period of performance for the work through completion of the Final RI report will be determined by ARNG (Worksheet #16).

QAPP Worksheet #13. Secondary Data Summary Discussion

Secondary Use Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
NOAA NS&T Monitoring Report	NOAA	Sediment Toxicity	Qualitative Reference	Not temporally collocated with survey
Delaware River Dredging Project Report	USACE	Sediment Chemistry	Qualitative reference	Not temporally collocated with survey
NCA	USEPA	Sediment and Tissue Chemistry	Qualitative reference	Not temporally collocated with survey
Bay Bottom Inventory	Partners for Delaware Bay	Sediment Chemistry	Qualitative reference	Not temporally collocated with survey

QAPP Worksheet #14. Summary of Project Tasks

Major project tasks are summarized below:

1. Sample Collection Tasks:

    a. Collect Phase 1 sediment samples for laboratory lead analysis at selected locations within three EUs. See Section 3.1 for details.

    b. Collect step-out sediment samples for lead analysis if Phase 1 lead results indicate further delineation is required. See Section 3.1 for step-out sample collection details.

    c. Collect Phase 2 sediment samples if the Phase 1 calculated EU EPCs exceed the background UTL and selected screening values, as described in Section 2.6. See Section 3.1 for Phase 2 sample collection details.

2. Laboratory Analytical Tasks: Laboratories will analyze Phase 1 lead samples; step-out lead samples, if required; and Phase 2 chemistry, bioassay, and macroinvertebrate samples, if required, in accordance with procedures and methods provided in Section 3.1, Section 3.2, and Appendix B.

3. Systematic Planning Tasks: Evaluate Phase 1 data using decision criteria provided in Section 2.6 to determine if Phase 2 sampling and risk assessment are required.

4. Quality Control Tasks: Sample collection and sample analyses will incorporate all QC samples described in Section 3.4 and QC measures described in Section 3.2.

5. Secondary Data Tasks: The use of secondary data is described in Section 2.7.

6. Data Management Tasks: The management of all project data (i.e., field records, laboratory records, data assessment records, and inspection and review records) is discussed in Section 3.5.

7. Project Assessment and Audit Tasks: Assessment and oversight elements are described in Section 4.

8. Data Review Tasks: Data Verification, data validation, data usability, and risk assessment are discussed in Section 5.

The screening methodology that will be used to evaluate the results of the RI field investigation is described in the following paragraphs. The components of the screening include an initial comparison to background as well as a comparison to human health- and ecological-based medium- specific values that are protective for unrestricted site use by fisherman and aquatic receptors.

Background Comparison Screening—Background comparisons will be conducted for analytical sediment samples from the MRS to determine whether concentrations are site related relative to naturally occurring metals in the Delaware River, as well as to ensure that the site boundaries have been properly delineated. Sediment data will be collected upstream of the MRS site that will be used for the background comparison unless the analytical data indicate that these locations may have been impacted by RRTS activities. In accordance with USEPA guidance (USEPA 2009b), the tolerance limit method will be used to calculate background screening values for metals, as discussed in Section 5.4.2.1.3. In Phase 1, only concentrations for lead will be compared to the UTL. In Phase 2, concentrations for lead and other target MCs will be compared to the UTL.

The aggregate EPC for each EU will be used as the point of comparison for the background screen (as opposed to the maximum detected concentration) such that any decisions made for the EU are based on the overall data distribution for the EU and not one single value. During the EPC calculation process, a statistical outlier analysis will be performed to identify any anomalous values. If suspected outliers are determined to be driving decisions for the EU, management input will be sought before proceeding.

Human Health and Ecological Screening—The human health and ecological screening comparisons will be conducted by comparing EPCs to screening values (see Worksheet #15 and Table 4). Both human health and ecological screening comparisons will be conducted using the processes discussed in Section 5.4. For human health screening, fish tissue concentrations predicted from the sediment data using a bioaccumulation approach will be compared against safe fish ingestion regional screening levels (mg/kg wet wt) assuming unrestricted use of the MRS site for fishing (used only for recreational purposes). For ecological screening, sediment data will be compared to toxicity benchmarks directly for benthic invertebrates. Food-chain modeling also will be used to predict fish tissue residues (mg/kg wet wt) resulting from sediment exposure for assessment of effects on fish themselves or on birds consuming fish (see Section 5.4). The sources of the human health and ecological screening values are described below:

- For human receptors, screening values are based on fish tissue concentrations considered safe for consumption
- For ecological receptors, the screening values are based on marine sediment quality benchmarks (SQBs) for benthic invertebrates, CBR for fish, and avian TRVs for birds.

Section 5.4.2 provides additional information regarding the recreational screening values comparison for sediments at the MRS site.

QAPP Worksheet #15. Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: ICP Metals by USEPA SW-846 Method 6010C

Analyte	Chemical Abstract Service (CAS) Number	Project Screening Threshold (mg/kg)	Project Screening Threshold Reference*	Project LOQ Goal (mg/kg)	Laboratory-Specific		
					LOQs (mg/kg)	LODs (mg/kg)	DLs (mg/kg)
Copper	7440508	18.7	BTAG	2.0	2.0	1.0	0.63
Lead	7439921	30.2	BTAG	3.0	5.0	2.5	0.200
Nickel	7440020	15.9	BTAG	2.0	4.0	2.0	0.083

Notes:
*Project Screening Threshold derived from USEPA Region 3 BTAG marine sediment benchmarks for benthic invertebrate toxicity (USEPA 2006a). http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/marsed/screenbench.htm

QAPP Worksheet #16. Project Schedule

Activities	Organization	Dates (MM/DD/YY)	
		Date of Initiation	Date of Completion
DQO Planning Meeting	All	11/3/11	11/4/11
Preliminary Draft Work Plan	SAIC	11/5/12	1/30/12
Review of Preliminary Draft Work Plan	ARNG/USACE	1/31/12	4/30/12
Responses to Comments (RTCs)/Draft Work Plan	SAIC	5/1/12	6/4/12
Review of Draft Work Plan	Stakeholders	6/5/12	9/26/12
RTCs/Final Work Plan	SAIC	9/27/12	10/5/12
Administrative Record/Repository Update	SAIC/URS	(a)	(a)
TPP1 Meeting	All	12/4/13	12/4/13
Update Project Planning Documents	URS	12/5/13	(1/2013)
MRS Field Sampling – Phase 1	URS	(3/2014)	(4/2014)
MRS Field Sampling – Phase 2 (if needed)	URS	(9/2014)	(10/2014)
*Draft RI Report	URS	(5/2014)	(7/2014)
*Draft Final RI Report	URS	(8/2014)	(9/2014)
*Review of Draft RI Report	Stakeholders	(9/2014)	(10/2014)
*Final RI Report	URS	(10/2014)	(11/2014)
*Draft Proposed Plan	URS	(9/2014)	(10/2014)
*Draft Final Proposed Plan	URS	(11/2014)	(1/2015)
*Final Proposed Plan	URS	(1/2015)	(2/2015)
*Public Review Proposed Plan	Public	(2/2015)	(3/2015)
*Draft Decision Document	URS	(2/2015)	(3/2015)
*Draft Final Decision Document	URS	(4/2015)	(5/2015)
*Final Decision Document	URS	(6/2015)	(8/2015)

(Dates in parenthesis are projected)
*Dates subject to change if Phase II sampling is required
(a) All final documents will be submitted to the Administrative Record/Repository

2.8.2 Project Schedule

The Project Manager will oversee the scheduling and conduct of project meetings and briefings (including conference calls) and reporting. Formal and informal periodic reviews also will be scheduled, within the contracting company and with the client, to status progress against plans, adjust schedules, and coordinate resolution of outstanding issues. The project schedule is included on Worksheet #16 and includes the start and completion dates for all project activities.

3. MEASUREMENT AND DATA ACQUISITION ELEMENTS

The following sections discuss how project data will be collected, measured, and documented. Proper implementation of these activities will help ensure that resulting data are sufficiently sound, of known and documented quality, and suitable for their intended use.

3.1 SAMPLING TASKS

The following sections include the process design and rationale, procedures, and requirements for RI sampling at the MRS. The RI sampling summary, including the number of samples and analytes, is summarized in Table 1. Details of field sampling procedures are provided in Section 3.1.2 and specific SOPs are provided in Appendix A. Sampling rationale is included on Worksheet #17. Worksheet #18 lists all site locations that will be sampled and the analyses that will be conducted. The matrix and depth at which samples will be collected also is included on this worksheet. Sample container, preservation, and holding time requirements are included on Worksheet #19. Worksheet #20a and Worksheet #20b include RI field QC for Phase 1 and Phase 2, respectively.

3.1.1 Sampling Process Design and Rationale

The investigative approach, rationale, field investigation methods, and procedures to be used during the RI sampling at the MRS are summarized in this section.

Field sampling will be conducted in two phases (Phase 1 and Phase 2). The purpose of Phase 1 sampling is to screen for potential MC-related risk within the MRS and determine the spatial extent of potential MC-related contamination. Phase 1 sampling will focus on lead as the representative MC. Lead was chosen as the representative MC because it is the major component (greater than 85% by weight) of the dominant bullets in use at the time of active range operations. If elevated lead levels are observed relative to both background concentrations and screening-level toxicity thresholds, then Phase 2 sampling will be conducted. The purpose of Phase 2 sampling is to evaluate potential MC-related risk based on more rigorous lines of evidence, including an expanded metals target analyte list and biological tests for benthic impact assessment and upper-level exposure through food-web modeling. The Phase 2 sampling will focus on the entire cupro-nickel composition of the dominant bullets used during active range operations.

During Phase 1, 82 sediment samples (SD-A1-001 through SD-A3-082) will be collected from the MRS and 20 samples from the background (reference) area will be sent to an analytical laboratory for lead analysis. To facilitate comparison with the variable sediment composition of the MRS, background sample locations (SD-BKG-001 to SD-BKG-020) will target an even distribution between sandy and silty sediments.

The locations for background sampling in relation to the MRS are shown in Figure 9. MRS sampling locations are shown in Figure 10 and background sampling locations are shown in Figure 11. A 200- by 200-foot reference grid was overlayed on the site and sample point density within the grid varied based on the likelihood for potential MC impacts. The MRS was divided into three EUs: EU 1, EU 2, and EU 3. EU 1 is 31 acres and has the highest likelihood for MC exposure, with undisturbed sediment and a location closest to the firing point of the

Table 1. RRTS MRS RI Sampling Summary

Building/ Site	Source of Potential Contamination	RI Work Plan/UFP-QAPP Recommendations	RI Number of Samples	
MRS	MC	**Phase 1:** Collect sediment samples for lead analysis from 82 locations representing 3 EUs delineated by the CSM. Collect 20 additional sediment samples for lead analysis reflecting both sand and silt background locations in a reference area upstream of the MRS.	**Phase 1:** 102 (82 MRS + 20 Bkg)	**Phase 1:** Sediment – Lead
		Collect sediment samples for lead analysis at additional step-out locations as required based on decision rules discussed in Section 2.6.1 and on Worksheet #11, Step 5 (Analytic Approach). **If Phase 1 evaluation of each EU finds the lead EPC exceeding the screening value and background UTL, then proceed to Phase 2.**	Based on Phase 1 lead results	Sediment – Lead
		Phase 2: Collect up to10 sediment samples from each affected MRS EU. Analyze samples for metals, hydrogen sulfide, SEM-AVS, and grain size. Collect six sediment samples from the reference locations. Analyze samples for metals, hydrogen sulfide, SEM-AVS, and grain size.	**Phase 2:** Per MRP EU : Sediment Chemistry – 10 Sediment Bioassays – 10 Macroinvertebrates – 10 Background: Sediment Chemistry – 6 Sediment Bioassays – 6 Macroinvertebrates – 6	**Phase 2:** Sediment – metals (lead, copper, and nickel), hydrogen sulfide, SEM-AVS, grain size, sediment toxicity, benthic community

QAPP Worksheet #17. Sampling Rationale

Sediment Sample Location	Rationale
Phase 1	
SD-DR-EU1-001 to SD-DR-EU1-035	EU 1 – Most likely impact area, closest to firing point where highest density of bullets would be concentrated
SD-DR-EU2-036 to SD-DR-EU2-072	EU 2 – Less likely impact area, but depression exists, which could concentrate bullets, including a channel that courses through the area
SD-DR-EU3-073 to SD-DR-EU3-082	EU 3 – Least likely impact area, farthest from firing point and somewhat isolated from other EUs due to orientation of the upstream current (north-south) being perpendicular to the MRS orientation (east-west)
SD-DR-BKG-083 to SD-DR-BKG-102	Upstream background area containing 10 sand and 10 silt stations
SD-DR-EU#-103 to SD-DR-EU#-120	Reserved for Phase 1 step-out sampling if necessary on the edge of an impacted area (EU1, EU2, or EU3).
Phase 2	
SD-DR-EU#-121 to SD-DR-EU#-130	Additional sampling of impacted area (EU1, EU2, or EU3) by reoccupying high lead locations from Phase I.
SD-DR-BKG-131 to SD-DR-BKG-136	Additional sampling of upstream background area if Phase 2 sampling of one or more EUs is required.

QAPP Worksheet #18. Sampling Locations and Methods

Site I.D.	Matrix	Depth Below Land Surface (BLS)	Analytical Group	Grain Size	Toxicity Analysis	Benthic Macro-invertebrate Assessment
Phase 1						
SD-DR-EU1-001 to SD-DR-EU3-082	Sediment	6 inches	Lead analysis	NA	NA	NA
SD-DR-BKG-001 to SD-DR-BKG-020	Sediment	6 inches	Lead analysis	NA	NA	NA
Phase 2						
SD-DR-EU#-121 to SD- DR-EU#-130	Sediment	6 inches	Metals (lead, copper, and nickel), hydrogen sulfide, SEM-AVS	x	x	x
SD-DR-BKG-131 to SD-DR-BKG-136	Sediment	6 inches	Metals, (lead, copper, and nickel), hydrogen sulfide, SEM-AVS	x	x	x

NA – Not applicable

QAPP Worksheet #19. Sample Container, Preservation, and Holding Time Requirements

Matrix	Analytical Group	USEPA Prep/Analytical Method	Laboratory Analytical and Preparation Method/SOP	Sample Container Quantity and Type	Sample Preservation	Sample Holding Time
Sediments	Lead	SW846 6010C	MET-6010C/200.7, MET-3050	4 oz. clear wide-mouth glass jar; Teflon®-lined cap	Cool 0-6 °C	180 days
Sediments	Metals (Lead, Copper, Nickel)	SW-846 6010C	MET-6010C/200.7, MET-3050	4 oz. clear wide-mouth glass jar; Teflon®-lined cap	Cool 0-6 °C	180 days
Aqueous (field QC blanks)	Metals (Lead, Copper, Nickel)	SW-846 6010C	MET-6010C/200.7, MET-3010	1 - 500 mL polypropylene	Cool 0-6 °C Nitric acid to pH ≤2	180 days
Sediment	SEM-AVS	EPA-821-R-91-100		1 – 4 oz. amber glass Teflon®-lined cap	Zero headspace, Cool 4°C	14 days
Sediment	Hydrogen Sulfide	EPA-821-R-91-100		1 – 4 oz. amber glass Teflon®-lined cap	Zero headspace, Cool 4°C	14 days
Sediment	Sorting Sample Residue for Macroinvertebrates	EPA-670/4-73-001 EPA 841-B-99-002		1-2 gallon	Cool 4°C from collection to laboratory receipt if < 24 hours. If > 24 hours preserve in 10% formalin or 70% ethanol	< 24 hours if not preserved
Sediment	I.D. and Number of Macroinvertebrates	EPA-670/4-73-001 EPA 841-B-99-002		Sample as above	Sample as above	< 24 hours if not preserved
Sediment	Macroinvertebrate Subsampling for High-Density Samples	EPA-670/4-73-001 Section 4.4 EPA 841-B-99-002		Follow SOP	Sample as above	< 24 hours if not preserved
Sediment	Sediment Toxicity Test 10 Day	EPA 100.4		1-2 L, plastic or glass jar	Cool 4°C from collection to laboratory receipt	14 days or 8 weeks (USEPA/USACE, 1991, 1998)
Sediment	Grain/Particle Size Analysis	American Society for Testing and Materials (ASTM) D 422		250g CWM or high-density polyethylene (HDPE)	Cool 4°C from collection to laboratory receipt	14 days

QAPP Worksheet #20a. RI Field Quality Control Summary – Phase 1

Parameter	Analytical Method	Number of Field Samples	Field Duplicate Samples	Rinsate Blanks	Field Blanks	MS/MSD Laboratory Duplicates	Total
Sediment							
Lead (48-hour turn-around time)	SW6010C	68	7	0	0	4/4	83
Lead (28-day turn-around time)	SW6010C	34	4	15	1	2/2	58

QAPP Worksheet #20b. RI Field QC Summary – Phase 2

Parameter	Analytical Method	Number of Field Samples	Field Duplicate Samples	Rinsate Blanks	Field Blanks	MS/MSD Laboratory Duplicates	Total
Sediment							
Metals (Lead, Copper, Nickel)	SW6010C/6010C	Up to 36	4	18	1	2/2	Up to 63
SEM-AVS	EPA-821-R-91-100	Up to 36	4	NA	NA	2/2	Up to 44
Hydrogen Sulfide	EPA-821-R-91-100	Up to 36	NA	NA	NA	NA	Up to 36
Benthic Community Assessment	Laboratory SOP	Up to 30	NA	NA	NA	NA	Up to 30
Bulk Sediment Toxicity Analysis	ASTM 2000	Up to 36	NA	NA	NA	NA	Up to 36
Grain Size Analysis	ASTM D422	Up to 36	NA	NA	NA	NA	Up to 36
Water Content	160.3 M	Up to 36	NA	NA	NA	NA	Up to 36
Total Organic Carbon (TOC)	Lloyd Khan	Up to 30	NA	NA	NA	NA	Up to 30

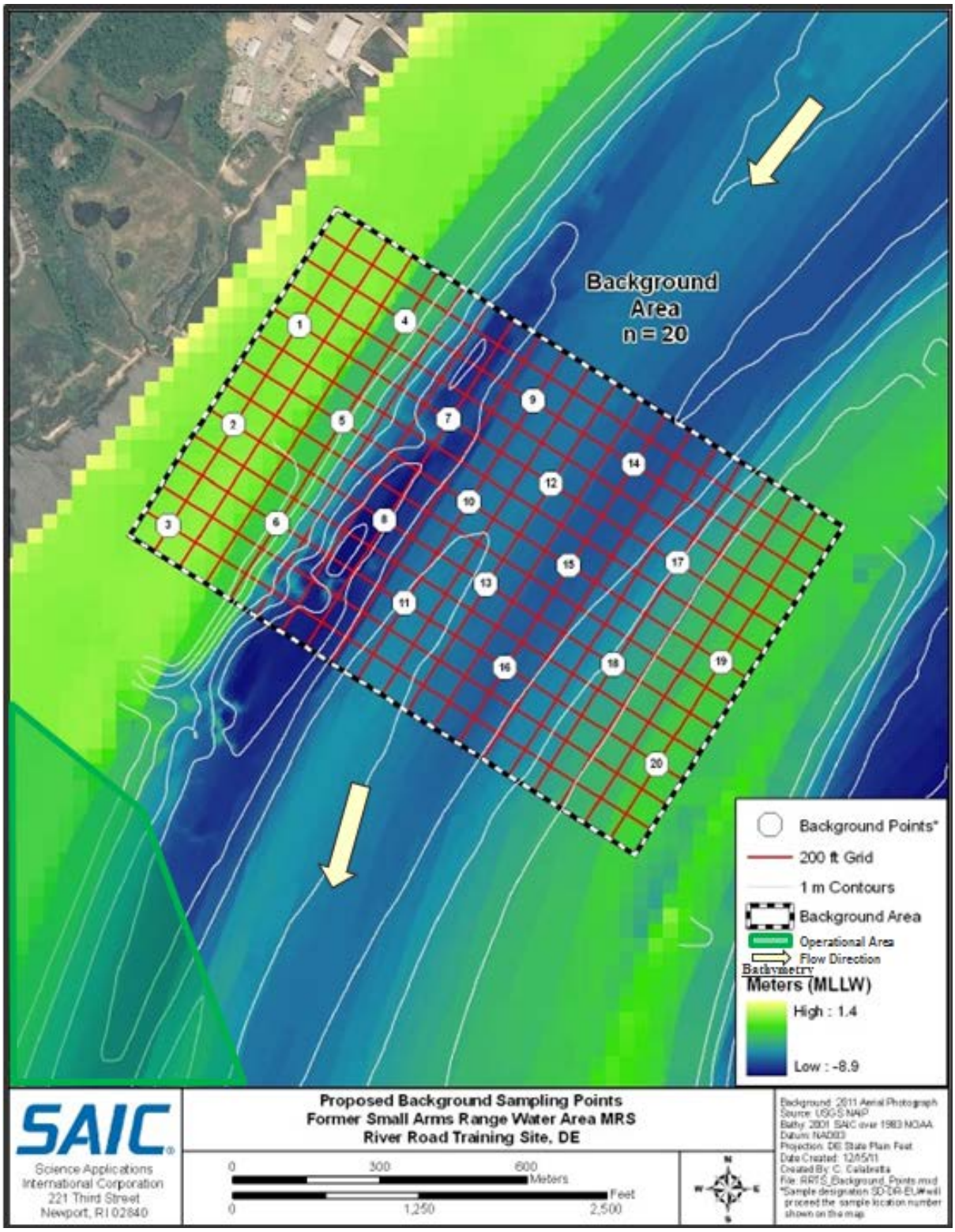


Figure 11. Proposed RI Sampling Locations for Background Area

Former Small Arms Range. Thirty-five sample points have been placed within EU 1 at a density of approximately 1 point per acre. EU 2 is 99 acres and has a moderate risk for MC exposure. Although farther from the firing point than EU 1, EU 2 is bisected by Bulkhead Shoal Channel, which may serve to concentrate bullets that have landed in this area. A total of 37 sampling points have been located in EU 2, at a density of about 0.5 points per acre. EU 3 is 82 acres and represents the portion of the MRS with the least likelihood of MC exposure. EU 3 is located farthest from shore, disturbed sediments, and a high likelihood for MC burial. A total of 10 sampling points have been located in EU 3 at a density of about 0.1 points per acre. The density of sampling points in the 239- acre background area is comparable to that of EU 3 (0.1 points per acre).

The sampling design was based on an evenly spaced grid with the sample density for each EU correlated to the relative likelihood MCs would be present at that location based on distance from the source and associated bottom features. Sampling in this manner would provide the greatest amount of uniform coverage for each EU while minimizing the number of samples required to accurately characterize the site. Because no previous site-specific MC investigations have been performed at the MRS, estimates of the standard deviation and analytical variability for both the MRS and the background area are not available, nor can any reasonable estimates be made regarding whether sampling data would be normally distributed. A lack of these parameters for the site precluded the use of any statistical-based analysis (e.g., visual sample plan [VSP]) to support the development of the sampling design.

Because the purpose of Phase 1 is, in part, to determine the spatial extent of potential MC-related contamination, additional step-out sampling may be necessary in the event that individual lead results exceeding the Phase 1 risk screening criteria in addition to the background UTL are identified along any portion of the MRS boundary that does not border an active SDZ. Thus, an individual lead exceedance of both the background UTL and Phase 1 risk screening criteria (30.2 mg/kg) along the MRS border will serve as the trigger for additional step-out sampling. Sediment samples from the background area will be collected first followed by perimeter samples in the MRS. Lead results for background and perimeter samples will be available within 48 hours of sample receipt to direct possible step-out sampling. Samples from all other locations will be analyzed on a normal (28-day) turn-around time. Figure 12 provides an example of step-out sampling for a hypothetical exceedance occurring along the western boundary of the MRS. The methodology for selecting step-out locations will be based on the existing 200- by 200-foot sampling grid, with step-out samples located at two to three grid nodes adjacent to and extending outward from the location where the exceedance has occurred. All step-out samples will be located at grid nodes only. These new data then will be compared again to the UTL and Phase 1 risk screening criteria to confirm that concentrations below these thresholds have been obtained. If these additional samples are still found to exceed the background UTL and Phase 1 risk screening criteria on an individual basis, step-out sampling may continue or ARNG may re-evaluate this approach in consultation with DNREC. In order to streamline workflow and facilitate the screening of samples collected along the boundary of the MRS, the data from the background area necessary to support the calculation of the background UTL must be collected first, prior to collection of the MRS data.

Phase 2 sampling will occur if the lead EPC for one or more of the EUs exceeds both the background concentration and the screening-level toxicity threshold (see decision rules

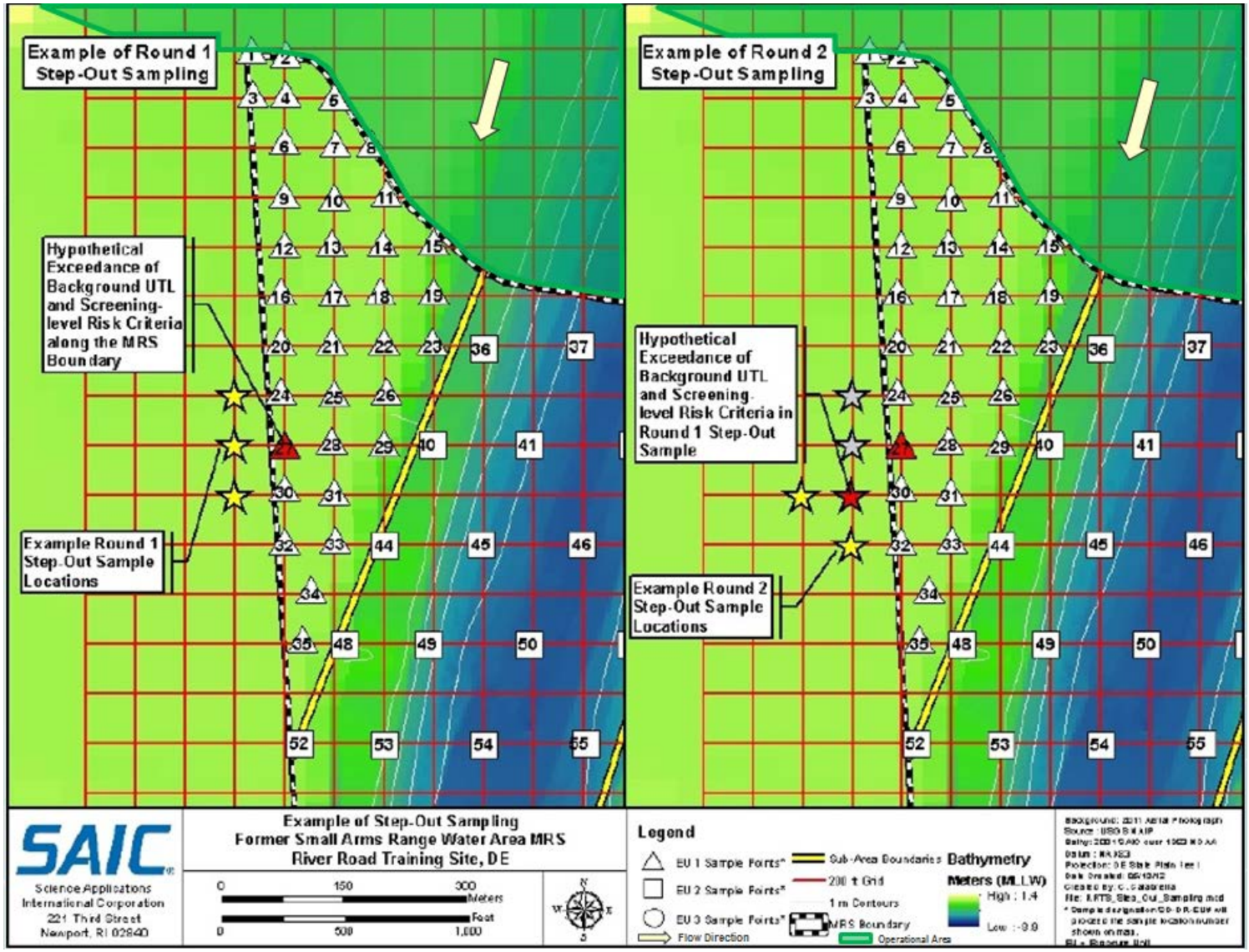


Figure 12. Proposed Step-Out Sampling Methodology

discussed in Section 2.6.1 and on Worksheet #11, Step 5 [Analytic Approach]). Phase 2 sampling will occur under a separate mobilization and will include the collection of up to 10 sediment samples from each of the affected EUs and 6 samples from the background area to be used for metals analysis (lead, copper, and nickel), sediment bioassays (survival and growth), benthic macroinvertebrate assessment, SEM-AVS analysis, and hydrogen sulfide analysis. Phase 2 samples within an affected EU will be collocated with lead hotspots that were identified during Phase 1. In the event that greater than 10 hotspots are identified within any one EU, hotspots will be prioritized such that locations with the 10 highest lead results are sampled. The six Phase 2 background samples will be collected from locations with sediment types comparable to those of the Phase 2 samples in the MRS and will span the range of the Phase 1 background lead results. As the location of the Phase 2 samples will depend on the Phase 1 results, the quantity and distribution of these samples is not known at this time. However, the Phase 2 samples are expected to be distributed across one or more of the MRS subareas shown in Figure 10. The final Phase 2 analyte list is lead, copper, and nickel because these metals make up the greatest percent composition of the bullets and cupro-nickel cartridge jackets used at the MRS.

3.1.2 Sampling Procedures and Requirements

Sampling procedures to be implemented during the RI are described in the following sections. Worksheet #21 presents project SOP references associated with field sampling. These SOPs are included in Appendix A. All SOPs related to the sampling procedures, including demobilization, field measurements, field documentation, and logbooks are provided in Appendix A.

3.1.2.1 Sample Collection Procedures

Sediment Sampling—Sediment samples will be collected from the MRS site using a ponar grab sampler deployed from a shallow draft vessel as described in SOP-1 (Appendix A). At each target station, sediment samples will be collected over an area of approximately 0.5 square feet to a maximum depth of 6 inches below the sediment surface. The ponar grab will be lowered to the seafloor via a soft line and davit system mounted on the bow of the work platform. The stainless steel grab sampler will be decontaminated between stations by scrubbing with acid-type Citranox® detergent (pH of 2.5 in a 1% solution), which is a phosphate free and biodegradable agent suitable for cleaning/removal of metal oxides, salts, and inorganic residues (See Appendix A, SOP-2 for details). The Citranox® scrub will be followed by sequential seawater (i.e., site water) and deionized [DI] water rinses before use at the next sampling station.

Once on board, the surface waters will be drained from each sediment sample by slightly opening the bucket and allowing the overlying waters to slowly drain from the sides. The draining process is controlled to prevent the loss of fine-grained material within the sediment sample. Following draining, the entire grab sample will be dumped directly from the grab into a stainless steel bucket. The sediment sample then will be subsampled from the bucket using stainless steel tools (e.g., spoons) with the target material transferred into the appropriate sample container. Both the bucket and tools used for this process will be subjected to the same decontamination process between samples as described for the grab sampler above and outlined in Section 3.1.2.3.

QAPP Worksheet #21. Project Field and Quality Assurance SOP References Table

Reference Number	Title	Originating Organization	Equipment Type	Modified for Project Work?	Comments
SOP-1	Surface Water and Sediment Sampling	URS	Ponar grab sampler, stainless steel spoons, sample containers	No	
SOP-2	Cleaning and Decontaminating Sample Containers and Equipment	SAIC	DI water, Citranox®	No	
SOP-3	Dissolved Oxygen	SAIC	Horiba U-22 water quality meter	No	
SOP-4	Field Measurement Procedures: pH, Temperature, Salinity, and Conductivity	SAIC	Horiba U-22 water quality meter	No	
SOP-5	Turbidity	SAIC	Horiba U-22 water quality meter	No	
SOP-6	Labeling, Packaging, and Shipping of Environmental Field Samples	SAIC	Coolers, ice, labels	No	
SOP-7	CoC	SAIC	CoC form, coolers	No	
SOP-8	Field Logbooks and Field Forms	SAIC/URS	Forms, logbooks	No	
SOP-9	Handling and Control of Sampling Documentation	SAIC	Forms, logbooks, sample labels	No	

QAPP Worksheet #21. Project Field and Quality Assurance SOP References Table (Continued)

Reference Number	Title	Originating Organization	Equipment Type	Modified for Project Work?	Comments
SOP-10	Documenting and Controlling Field Changes to Approved Work Plans	SAIC	Forms	No	
SOP-11	Tracking Analytical Data	SAIC	CoC form	No	
SOP-12	Network Data: Backup, Recovery, Archive, and Storage	SAIC	Storage network	No	
SOP-13	Records Management	SAIC	Document review record, central records facility	No	
SOP-14	Vessel Pre-Departure Checklist	SAIC	Sampling vessel	No	
SOP-15	Control of Nonconforming Items	SAIC	As required for project work, central records	No	

If any identifiable bullets or other munitions fragments are encountered during the subsampling process, they will be documented in the field logbook, counted, and photographed for the project file. The items then will be turned over to the RRTS solid waste POC for storage and disposal.

Water Quality Analysis—Surface water quality conditions will be analyzed in the field at each target sediment sampling station using a portable multiparameter water quality monitoring system (e.g., Horiba U-22). This instrument will be calibrated prior to use following the calibration procedures outlined on Worksheet #22. Upon arriving at a sampling station, the sensor end of the water quality monitoring system will be submerged over the side of the vessel. Data then will be collected for the following water quality parameters following the standard operating procedures presented in Worksheet #21: dissolved oxygen, pH, temperature, salinity, conductivity, and turbidity. Data for each of these parameters at each sampling station will be recorded in the field logbook. Water quality analysis will be performed prior to sediment sampling at each station to avoid impacts from seafloor disturbance and suspended sediments caused by the grab sampling procedure. Water quality analytical procedures are provided in SOP-3, SOP-4, and SOP-5 (Appendix A).

Benthic Community Analysis—The use of benthic surveys to evaluate aquatic ecosystems is a common method to examine the potential of community-level impacts. The benthic community is particularly suited for use as an indicator because it consists of populations that are generally sessile or of low mobility and, therefore, reflects the quality of their local environment. Field surveys offer a link between the presence of contamination and observed ecological effects (e.g., absence of commonly occurring species, presence of stress-tolerant species).

Phase 2 sediment samples to be used for benthic community analysis will be collected from each target station using the same ponar grab sampler used to obtain sediment samples for analytical chemistry analysis. At each target station, sediment will be collected over an area of approximately 0.5 square feet to a maximum depth of 6 to 8 inches. Five replicate grab samples will be collected from each station and reduced in the field by sieving through 0.5mm aluminum mesh screens. Sieving equipment will include a plastic tub with drainage hose for holding screens and carrying sediment overboard, nested sets of sieve screens for maintaining organisms of various sizes, fine forceps for picking organisms from sieve screens, stiff-bristle brushes for cleaning sieve screens between samples, canning funnels to aid in transferring samples from sieve screens to sample jars, and plastic squirt bottles for rinsing sieve screens into the canning funnels. A pressurized site water supply will be provided by a garden hose assemblage attached to a sump pump powered by a battery that is dropped over the side of the vessel. Prior to initiating sieving, all overlying water from the sediment grab will be decanted directly into the sample jar so as not to lose any suspended particles. All organisms and sediment grains retained by the sieve then will be transferred into the pre-labeled sample jar, appropriately preserved, and stored at 4°C for shipment to the analytical laboratory. If benthic community samples are to be shipped to the analytical laboratory in less than 24 hours, preservation in site water is appropriate. If samples are to be held for greater than 24 hours prior to shipping, preservation with 10 percent formalin or 70 percent isopropanol will be required. During the sieving process, brief notes will be recorded in the field logbook as to the

QAPP Worksheet #22. Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference
Horiba	Verify calibration and autocalibration solution for pH, conductivity, and turbidity	Charge battery	NA	Inspect for visual damage	Calibrate at beginning of day Perform maintenance as required	Calibration does not drift	Recalibrate or replace	Field Manager	SOP-3 SOP-4 SOP-5
Ponar Grab	NA	Decontaminate with DI water/Citranox® rinse	NA	Inspect for visual damage	After each sampling station	NA	NA	Field Manager	SOP-1
Sampling Vessel	NA	In accordance with operator manual	NA	Inspect vessel for leaks and make sure components are working properly, complete pre-departure checklist	Inspect vessel at beginning of day	NA	NA	Vessel Operator	SOP-14

nature and volume of benthic macroinvertebrates encountered (e.g., presence of large worms, shells, or jellyfish).

Once at the analytical laboratory, the benthic organisms in each sample will be identified and enumerated. Notes will be made regarding the size distribution of key species and specimens will be used for taxonomic determination/verification and population analysis (provided the number of species supports standard benthic community metrics). Damaged or immature specimens that are difficult to identify will be recorded as known species or combined in more inclusive taxa to simplify interpretation.

Sediment Bioassays (Toxicity Testing)—Sediment samples to be used for bioassay will be collected from separate casts at each target station using the same ponar grab sampler used to obtain sediment samples for analytical chemistry analysis. Although there is the potential for high sulfide concentration in the sediment below approximately 2 inches BLS and associated high toxicity, the target horizon for each bioassay sample will be the same as the horizon for analytical chemistry samples (a maximum depth of 6 inches). The sediment bioassay samples will be containerized separately from the analytical chemistry samples and shipped to the designated laboratory for toxicity testing by exposing the amphipod *Leptocheirus plumulosus* to the whole sediment (1 to 2 liters per station) for 10 days (five replicates) under the conditions listed below (Table 2). Sediment pore water will be extracted for ammonia analysis and water quality parameters (pH, dissolved oxygen, salinity, and ammonia) will be measured in the overlying water at least twice during the exposure period in two test replicates per sample. The overlying water temperature will be measured daily in at least one replicate per sample. For control purposes, a negative sediment sample and a reference toxicant test (*L. plumulosus* exposed to cadmium chloride in water) will be performed concurrently with the analytical sample test.

Handling and Disposition of IDW—IDW generated during the RI sampling may include decontamination water, PPE (e.g., nitrile gloves), and excess sediment. Excess sediment will be returned to the river in the same location in which it was collected. Since the Citranox® detergent used for decontamination is phosphate free and biodegradable the decontamination water will not negatively impact the environment. The small volumes of non-hazardous decontamination water will be emptied into the river at the point of sampling.

Soiled PPE designated as IDW will be bagged and disposed of as municipal solid waste. Any recovered bullets will be returned to the RRTS Environmental Manager. Waste generation will be minimized whenever possible and feasible. No hazardous wastes are anticipated for this project.

3.1.2.2 Sample Containers, Volume, and Preservation

Sample containers, analytical methods, chemical preservation techniques, and holding times for sediment samples to be collected during the RI for the MRS are described on Worksheet #19. Additional sample volumes will be collected and provided, when necessary, for the express purpose of performing associated laboratory QC (laboratory duplicates and MS/MSDs). All sample containers will be provided by the analytical laboratories, which also will provide the required types and volumes of preservatives with containers.

Table 2. Summary of the Sediment Toxicity Test Procedures with *Leptocheirus plumulosus*

Test Duration	10 days
Number of Organisms per Chamber	20
Number of Replicates per Treatment	5
Test Chambers	1,000 mL glass jars
Test Temperature	25°C
Salinity	20 parts per thousand
(ppt) Photoperiod	Continuous light
Age/Size of Test Organisms	2 to 4mm juveniles
Volume of Sediment	175 mL
Volume of Overlying Water	800 mL
Type of Water	Clean seawater
Bay Feeding/Chamber	None
90% survival in control	Survival, reburial
Acceptance Criteria	90% survival in control

Source: USEPA 1994. Methods for Assessing the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods. EPA/600/R-94/025.

3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures

Decontamination operations will be conducted to reduce the potential for cross-contamination from sampling equipment. Potable water for decontamination will be obtained from a source at the RRTS. DI water provided by the analytical laboratory will be used as a final rinse in the decontamination process for all sampling equipment coming into direct contact with analytical samples. Potable and DI water sources used in the decontamination process will be analyzed for all target MCs.

The decontamination procedure for the ponar grab sampler is described in Section 3.1.2.1. All other sampling equipment, including stainless steel buckets and stainless steel sampling tools (e.g., spoons), will be decontaminated using the following field procedure:

- Scrub with phosphate-free, biodegradable, acid-type detergent (i.e., Citranox®)
- Rinse with potable water
- Rinse with DI water
- Air dry
- Secondary rinse with DI water
- Air dry
- Wrap in aluminum foil.

Procedures for sample container and sampling equipment decontamination are provided in SOP-2 (Appendix A).

3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures

As part of the QA/QC program, a routine preventive maintenance program is conducted by the field sampling team to minimize the occurrence of equipment failure and other system malfunctions. Field equipment and instruments (other than analytical instrumentation) that require calibration, maintenance, testing, or inspection are listed on Worksheet #22. The frequency of activity, acceptance criteria, and CA requirements are included on the worksheet.

3.1.2.5 Supply Inspection and Acceptance Procedures

ARNG-approved analytical laboratories will provide all sample containers. The containers will be provided and prepared as described in the DOD QSM (DOD 2013). Preparation certification and lot numbers will accompany all sample containers shipped to the RRTS from the laboratory.

3.1.2.6 Field Documentation Procedures

All field measurements and observations will be recorded in project logbooks, field data records, or similar types of recordkeeping books in accordance with SOP-8 and SOP-9 (Appendix A). Field measurements include measurement of sampling depths and visual observations about the weather and sampling area. All data will be recorded directly and legibly with indelible ink, and all entries will be signed and dated. If entries must be changed, a single line will be drawn through the incorrect entry. The reason for the change will be stated and the correction and explanation will be signed and dated at the time the correction is made. Field data records will be organized into standard formats, whenever possible, and retained at the central records facility.

***Daily Quality Control Reports*—**During the investigations at the MRS, a daily quality control report (DQCR) will be provided by the Task Manager onsite. The DQCR will be distributed verbally or electronically via e-mail to the Project Manager. The DQCR will include the following information:

- Summary of work conducted during the day
- Samples collected
- Problems encountered during the day, including deviations from investigation protocols, site access problems, utility issues, sampling procedures that may affect DQOs, unusual findings, and archaeological issues.

***Field Logbook and/or Sample Field Sheets*—**Field logbooks will be hardbound with supplemental, water-resistant log sheets. Entries in the logbooks and supplemental log sheets will be written using indelible ink. The top of each page will include the project name and number, date, and page number. The bottom of each page in the book will include the time, initials of the person recording the entries, and sufficient detail so that the logic used in decisionmaking during the project can be tracked through later review. During each day of investigative activity, information will be recorded in each field logbook including, but not limited to:

- Name and task-related title of each field sampling team member
- Date/time
- Name and title of any personnel or Army representatives onsite
- Purpose of the field activity
- Location of investigation activities
- Planned chronology of events during the day
- Information concerning any property access arrangements
- Weather conditions, air temperature, wind speed, and direction
- General field observations
- Information about any conversations with property owners or members of the public

- Actual chronology of investigation activity during the day
- Date and time of sample collection
- Sample I.D. number(s)
- Sample transportation information, including the name of the laboratory and courier
- Information on any deviations from the approved work plans, including methodology and sample collection
- Summary of daily tasks and documentation on any scope of work changes required by field conditions
- Signature and date on each log page.

***Photographic Records*—**Digital photography obtained during the RI will be numbered and cataloged in the field notebook to include a description of the scene, site area, date, and time. The digital photography will be downloaded to a project subdirectory within the main MRS project directory at the data storage facility. Selected digital photographs will be incorporated into the RI Report. A photographic log will be maintained in the field notebook to identify the location and subject of each photograph. The photographer will review the photographs and compare them to the photographic log to confirm the log and photographs match.

***Sample Documentation*—**Sample labels are to be completed for each sample container. These labels will include a site I.D., field sample number, date and time of collection, sampler initials, and sampling location. During transit, field samples will be accompanied by a properly completed and signed CoC form. The information from the sample labels will be listed on the CoC form. Detailed procedures for sample handling and sample custody are discussed in Sections 3.3.2 and 3.3.3, respectively.

3.1.2.7 Sample Identification

A ample I.D. system will be used to identify each environmental sample collected and field QC sample prepared during the field investigation at the MRS. This system provides a tracking procedure to allow information about a particular sample or sample location to be retrieved easily and accurately and ensures that each sample is unique. The Field Manager and Data Manager will maintain a complete list of field sample numbers and site I.D.s.

Site I.D.—The Site I.D. is a four-term unique designation that describes the specific locations at which sampling activities will occur. The first two letters of the site I.D. represent the sample type (e.g., SD-Sediment). The next set of digits represents the study area (e.g., DR-Delaware River) and exposure unit (e.g., EU 1), respectively. The last three digits represent the precise sampling location number (e.g., 001). All three-digit sampling location numbers will increment sequentially regardless of the EU from which they are collected. The format of a typical site I.D. is as follows:

Site I.D.	Sample Description
SD-DR-EU1-001	Sediment sample from MRS location 001 in the Delaware River in EU 1.

Field Sample Number—The field sample number is a single-term unique designation assigned by the field team to each environmental sample and field QC sample collected for a particular site I.D. For example, a field sample number of "ORG01" for site I.D. SD-DR-EU1-001 would indicate that it was the first sample collected from sediment sampling location 001 in the

Delaware River in EU 1 by sampling organization "ORG." Recollected samples will be designated with an "R" at the end of the field sample number (i.e., ORG01R).

Duplicate and Field QC Blanks—The following QC test and flagging codes will be used to identify duplicate environmental and field QC blank samples:

- "D" entered in the flagging code field will be used to identify all field duplicates collected in the field
- "R" entered in the QC test code field will be used to identify all equipment rinsate blanks collected in the field
- "F" entered in the QC test code field will be used to identify all field blanks collected in the field.

Preprinted sample labels will be filled out at the time of sampling and will be attached to each container with waterproof tape. The label will be completed in indelible ink and contain the following information:

- Date and time sample collected
- Media type
- Method matrix
- Purpose of the sample (analytical parameter)
- Site I.D. and field sample number
- Site type
- Field sample number
- Depth
- Project number and location of sampling (i.e., site number)
- Installation
- Preservative used (if any)
- Initials of sample collector.

3.2 ANALYTICAL TASKS

All analytical samples collected during this investigation will be analyzed by laboratories determined to be DOD QSM (v5.0, DOD 2013) compliant and holding a current DOD Environmental Laboratory Accreditation Program (ELAP) accreditation. Each laboratory supporting this work will provide statements of qualifications, including organizational structure, QA Manual, and SOPs for approval by ARNG.

3.2.1 Analytical SOPs

Principal laboratory facilities will not subcontract or transfer any portion of this work to another facility, unless expressly permitted to do so in writing beforehand by the Project Manager.

In cases where contaminant concentrations are high, or for matrices other than normal waters and sediments, analytical protocols may be inadequate; therefore, the sample analysis may require modifications to defined methodology. Any proposed changes to specified analytical methods require written approval from the RI Project Manager and the ARNG Project Manager. All analytical method variations will be identified in field change records. These

may be submitted for regulatory review and approval when directed by the ARNG Project Manager.

Analytical SOPs must be adapted from and reference standard accepted methods and thereby specify:

- Procedures for sample preparation
- Instrument start-up and performance check
- Procedures to establish the actual and required detection limits for each parameter
- Initial and continuing calibration check requirements
- Specific methods for each sample matrix type
- Required analyses and QC requirements.

Methods to be used for analysis of sediment and associated QC samples collected during the RI sampling activities at the MRS are presented on Worksheet #23. The analytical method SOPs are presented in Appendix B and kept on file at the analytical laboratories and at the investigative organization's facilities. Internal laboratory QC requirements for each analytical sample batch (i.e., sample delivery group [SDG]) are described in Section 2.6.2.

3.2.2 Analytical Instrument Calibration Procedures

This section describes procedures for maintaining the accuracy of the instruments and measuring equipment that are used for conducting laboratory analyses. These instruments and equipment will be calibrated before each use or on a scheduled, periodic basis according to SW-846 procedures and the analytical method SOPs presented in Appendix B.

Calibration is the process of determining and adjusting instrumental response, relative to physical or chemical standards traceable to USEPA or the National Institute of Standards and Technology (NIST). Each calibration point is a reproducible reference to which all sample measurements can be correlated. To ensure that daily variances have not adversely affected the operation of the instrument, a series of calibration standards will be analyzed before any samples are analyzed. The calibration will be verified with another calibration standard each day. Calibration check standards will be analyzed according to the method specifications. Calibration of laboratory equipment will be based on approved written procedures.

Records of calibration, repairs, or replacement will be filed and maintained by laboratory personnel conducting QC activities. These records will be filed at the location where the work is conducted and will be subject to a QA audit. Procedures and records of calibration will follow laboratory-specific QA plans and will be reviewed by the QA Manager. The laboratory will maintain service contracts with the applicable instrument vendor, as appropriate. Appendix B contains the analytical SOPs and the calibration procedures specific to each analytical method.

QAPP Worksheet #23. Analytical SOP Reference Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix	Analytical Group	Organization Performing Analysis	Modified for Project Work?
MET-3050 *MET-6010C/200.7*	Metals Digestion, Soils, Sediment, and Sludge, For ICP-AES and ICP-MS Analysis, Revision 5, 11/4/13 Determination of Metals and Trace Elements By Inductively Coupled Plasma Emission Spectroscopy (ICP) EPA 200.7 and SW 846 6010C, Revision 14, 11/4/13	Definitive	Sediment	Metals	ALS	No
SEM-AVS	SEM-AVS SOP	Definitive	Sediment	SEM-AVS	ALS	No
Laboratory SOP	Hydrogen Sulfide Analysis SOP	Definitive	Sediment	Hydrogen Sulfide	ALS	No
Analytical SOP	Sorting of Macroinvertebrates from Sample Residue SOP	Definitive	Sediment	Benthic Community Assessment	Cove Corp.	No
Analytical SOP	Identification and Enumeration of Macroinvertebrates SOP	Definitive	Sediment	Benthic Community Assessment	Cove Corp.	No
Analytical SOP	Macroinvertebrate Sample Subsampling SOP	Definitive	Sediment	Benthic Community Assessment	Cove Corp.	No
Analytical SOP	10-Day Sediment Toxicity Test – Estuarine Amphipods SOP	Definitive	Sediment	Bulk Sediment Toxicity Analysis	EnviroSystems	No

Records of calibration will be kept as follows:

- Each instrument will have a record of calibration with an assigned record number.
- A label will be affixed to each instrument showing I.D. numbers, manufacturer, model numbers, date of last calibration, signature of calibrating analyst, and due date of next calibration. Reports and compensation or correction figures will be maintained with each instrument.
- A written step-wise calibration procedure will be available for each piece of test and measurement equipment.

Any instrument that is not calibrated to the manufacturer's original specifications will display a warning tag to alert the analyst that the device is out of service until corrections can be made.

Worksheet #24 contains general calibration procedures for laboratory analytical equipment. For detailed information regarding laboratory equipment calibration procedures see the laboratory analytical SOPs provided in Appendix B.

3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection

A part of the QA/QC program, a routine preventive maintenance program is conducted by the field sampling team and laboratories to minimize the occurrence of instrument failure and other system malfunctions. Laboratory equipment maintenance, testing, and inspection information is provided on Worksheet #25.

3.2.4 Analytical Supply Inspection and Acceptance Procedures

The laboratory maintains records for all suppliers from whom it obtains support services or supplies required for all analytical work. Procedures exist for the purchase, reception, and storage of consumable materials used for the technical operations of the laboratory. Standards and reagents are obtained from nationally recognized vendors. These vendors are to be included in the laboratories' Analytical QA Manual provided as part of Appendix B.

The laboratory retains records for all standards, including the manufacturer/vendor, manufacturer's Certificate of Analysis or purity, date of receipt, recommended storage conditions, and an expiration date after which the materials shall not be used unless it is verified by the laboratory. Original containers are labeled with an expiration date. Records are maintained on reagent and standard preparation, expiration date, and preparer's initials. All containers of prepared reagents and standards must bear a unique identifier and expiration date and be linked to the documentation requirements.

3.3 SAMPLE COLLECTION DOCUMENTATION, HANDLING, TRACKING, AND CUSTODY PROCEDURES

The sample packaging and shipment procedures summarized below will ensure that samples will arrive at the laboratory with the CoC intact. The protocol for specific sample numbering using case numbers and traffic report numbers (if applicable) and other sample designations will be followed.

QAPP Worksheet #24. Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference*
ICP /AES (Metals)	ICAL for all analytes	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, $r^2 \geq 0.99$.	Correct problem, then repeat ICAL.	Laboratory Technician	See Worksheet #23.
	Second source initial calibration verification (ICV)	Once after each ICAL, analysis of a second source standard prior to sample analysis.	All reported analytes within ± 10% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.		
	CCV	After every 10 samples and at the end of the analysis sequence	Analytes must agree within ± 10% of true value.	Recalibrate, and reanalyze all affected samples since the last acceptable CCV; or Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis.		
	Tuning	Prior to ICAL	Mass Calibration ≤0.1 amu from the true value; Resolution <0.9amu full width at 10% peak height; RSD ≤5% for at least from replicate analyses.	Correct problem, rerun calibration verification.		
	Low Level Calibration Standard (Low Level ICV)	Daily	All reported analytes within ± 20% of true value.	Correct problem and repeat ICAL.		
	Calibration Blank (ICB/CCB)	Before beginning a sample run, after every 10 field samples, and at end of the analysis sequence.	No analyte detected >LOD.	Correct problem and repeat ICAL. All samples following the last acceptable calibration blank must be reanalyzed.		

QAPP Worksheet #24. Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference*
ICP /AES (Metals)	Linear Dynamic Range or High level Check Standard	At initial set up and checked every 6 months with a high standard at the upper limit of the range.	Within ± 10% of true value.	Dilute samples within the calibration range, or re-establish/ verify the LDR.	Laboratory Technician	MET-200.7/6010C
	Interference Check Standards	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked analytes <LOD (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ±20% of true value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.		

*Specify the appropriate reference letter or number from the analytical SOP references table (Worksheet #23).

QAPP Worksheet #25. Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference*
ICP - AES	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing	Metals	Torch, filters, nebulizer chamber, pump, pump tubing	Perform as needed.	Must meet initial and continuing calibration criteria.	Repeat maintenance activity or remove from service.	Analyst / Lab Area Supervisor	MET-200.7/6010C

*Specify the appropriate reference letter or number from Analytical SOP References table (Worksheet #23).

3.3.1 Sample Collection Documentation

During sample collection activities, the field personnel will record all aspects of the sampling process in the field logbooks. These logbooks will be hardbound with supplemental, water-resistant log sheets. Entries in the logbooks and supplemental log sheets will be written using indelible ink. The top of each page will include the project name and number, date, and page number. The bottom of each page will include the time, initials of the person recording the entries, and sufficient detail so that the logic used in decisionmaking during the project can be tracked through later review. During each day of investigative activity, information will be recorded in each field logbook, as discussed in Section 3.1.2.6.

3.3.2 Sample Handling and Tracking System

The sample packaging and shipment procedures summarized below will ensure that samples will arrive at the laboratory with the CoC intact. The Field Manager is responsible for the care and custody of the samples until they are transferred or properly dispatched. Sample handling is described below and summarized on Worksheet #26.

The procedures to be followed when transporting environmental samples and field QC blanks from the RRTS to the laboratory are as follows:

- Sample collection points, depth increments, and sampling devices documented in the field logbooks will be verified with the information written on the sample label and CoC form.
- Custody seals will be wrapped over the top and down the side of each sample container. Glass sample containers will be wrapped with plastic insulating material (bubble wrap) to prevent contact with other sample containers or the inner walls of the cooler. Samples will be placed into resealable plastic bags.
- Samples will be packaged in thermally insulated, rigid coolers, according to U.S. Department of Transportation (DOT) specifications 173 Subparts A and B and 172 Subparts B, C, and D. Environmental samples and field QC blanks to be submitted to the analytical laboratory will be placed in a sample cooler along with ice if required and coolant blanks and the final cooler temperature will be recorded where applicable. After a cooler is filled, the appropriate CoC form will be placed inside a resealable plastic bag and taped to the inside lid of the cooler, and the outer surface of the cooler will be cleaned.
- Custody seals will be attached in two separate locations on the outside of each cooler.

Sample coolers will be shipped to the analytical laboratory by overnight delivery. All samples will be kept on ice if required in a cooler after sample collection. Sample preparation and packaging will be completed at the end of each day that samples were collected. When samples are collected during the weekend, the samples will undergo normal preparation; however, the samples will not be packaged for shipment. Samples collected on the weekend will be kept within a cooler on ice if required until all samples for the next shipment have been collected. On Monday, the iced samples will be packed for overnight shipment. All shipments will be in compliance with applicable DOT regulations.

QAPP Worksheet #26. Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): **Field Manager**
Sample Packaging (Personnel/Organization): **Field Manager**
Coordination of Shipment (Personnel/Organization): **Field Manager**
Type of Shipment/Carrier: **Overnight via FedEx**
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): **Sample receipt staff at laboratories Identified on Worksheet #23**
Sample Custody and Storage (Personnel/Organization): **Sample receipt staff at Laboratories Identified on Worksheet #23**
Sample Preparation (Personnel/Organization): **Laboratory Technician at Laboratories Identified on Worksheet #23**
Sample Determinative Analysis (Personnel/Organization): **Laboratory Technician at Laboratories Identified on Worksheet #23**
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): **Per Worksheet #19**
Sample Extract/Digestate Storage (No. of days from extraction/digestion): **Per Worksheet #19**
Biological Sample Storage (No. of days from sample collection): **Per Worksheet #19**

QAPP Worksheet #27. Sample Custody Requirements and Example Chain-of-Custody

Information on the sample custody requirements is provided in Section 3.3. An example CoC form is provided on Worksheet #27.

COC NO.:

CHAIN OF CUSTODY RECORD

PROJECT NAME:

PROJECT NUMBER:

PROJECT MANAGER:

Sampler (Signature) (Printed Name)

REQUESTED PARAMETERS

LABORATORY NAME:

LABORATORY ADDRESS:

PHONE NO:

Sample ID	Date Collected	Time Collected	Matrix	Toxicology Test (10 day Hyalella)																				No. of Bottles/Vials	OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS

RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time	TOTAL NUMBER OF CONTAINERS:	Cooler Temperature:
COMPANY NAME:		COMPANY NAME:		Cooler ID:	FEDEX NUMBER:
RECEIVED BY:	Date/Time	RELINQUISHED BY:	Date/Time		
COMPANY NAME:		COMPANY NAME:			
RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time		
COMPANY NAME:		COMPANY NAME:			

3.3.3 Sample Custody

Field samples will be accompanied by a properly completed and signed CoC form. Each sample cooler will have its own CoC form. The sample numbers and locations will be listed on the CoC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record will document transfer of custody of samples from the sampler to another person, to the laboratory, or to/from a secure storage area. Because field personnel will be having samples transported from the site to the laboratory via a courier service, the appropriate tracking number will be documented in a signature blank (with type of service noted [e.g., Federal Express]) on all associated CoC forms. All shipping documentation will be retained by the laboratory, along with the original, corresponding CoC forms. All shipments will be accompanied by the CoC record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler for return to project management and the project file. The Project Manager, in conjunction with the QA Manager and ARNG Project Manager, will review all field activities to determine whether proper custody procedure was maintained during the field work and to decide if additional samples are required.

3.3.4 Laboratory CoC Procedures

Custody procedures, along with the holding time and sample preservative requirements for samples, are described in laboratory QA Plans. These documents identify the laboratory custody procedures for sample receipt and log-in, sample storage, tracking during sample preparation and analysis, and laboratory storage of data.

3.3.5 Cooler Receipt Checklist

The condition of shipping coolers and enclosed sample containers will be documented upon receipt at the analytical laboratory. This documentation will be accomplished using the cooler receipt checklist. A copy of the checklist will be faxed or e-mailed to the attention of the QA Manager immediately after it has been completed at the laboratory. The original completed checklist will be transmitted with the final analytical results from the laboratory.

3.3.6 Letter-of-Receipt

The laboratories will confirm sample receipt and log-in information through transmission of a Letter-of-Receipt (LOR) to the QA Manager. This will include returning a copy of the completed (signed) CoC, a copy of the cooler receipt checklist, courier shipping documentation, and confirmation of the analytical log-in following receipt of the cooler(s) by the laboratories. Confirmation of the analytical log-in will be provided in the form of a report (e.g., a laboratory sample confirmation report or a laboratory log-in report), which also will provide SDG information and laboratory-assigned sample I.D. numbers. For each sample shipment, the laboratories must submit to the QA Manager copies of all sample receipt documents and log-in confirmation reports within 24 hours of receipt of each shipment. In the event that sample integrity is compromised upon receipt by the laboratory (e.g., broken bottles, missing labels), the laboratory will contact the QA Manager immediately.

3.3.7 Final Evidence File Custody Procedures

The investigative organization is the custodian of the evidence file for this project. The evidence file will include all relevant records, reports, logs, field notebooks, pictures, subcontract reports, correspondence, laboratory logbooks, and CoC forms. The evidence file will be stored in a secure, limited-access area and under custody of the Project Manager and QA Manager.

3.4 QUALITY CONTROL SAMPLES

Implementation of QC procedures during sample collection, analysis, and reporting ensures that the data obtained are adequate for their intended use. Analytical QC measures are used to determine if the analytical process is in control, as well as to determine the sample matrix effects on the data being generated. Both field QC and laboratory QC checks are conducted throughout the project to document potential bias in the data and to establish a basis for using the results with confidence.

Specifications include the types of QC required (e.g., duplicates, sample spikes, reference samples, controls, and blanks), the frequency for implementing each QC measure, compounds to be used for sample spikes, and the acceptance criteria for the QC results for both laboratory and field analysis.

Laboratories will provide documentation in each data package that both initial and ongoing instrument and analytical QC functions have been met. Any nonconforming analysis will be reanalyzed by the laboratory if sufficient sample volume is available. It is expected that sufficient sample volumes will be collected to provide for reanalysis if required. QC procedures are discussed below and summarized on Worksheet #28.

3.4.1 Sampling Quality Control Samples

During all activities conducted as part of the MRS RI sampling, field QC samples will be collected to gauge the impacts from various components of the field activities. Field QC samples are obtained to determine the degree of cross-contamination, ensure successful decontamination procedures, or determine the effects of media heterogeneity on results. Equipment rinsate blanks and field blanks provide a measure of various cross-contamination, decontamination efficiency, and any other potential error that can be introduced from sources other than the sample. Field duplicate sample pairs will be collected to ascertain the contribution of variability (i.e., precision) associated with environmental media and sampling precision technique.

3.4.2 Analytical Quality Control Samples

QC procedures are described in the following paragraphs for method and extraction blanks and LCSs.

Method Blanks—An MB is a sample of an analyte-free substance similar to the matrix of interest (usually distilled/DI water or silica sand) that is subjected to all of the sample preparation (digestion, distillation, and extraction) and analytical methodology applied to the samples. The purpose of the MB is to check for contamination from within the laboratory that

QAPP Worksheet #28. QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Laboratory Metals						
Field Duplicate	1 per 10 samples (NA for biota samples)	RPD ≤ 50%	No CA is taken on field duplicate data alone. Assess data and determine if re- sampling is required.	QA Manager	Laboratory and Field Precision	RPD ≤ 50%
Equipment Blank	Collect one per day per medium	NA	Qualify data as appropriate.	QA Manager	Accuracy/Bias Contamination	NA
Field Blanks (Source DI and Tap)	Once every 6 months	NA	Qualify data as appropriate.	QA Manager	Accuracy/Bias Contamination	NA
Method Blank	Each preparatory batch	No analyte detected >1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater	Correct problem. If required, reprep and re-analyze method blank and all samples processed with the contaminated blank; otherwise report data and narrate.	Laboratory Project/QA Manager	Accuracy/Bias Contamination	No analyte detected >1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater
MS/MSD	1 pair per 20 samples	RPD ≤ 20%	Reanalyze samples if possible; otherwise report data and narrate.	Laboratory Project/QA Manager	Precision	RPD ≤ 20%
Laboratory Duplicate	1 pair per 20 samples if no MS/MSD	RPD ≤ 20%	Reanalyze samples if possible; otherwise report data and narrate.	Laboratory Project/QA Manager	Precision	RPD ≤ 20%
LCS/LCSD	Once per batch if no MS/MSD pair or laboratory duplicate	RPD ≤ 20%	Reanalyze samples if possible; otherwise report data and narrate.	Laboratory Project/QA Manager	Precision	RPD ≤ 20%
MS	One per 20 samples	Aqueous: EQB only - N/A Sediment: Lead : 81-112% Copper: 81-117% Nickel: 83-113%	No CA based on MS data alone; contact QA Manager for instruction.	Laboratory Project/QA Manager	Accuracy/Bias	

QAPP Worksheet #28. QC Samples Table (Continued)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Laboratory Metals (Continued)						
LCS	One per analytical batch	Aqueous: Lead : 86-113% Copper: 86-114% Nickel: 88-113% Sediment: Lead : 81-112% Copper: 81-117% Nickel: 83-113%	Reanalyze samples if possible; otherwise report data and narrate.	Laboratory Project/QA Manager	Accuracy/Bias	
Dilution Test	One per preparatory batch if MS or MSD fails.	Five-fold dilution must agree within 10% of the original measurement.	Document failure in case narrative.	Analyst	Accuracy	Five-fold dilution must agree within 10% of the original measurement.
Post Digestion Spike (PDS) Addition	Perform if MS/MSD fails. One per preparatory batch (using the same sample as used for the MS/MSD if possible).	Recovery within 80-120%	Document failure in case narrative.	Analyst	Accuracy / Reproducibility	Recovery within 80-120%

QAPP Worksheet #28. QC Sample Table (Continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Benthic Community Assessment						
Re-Sort	One per 10	> 90% efficiency	Re-sort.	Laboratory Project/QA Manager	Accuracy/ Precision	> 90% efficiency
Re-Identify	One per 10	90% of original identifications and taxa counts confirmed	Correct identity of taxon or move to taxonomic level where agreement is reached.	Laboratory Project/QA Manager	Accuracy/ Precision	90% of original identifications and taxa counts confirmed
Subsampling	Each sample subsampled	Accuracy estimate above 90%	Examine remaining fractions.	Laboratory Project/QA Manager	Accuracy/ Precision	Accuracy estimate above 90%
Bulk Sediment Toxicity Analysis						
Reference Toxicity Test Control	1 test per series and species	90% mean survival; no single replicate <80%: LC50 ± 2 standard deviations of historical mean	Notify QA Manager.	Laboratory Project/QA Manager	Accuracy/ Precision	90% mean survival; no single replicate <80%: LC50 ± 2 standard deviations of historical mean
Native Control	1 test per series and species	Minimum average control survival of 90%	Notify QA Manager.	Laboratory Project/QA Manager	Accuracy/ Precision	Minimum average control survival of 90%
Geotechnical Characterization						
Grain Size Laboratory Duplicate	1 per batch	20% RPD	Repeat analysis.	Laboratory Project/QA Manager	Accuracy/Bias	20% RPD
Grain Size: Visual Inspection of Graphical Presentation of Results	1 per batch	NA	NA	NA	NA	NA

might be introduced during sample preparation and analysis that would adversely affect analytical results. An MB must be analyzed with each analytical sample batch.

Laboratory Control Samples—The LCS contains known concentrations of specified target analytes and is carried through the entire preparation and analysis process. Commercially available LCSs or those from USEPA may be used. LCS standards prepared in-house must be made from a source independent of that of the calibration standards. Each LCS analyte must be plotted on a control chart. The primary purpose of the LCS is to establish and monitor the laboratory's analytical process control. An LCS must be analyzed with each analytical sample batch.

Laboratory Duplicates—Laboratory duplicates are separate aliquots of a single sample that are prepared and analyzed concurrently at the laboratory. The duplicate sample must be selected from one of the project's environmental media samples (not a blank). The primary purpose of the laboratory duplicate is to check the precision of the laboratory analyst, the sample preparation methodology, and the analytical methodology. If there are significant differences among the duplicates, the affected analytical results will be re-examined. One in 20 samples will be a laboratory duplicate, with fractions rounded to the next whole number. Laboratory duplicates are routinely used to measure precision for inorganic analyses.

Matrix Spikes and Matrix Spike Duplicates—An MS is an aliquot of a sample spiked with known quantities of specified target analytes and subjected to the entire analytical procedure. It is used to measure method accuracy and to indicate matrix effects. An MSD is a second aliquot of the same sample spiked with known quantities of the same compounds. The purpose of the MSD, when compared to the MS, is to determine precision for the method, field procedures, and matrix. MSs and MSDs are analyzed at a minimum frequency of 1 per 20 samples or 1 per analytical batch if the batches contain fewer than 20 samples. The frequency of MS/MSD analysis applies to each matrix analyzed.

Method-specific Quality Control—The laboratories must follow specific quality processes as defined by the method. These include measures such as calibration verification samples, instrument blank analysis, internal standard (IS) implementation, surrogates, interference check samples, breakdown checks, serial dilution analysis, and post-digestion spike analysis.

Temperature Blank Samples—A temperature blank is a container of water packaged along with field samples in the shipment cooler that will represent the temperature of the incoming cooler upon receipt at the laboratory. Use of these samples within a shipping container enables the receiving laboratory to assess the temperature of the shipment without disturbing any project field samples. The contract laboratories will provide a temperature blank with each cooler.

3.5 DATA MANAGEMENT TASKS

All project data and information will be documented in a format that is usable by project personnel. The following sections describe how project data and information will be documented, tracked, and managed. A summary of project documents is provided on Worksheet #29.

QAPP Worksheet #29. Project Documents and Records Table

Sample Collection Documents and Records	Onsite Analysis Documents and Records	Offsite Analysis Documents and Records	Data Assessment Documents and Records	Other
Sample Logbook Identification of QC Samples CoC Records Sample Shipping Records GPS Data Photographs Meteorological Data	Sample Logbooks Digital Photographs Calibration Logs	Sample Receipt Forms CoC Records Sample Shipping Records Sample Analytical Records (Full Level IV Data Package) Equipment Calibration and Maintenance Records Source Documentation on Standards and Surrogates QA/QC Records Case Narrative CA Reports (CARs)	Data Verification/Validation Assessment Report CAR Nonconformance Report Forms	Equipment Inspection Forms Readiness Review Checklist Readiness Review Action Item Memorandum Document Review Records

3.5.1 Project Documentation and Records

Examples of project documents are provided on Worksheet #29. Details regarding the handling and management of project data are discussed in Section 3.5.1. To maximize configuration control, the investigative organization will track document reviews, approvals, issues, and revisions. Project personnel will track documents and technical data through a web-based digital archival and retrieval system. This system allows the management team to access/retrieve data on a real-time basis, including analytical results, maps, design specifications, drawings, plans, photographs, sketches, contract information, and other critical data. The system also tracks documents through a unique document control number and logs all correspondence to facilitate project closeout. This process is done in accordance with records management procedures presented in SOP-13 (Appendix A).

Field documentation from logbooks, data collection sheets, digital photography, DQCRs, correspondence, and CoC forms will comprise the bulk of the documentation associated with the investigations at the MRS. The procedures for field documentation, as appropriate, will be performed in accordance with SOP-6 through SOP-9 (Appendix A). Hard copy field data will be reproduced for backup and scanned for inclusion in the RI Report. Digital data will be accumulated and maintained on the project directory and tape backup in accordance with established protocols as presented in SOP-14 (Appendix A). All data will be stored at the investigative organization's office until project activities are complete. Thereafter, all data will be sent to the central records facility and maintained for 7 years in accordance with records management procedures outlined in SOP-13.

The process for document review includes the assignment of an ITR lead. The ITR lead will work with the Project Manager to ensure ITRs of all deliverables are completed. The Project Manager will use a Document Review Record (DRR) Form to document all ITRs (Figure 13). The ITR assigned personnel will focus on identifying and correcting deficiencies relating to compliance with the SOW and relevant specifications, laws, and regulations. In addition, ITR assigned personnel will ensure the clarity of the document and use of proper punctuation, syntax, and grammar. Verification that deficiencies have been addressed properly will be conducted by the ITR lead who received the document, as well as the Project Manager.

3.5.2 Data Package Deliverables and Formats

Laboratories will prepare and submit USEPA Contract Laboratory Program (CLP)-like Level IV (Level D) data packages and electronic data deliverables (EDDs) in compliance with the requirements of the QAPP. The definitive data package will include a cover sheet, table of contents, case narrative, analytical results, sample receipt and data management records, internal laboratory QA/QC information, and all raw data. The laboratory data package should be organized so that the analytical results are reported on a per batch basis. Worksheet #30 summarizes which organizations will provide analytical services.

Laboratory QA/QC summary data should include the following:

Inorganics

- Method blank results
- ICAL summary

Figure 13. Document Review Record

DOCUMENT REVIEW RECORD			
DOCUMENT PREPARER:			
DOCUMENT TITLE:			
REVISION:			
DATE TRANSMITTED:		DATE COMMENTS REQUIRED:	
REVIEW TYPE: TECHNICAL EDITORIAL			
COMMENTS THAT ARE ANNOTATED WITH AN (*) ARE MANDATORY AND REQUIRE RESPONSE AND RESOLUTION			
PAGE OR SECTION/ PARAGRAPH	REVIEWERS COMMENTS	PREPARER RESPONSE	REVIEWER/ ACCEPT/ REJECT
REVIEWED BY:		RESPONSE BY:	
PRINT NAME		PRINT NAME	
SIGNATURE	DATE	SIGNATURE	DATE

QAPP Worksheet #30. Analytical Services Summary

Matrix	Analytical Group	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)
Sediment and associated EQB	Metals Analysis	See Worksheet #23	*30 days from sample receipt	ALS Environmental 1565 Jefferson Road Building 300, Suite 360 Rochester, NY 14623 Janice Jaeger (585) 672-7472
Sediment	Grain/Particle Size Analysis	See Worksheet #23	30 days from sample receipt	ALS Analytical
Sediment	Benthic Community Assessment	See Worksheet #23	60 days from sample receipt	Cove Corporation 10200 Breeden Road Lusby, MD 20657 Nancy Mountford (410) 326-4577
Sediment	10-Day Bulk Sediment Toxicity Analysis	See Worksheet #23	60 days from sample receipt	EnviroSystems, Inc. PO Box 778 Hampton, NH 03843 Petra Karber (603) 926-3345
Sediment	SEM-AVS	See Worksheet #23	30 days from sample receipt	ALS Analytical
Sediment	Hydrogen Sulfide	See Worksheet #23	30 days from sample receipt	ALS Analytical
Sediment	Backup Laboratory for all analytes	See Worksheet #23	See above	Accutest Laboratories 2235 Route 130 Dayton, NJ 08810 Phillip Worbe (732) 329-0200

*48 hour turnaround time for preliminary lead data for Phase I background and MRS perimeter samples

- Contract required detection limit (CRDL) results
- ICB and CCB summary
- CCV summary
- MS/MSD summary
- Post digestion spike summary
- LCS summary
- Laboratory duplicate summary
- Interference check sample summary
- Serial dilution summary.

EDDs shall contain the same information as described for the hard copy deliverables. EDDs should use common syntax for terms, provide sufficient input to link analytical data, provide traceability of data, and allow a mechanism to report complex analytical relationships.

In instances where data deliverables are not compatible with Automated Data Review (ADR) EDD specifications (i.e., benthic community assessment, geotechnical characterization, and bulk sediment toxicity analysis), data will be provided in the form of MS Excel workbooks (data) and MS Word (narrative report).

The analytical laboratories will be required to confirm sample receipt and log-in information. The laboratories will return a copy of the completed CoC and confirmation of the laboratory's analytical log-in within 2 days of sample receipt.

The analytical laboratories will prepare and retain full analytical and QC documentation. Such retained documentation will include all hard copies and other storage media (e.g., disc storage). As needed, the subcontract analytical laboratories will make available all retained analytical data information. The investigative organization will process and track all analytical data in accordance with SOP-11 (Appendix A).

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4. ASSESSMENT AND OVERSIGHT ELEMENTS

Assessment and oversight elements ensure that planned project activities are implemented as described in the QAPP and that reports are provided to apprise management of the project status and any QA issues that arise during implementation. Assessment activities help to ensure that the resultant data quality is adequate for its intended use, and that appropriate responses are in place to address nonconformances and deviations from the QAPP.

4.1 ASSESSMENTS AND RESPONSE ACTIONS

The following sections describe the planned assessments that will be conducted and the response actions that will be taken.

4.1.1 Planned Assessments

Performance and system audits of laboratory activities and field sampling activities will be conducted to verify that sampling and analysis are conducted in accordance with the procedures established in this QAPP. Audits of laboratory activities may include both internal and external audits.

ARNG may conduct an independent onsite systems audit of the analytical laboratories. A systems audit includes examination of laboratory documentation of sample receiving, sample log-in, sample storage, CoC procedures, sample preparation and analysis, and instrument operating records. ARNG may also conduct a performance audit of the analytical laboratory, which would consist of sending performance evaluation samples to designated alternate laboratories for ongoing assessment of laboratory precision and accuracy. The analytical results of the performance evaluation samples are reviewed to ensure the project laboratory maintains acceptable performance.

Internal performance audits also may be conducted on a regular basis. The QA Manager may perform a laboratory system audit at the analytical laboratory in support of the MRS RI activities. In addition, a field system audit may be performed during the MRS RI field activities.

Other planned assessments include readiness reviews prior to initiating field work or beginning a new phase of the project to ensure that all documents, SOPs, and logistics are in order. In addition, a Data Quality Assessment (DQA) will be performed as described in Section 5. Planned project assessments are included on Worksheet #31.

4.1.2 Assessment Findings and Corrective Action Responses

CAs may be required for two major types of problems: analytical/equipment problems and noncompliance with criteria. Analytical and equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review.

Noncompliance with specified criteria and analytical/equipment problems will be documented through a formal CA program at the time the problem is identified. The person identifying the problem is responsible for notifying the Project Manager, who will notify the ARNG Contracting Officer Representative (COR). When the problem is analytical in nature, information on the problem will be communicated promptly to the Project Chemist. Implementation of CA will be confirmed in writing.

QAPP Worksheet #31. Potential Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing CA (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Readiness Review	Prior to the start of each definable feature of work	Internal	URS	QA staff assigned by QA Manager	Person responsible for action item as determined during readiness review	Project Manager QA Manager	QA Manager
Field Sampling Surveillance	During MRS RI field activities	Internal	URS	Trained Surveillance Staff	Task Manager	Project Manager Task Manager	QA Manager
Laboratory Surveillance at Analytical Laboratory	During analysis of field project samples	Internal	URS	Project Chemist	Laboratory Project Manager	Project Manager QA Manager	Project Chemist
Analytical DQA	After receipt of data package	Internal	URS	Project Chemist	Laboratory Project Manager	Laboratory Project Manager	Project Chemist

Any nonconformance with the established QC procedures in this QAPP will be identified and corrected in accordance with the QAPP. The Project Manager or designee will issue a noncompliance report (NCR) for each nonconforming condition. The NCR form is provided in Figure 14 and the procedure shall be followed as outlined in SOP-15 (Appendix A). The persons responsible for initiating CAs, receiving CAs, and those approving CAs, as well as the timeframe for the completion of CARs, are summarized on Worksheet #32.

CAs will be implemented and documented in the field record book. No staff member will initiate CA without prior communication of findings through the proper channels. If CAs are deemed insufficient, work may be stopped through a stop-work order issued by the Project Manager and/or ARNG.

Laboratory QA plans will provide systematic procedures to identify out-of-control situations and document CAs. CAs will be implemented to resolve problems and restore malfunctioning analytical systems. Laboratory personnel will receive QA training and be made aware that CAs are necessary for the following situations:

- QC data are outside warning or control windows for precision and accuracy
- CRDL standard analysis is outside acceptance limits
- Blanks contain target analytes above acceptable levels and must be investigated
- Undesirable trends are detected in spike recoveries or RPD between duplicates
- There are unusual changes in detection limits
- Deficiencies are detected by internal audits, external audits, or performance evaluation sample results
- Inquiries concerning data quality are received.

CA procedures often are handled at the bench level by the analyst who reviews the preparation or extraction procedure for possible errors and checks such factors as instrument calibration, spike and calibration mixes, and instrument sensitivity. If the problem persists or cannot be identified, the matter is referred to the Laboratory Supervisor, Manager, and/or QA Department for further investigation. When resolved, full documentation of the CA procedure is filled with project records and the laboratory QA Department, and the information is summarized within case narratives. CAs may include, but are not limited to, the following:

- Reanalyzing the samples if holding time criteria permit
- Evaluating blank contaminant sources, eliminating these sources, and reanalyzing
- Modifying the analytical method (i.e., standard additions) with appropriate notification and documentation
- Resampling and analysis
- Evaluating and amending sampling procedures
- Accepting data and acknowledging the level of uncertainty.

NONCONFORMANCE REPORT	DATE OF NCR	NCR NUMBER
	LOCATION OF NONCONFORMANCE	PAGE OF
INITIATOR (NAME/ORGANIZATION/ PHONE)	FOUND BY	DATE FOUND
RESPONSIBLE ORGANIZATION/INDIVIDUAL		PROGRAM
		PROJECT
DESCRIPTION OF NONCONFORMANCE		CATEGORY:

A INITIATOR DATE QA/QC OFFICER DATE CAR REQ'D YES ☐ NO ☐

DISPOSITION:

PROBABLE CAUSE:

ACTIONS TAKEN TO PREVENT RECURRENCE:

B PROPOSED BY: NAME DATE

JUSTIFICATION FOR ACCEPTANCE:

C INITIATOR: NAME DATE

VERIFICATION OF DISPOSITION AND CLOSURE APPROVAL

REINSPECTION/RETEST REQUIRED YES ☐ NO ☐ IF YES; DATE RESULT

D QUALITY ASSURANCE: NAME DATE

Figure 14. Nonconformance Report Form

QAPP Worksheet #32. Assessment Findings and CA Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response (Name, Title, Org.)	Timeframe for Response
Readiness Review	Action Item Memorandum	Person responsible for action item as determined during readiness review	At time of Readiness Review	Completing Action Item Memorandum	Rosa Gwinn, QA Manager, URS	Prior to the start of definable feature of work
Field Sampling Surveillance	Surveillance Report	Laurie Stenberg/ URS Project Manager Joshua Collins and Theresa Allinger/ URS Field Staff	Immediately	NCR (if required) CAR (if required)	Rosa Gwinn, QA Manager, URS	2 weeks
Laboratory Surveillance at Analytical Laboratory	Surveillance Report	Laurie Stenberg/ URS Project Manager Janice Jaeger/ ALS Project Manager	Immediately	NCR (if required) CAR (if required)	Rosa Gwinn, QA Manager, URS	2 weeks
Analytical DQA	DQA Report	Laurie Stenberg/ URS Project Manager Janice Jaeger/ ALS Project Manager	Immediately	NCR (if required) CAR (if required)	Rosa Gwinn, QA Manager, URS	2 weeks

If resampling is deemed necessary due to laboratory problems, the Project Manager will identify the necessary recovery approach to implement the additional sampling effort. The following CA procedures will be required:

- Problems noted during sample receipt will be documented in the appropriate laboratory LOR.

  The Project Chemist and Project Manager will be contacted immediately to determine problem resolution. The Project Manager will notify the ARNG COR. All CAs will be documented thoroughly.
- When sample extraction/digestion or analytical holding times are not within method-required specifications, the Project Chemist and Project Manager will be contacted immediately to determine problem resolution. The Project Manager will notify the ARNG COR. All CAs will be documented thoroughly.
- All initial and continuing calibration sequences that do not meet method requirements will result in a review of the calibration. When appropriate, reanalysis of the standards or reanalysis of the affected samples back to the previous acceptable calibration check is warranted.
- All appropriate measures will be taken to prepare and clean up samples in an attempt to achieve the practical quantitation limits (PQLs) as stated. When difficulties arise in achieving these limits, the laboratory will notify the Project Chemist and Project Manager. The Project Manager will notify the ARNG COR to determine problem resolution. All CAs will be documented thoroughly.
- Any dilutions impacting the PQLs will be documented in case narratives along with revised quantitation limits for those analytes affected. Analytes detected above the method detection limits (MDLs), but below the PQLs, will be reported as estimated values.
- Failure of method-required QC to meet the requirements specified in the QAPP will result in review of all affected data. Resulting CAs may encompass those identified earlier. The QA Manager and Project Manager will be notified as soon as possible to discuss possible CAs, particularly when unusual or difficult sample matrices are encountered. The Project Manager will notify the ARNG COR.
- When calculation and reporting errors are noted within any given data package, reports will be reissued with applicable corrections. Case narratives will clearly state the reasons for reissuance of reports.

4.2 QA MANAGEMENT REPORTS

Reports of a variety of QC activities will be provided to managers of appropriate levels of the organization. QC reports are available to ARNG for review. Field QA reports will be generated based on results of field audits. The Laboratory Project Manager will provide QA update memoranda (i.e., copies of all field custody forms received and laboratory sample status and custody forms generated) for each sampling event to the QA Manager and Project Manager upon evaluation of the analytical work for that event.

The Project Chemist and Project Manager will be notified immediately of laboratory QA situations (e.g., exceeded holding times, surrogate recoveries in MBs, and inadequate sample volume) requiring immediate CA (i.e., recollecting samples). CARs will document these deviations. The laboratory sample custodian will note all QA situations that may affect laboratory and project QA objectives on the four-part CoC form and return a copy to the Project Manager and a copy to the QA Manager.

The Project Manager will submit monthly progress reports to ARNG describing the progress of the project. To support this requirement, the Field Manager will provide the Project Manager with daily field progress reports, compiled field data sets, and CA documentation at appropriate intervals. Based on information gathered during unannounced site audits, the QA Manager will provide the Project Manager with periodic QA updates. Situations requiring immediate CA measures will be brought to the attention of the Project Manager. QA management reports are summarized on Worksheet #33.

4.3 FINAL PROJECT REPORT

The following sections describe the DQA and RI Report.

4.3.1 Data Quality Assessment

As part of the final closure report, the investigative organization will submit a DQA. The DQA will discuss results of laboratory MBs, MS/MSDs, LCSs, holding times, calibration criteria, equipment rinsate blanks, field blanks, and field duplicates. Any deviations from QC criteria will be discussed. This assessment also will discuss precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters; limitations of the data; QC frequency; audits; and CAs.

4.3.2 RI Report

The RI report will incorporate data and information from the SI and the RI into a comprehensive document. The report format will closely follow the suggested USEPA guidance (USEPA 1988) and will include historical and background information, field measurements, analytical results, a summary of field protocols, identified nature and extent of contamination, contaminant fate and transport, geologic data interpretations, ecological and human health risk assessment results, and raw data tabulations. Table 3 presents a preliminary RI report outline. The overall RI Report process will include a preliminary draft report, responses to U.S. Army comments on the preliminary draft report, a draft report, responses to stakeholder comments on the draft report, and a final report documenting the results and findings of the RI.

Prior to submittal of the draft RI report, an MC Data Package will be submitted to provide the stakeholders with an opportunity to review the preliminary analytical data, field logs, and field photographs.

QAPP Worksheet #33. QA Management Reports Table

Type of Report	Frequency (daily, weekly, monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Readiness Review Action Item Memorandum	After each readiness review	Within 24 hours of readiness review	QA Manager designee, URS	Rosa Gwinn, QA Manager, URS
Field Surveillance Report	After completion of field surveillance	Within 1 week of field surveillance	QA Manager designee, URS	Rosa Gwinn, QA Manager, URS
Laboratory Surveillance Report	After completion of field surveillance	Within 1 week of laboratory surveillance	Andrea Sansom, Project Chemist, URS	Rosa Gwinn, QA Manager, URS
Analytical DQA Report	After receipt of all analytical data	60 days after receipt of final data	Andrea Sansom, Project Chemist, URS	Project Managers at USACE and ARNG

Table 3. Example RI Report Format

Executive Summary
1. Introduction
1.1 Purpose and Scope of the RI
1.2 Installation Background
1.3 Previous Environmental Actions
2. Environmental Setting
3. Investigation and Data Evaluation Methods
3.1 Investigative Methods
3.2 Summary of Data
3.4 Determination of Site Chemical Background
3.5 Contaminant Fate and Transport Analyses Overview
4. Results of the Field Investigation
4.1 Investigation Site
4.1.1 Background Information
4.1.2 Investigation Activities
4.1.3 Nature and Extent of Contamination
5. Baseline Risk Assessment
5.1 Human Health Evaluation
5.2 Ecological Evaluation
6. Conclusions and Recommendations
6.1 Conclusions
6.2 Recommendations
7. References
Appendices

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5. DATA REVIEW ELEMENTS

The following sections describe how the MRS data will be examined, evaluated, and used for decisionmaking. Following the identified processes will ensure data used for decisionmaking are valid and defensible and of appropriate quality to support site closure.

5.1 OVERVIEW

Three distinct evaluative steps will be used to ensure project data quality needs are met: verification, validation, and usability assessment. These steps apply to all aspects of the RI data generation, including field sampling and analytical activities.

5.2 DATA REVIEW STEPS

The data review process includes both verification and validation.

5.2.1 Step I: Verification

The following section describes laboratory data verification and investigator data verification.

5.2.1.1 Laboratory Data Verification

Laboratories will perform in-house analytical data reduction under the direction of the Laboratory Project Manager. The Laboratory Project Manager is responsible for assessing data quality and informing the QA Manager and ARNG of any data that are considered unacceptable or require caution on the part of the data user in terms of its reliability. Data will be reduced, evaluated, and reported as described in the laboratory QA plan. Data reduction, review, and reporting by the laboratory will be conducted as follows:

- Raw data are produced by the analyst who has primary responsibility for the correctness and completeness of the data. All data will be generated and reduced following the QAPP-defined methods and implementing laboratory SOP.
- Level 1 technical data review is completed relative to an established set of guidelines by a peer analyst. The review will ensure the completeness and correctness of the data while ensuring all method QC measures have been implemented and were within appropriate criteria.
- Level 2 technical review is completed by the area supervisor or data review specialist. This specialist reviews the data for attainment of QC criteria as outlined in the established methods and for overall reasonableness. The review will ensure that all calibration and QC data are in compliance and check at least 10 percent of the data calculations. The review will document that the data package is complete and ready for reporting and archiving.
- Upon acceptance of the raw data by the area supervisor, the report is generated and sent to the Laboratory Project Manager for Level 3 administrative data review. The review will ensure consistency and compliance with all laboratory instructions, the laboratory QA plan, the project laboratory SOW, and the QAPP.
- The Laboratory Project Manager will complete a thorough review of all reports.

- Final reports will be generated and signed by the Laboratory Project Manager.
- Data then will be delivered to the QA Manager for data verification.

The data review process will include identification of any out-of-control data points and data omissions, as well as interactions with the laboratories to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project. The laboratories will provide flagged data to include such items as: 1) concentration below required LOQs, 2) estimated concentration due to poor spike recovery, and 3) concentration of chemical also found in laboratory blank.

Laboratories will prepare and retain full analytical and QC documentation for the project. Such retained documentation will be both hard (paper) copy and electronic storage media (e.g., compact disc [CD] or digital versatile disc [DVD]) as dictated by the analytical methodologies employed. As needed, laboratories will supply hard copies of the retained information.

Laboratories will provide the following information in each analytical data package submitted:

- Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis
- Tabulated results of inorganic, organic, and miscellaneous parameters identified and quantified
- Analytical results for QC sample spikes, sample duplicates, initial and continuing calibrations, verifications of standards and blanks, standard procedural blanks, LCSs, and other deliverables as identified in Section 3.4.
- Tabulation of DL, LOD, and LOQ determination.

5.2.1.2 Data Verification

The QA Manager or designee will initiate a verification of the analytical data packages, as described below. One hundred percent of the data (sediment and field QC blanks) will be verified according to the USEPA National Functional Guidelines for Inorganic Data Review (USEPA 2010) using DOD QSM acceptance criteria.

An independent data review of the entire primary dataset will be performed by the QA Manager. A systematic process for data verification and evaluation will be performed to ensure that the precision and accuracy of the analytical data are adequate for their intended use. The greatest uncertainty in a measurement is often a result of the sampling process and inherent variability in the environmental media rather than the analytical measurement. Therefore, analytical data evaluation will be performed to the level necessary to ascertain data usability (e.g., identifying estimated or rejected data) and to minimize the potential of using false positive or false negative results in the decisionmaking process (i.e., to ensure accurate identification of detected versus nondetect compounds). This approach is consistent with the DQOs for the project, with the analytical methods, and for determining COCs and calculating risk.

The verification process will meet all of the data review objectives specified in the UFP QAPP Manual (IDQTF 2005). Data review objectives specified in the UFP QAPP Manual includes:

- Review data packages for completeness
- Assess and document performances of the field sample collection process
- Assess and document performance of the analytical process
- Assess and document usability to meet PQOs.

Samples will be analyzed through implementation of definitive analytical methods. Definitive data will be reported consistent with the deliverables identified in Section 3.5.2. This definitive data then will be evaluated through the review process presented in USEPA National Functional Guidelines for Inorganic Data Review (USEPA 2002) using QA acceptance criteria presented in Appendix D of the DOD QSM v5.0 (DOD 2013).

Data evaluation will be accomplished by comparing the contents of the data packages and QA/QC results to requirements contained in the requested analytical methods. The QA Manager will evaluate QC data reported by the laboratory against required precision and accuracy limits established in DOD's QSM v5.0 (DOD 2013) and QC criteria presented in the QAPP.

The data verification support staff will conduct a systematic review of the entire primary data set for compliance with the established QC criteria based on the following categories:

- Sample condition upon receipt
- Holding times
- Blanks
- Instrument tunes
- MS/MSDs
- LCSs
- Inorganic duplicates
- ICP or atomic absorption QC (i.e., serial dilutions, interference check samples)
- Calibration
- CRDL results
- Sample reanalysis
- Secondary dilutions
- Laboratory case narrative.

Consistent with the data quality requirements as defined in the DQOs, all project data and associated QC will be evaluated on these categories and qualified as per the outcome of the review. During the review, laboratory-applied data qualifiers will be evaluated, defined, and explained. During verification, individual sample results will be qualified, as necessary, to designate usability of the data toward meeting project objectives. The qualifiers used are defined as follows:

- *U*—The analyte was analyzed for, but was not detected above the reported sample quantitation limit. These results are qualitatively acceptable.

- *J*—The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. These results are qualitatively acceptable, but estimates.
- *UJ*—The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample. These results are qualitatively acceptable, but estimates.
- *R*—The sample results were rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified.

Data qualifications will be applied based on deviations from the measurement performance criteria identified on Worksheet #28. Information gathered during this verification process will be consistent with the information demonstrated by the verification forms.

As part of the MRS RI Report, the investigative organization will submit a DQA. The DQA will discuss results of laboratory MBs, MS/MSDs, LCSs, holding times, calibration and tuning criteria, equipment rinsate blanks, field blanks, and field duplicates. Any deviations from QC criteria will be discussed. This assessment also will discuss PARCC parameters, limitations of the data, QC frequency, and CAs. Data verification steps are summarized on Worksheet #34.

5.2.2 Step II: Validation

Full data validation will be conducted on 10 percent of the analytical data, as described below. Full validation consists of validating the data using the USEPA National Functional Guidelines for Inorganic

Data Review (USEPA 2010) and recalculating the positive detects above the CRDL. However, instead of using the QA acceptance criteria outlined in the National Functional, the criteria from the DOD QSM will be used. A Data Validation Report (DVR), as described in the National Functional Guidelines, details the assessment and validation of the analytical data.

The QA Manager or designee will initiate a validation of the analytical data packages. Ten percent of the data will be validated using the National Functional Guidelines and DOD QSM acceptance criteria. The 10 percent of the data that is validated is 10 percent of all data, incorporating a minimum of 10 percent for all analytical methodologies.

During the data validation for 10 percent of the data, samples will be reviewed for holding times, blank contamination, calibrations, precision (i.e., laboratory and field), accuracy (i.e., laboratory and field), error determination, detection limits, QC data, (e.g., MS/MSDs, LCSs, and duplicates), and confirmed identification data. Calculations of reported results will be verified from raw data. The data package must be reviewed for content to ensure that the necessary forms and raw data required to validate the sample results are present. Laboratory QC forms will be reviewed to ensure that the QC results fall within appropriate QC limits. In addition, summary results for hand-transcribed values and computer- generated forms will be recalculated from the raw data to verify that the algorithms were used and that data transcription was correct. Analytical results will be checked and recalculated from raw data. If a significant problem is found in any analytical protocol or matrix type (e.g., consistent failure to meet calibration requirements or poor spike recoveries), 100 percent of the data

QAPP Worksheet #34. Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification
Sample Receipt and CoC	The condition of shipping coolers and enclosed sample containers will be documented upon receipt at the analytical laboratory. This documentation will be accomplished using a cooler receipt checklist. The original completed checklist will be transmitted with the final analytical results from the laboratory.	I	Laboratory
Analytical Data Package	Laboratories will perform in-house analytical data reduction under the direction of the Laboratory Project Manager. The Laboratory Project Manager is responsible for assessing data quality and informing the QA Manager of any data that do not meet QAPP QA specifications.	I	Laboratory
SDG Verification Report for Each Analytical Parameter	Verify Data Package for completeness and QAPP compliance with Worksheets #12, #15, #24, and #28 for the following: Laboratory case narrative Sample condition upon receipt Holding times Sample results Blanks MS/MSDs LCSs CRDL recovery Initial and continuing calibration summary and raw data Sample analysis raw data.	I	QA Manager
Data Verification Qualifier Input	Enter data verification qualifiers for field samples based on verification process.	I	QA Manager

generated by that particular method will be fully validated to determine if a serious systemic problem exists in the data set. Data validation will be conducted in three stages:

- Examination of the data package for completeness and legibility.
- Detailed review of all QC parameters and recalculation of the sample results from the raw data.

  If errors are noted during validation of the package, more extensive examination of the results will be necessary to determine if the error is an isolated case confined to one particular sample or QC parameter or extended throughout the package.
- Preparation of a DVR for each analysis data package reviewed. This report includes a detailed data validation assessment, the sample Form 1s for the lot evaluated, and any data validation notes. Each DVR includes a section summary specific to each QA/QC procedure to be evaluated according to the guidelines previously specified. Each summary section should clearly state whether the required QC criteria were met for that particular QA/QC procedure. If QC criteria were not met, the section summary should explicitly state the nature and extent of the problem encountered, and specifies which qualifiers, if any, should be applied to associated sample results.
- The deliverable will include:

  Technical reports for each analysis (e.g., metals) that detail the acceptance criteria used, outliers, affected samples, qualifiers, reasons for qualifiers assigned to the data, and signatures of the data validator and senior data validator.
- Validation worksheets showing calculations and verifications for both sample and QC results.

Annotated Form 1s with specific validation qualifiers assigned to the results for each parameter that is not judged fully quantitative by the reviewer. If dilutions or re-analyses are required, both the original and secondary analyses will be qualified and included in the deliverable; however, the technical report will suggest which analytical results are best to use.

5.2.2.1 Step IIa Validation Activities

Step IIa validation activities will be performed in accordance with Worksheets #35 and #36.

5.2.2.2 Step IIb Validation Activities

Step IIb validation activities will be performed as described in accordance with Worksheets #35 and #36.

5.2.3 Step III: Usability Assessment

The usability assessment considers whether the collected data meet the project DQOs as they relate to the decision to be made, and evaluates whether data are suitable for making that decision. The usability assessment is the final step of data review and will be performed only on verified and validated data. The DQO process for this project is presented throughout this document, but principally on Worksheets #10, #11, #17, #19, and #28. Sampling methods and techniques are described in Section 3.1.2. The usability assessment process is provided on Worksheet #37.

QAPP Worksheet #35. Validation (Steps IIa and IIb) Process Table

The following validation process will be performed as outlined below. Data qualification qualifiers (i.e., U, J, UJ, and R) will be applied in accordance with the National Functional Guidelines for Inorganic Data Review (USEPA 2010), the DOD QSM Version 5.0 (DOD 2013), and this QAPP. The data validation process will follow the guidelines presented in this QAPP for method quality objectives and the National Functional Guidelines for the qualification of data.

Step IIa/IIb	Validation Input	Description	Responsible for Validation
IIa	Evaluate sample receipt, preservation, and holding times	Verify that method criteria were met.	QA Manager
IIb	Data validation for all QA/QC parameters on 10 percent of the analytical results from primary laboratory	Verify that criteria on QAPP Worksheets #12, #15, #24, and #25 were met. Perform required recalculations from the raw data for the following: • Sample results • Blanks • MS/MSDs • LCSs • MRL recovery • Serial dilutions • Interference check samples • Initial and continuing calibration results • Review sample and standard chromatography.	QA Manager
IIb	Equipment blanks, rinse blanks, and field blanks	Review blanks for the presence of target compounds that are above the MDL and qualify associated field samples accordingly.	QA Manager

QAPP Worksheet #36. Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	100% Sediment	Metals	Low/Medium	QAPP Worksheets #12, #15, #24, and #28	QA Manager
IIb	100% Sediment	Metals	Low/Medium	QAPP Worksheets #12, #15, #24, and #28	QA Manager

Note:
The Environmental Restoration Information System (ERIS) is a Web-based database system for the storage of Army environmental restoration and range field data. It serves as a central repository for the Army installation chemical, geological, and geographical data. Since its release in November 2001, ERIS has undergone several enhancements to increase the quality and quantity of the reports and the retrieval of data.

The basic process of ERIS upload includes:
1. Submission of electronic data deliverables by the laboratory to URS. These must be created in a specific format which is detailed in the ERIS Upload Specification Spreadsheet Provided by the AEC.
2. Editing and Quality control check of EDDs as needed by URS.
3. Uploading of the EDDs to the ERIS system online by URS. The upload process is iterative and no data is uploaded until the file format fits correctly and all data required is included.

RRTS is listed as an installation in ERIS as the former Newcastle Rifle Range:
http://www.denix.osd.mil/sri/upload/ORAP-DE-RiverRoad.pdf

Acknowledgement of successful upload will be forwarded to USACE-Baltimore District Project Chemist or Chemical/Environmental Engineers to verify the ERIS upload results of the River Road Training Site RI project.

QAPP Worksheet #37. Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:
The Data Usability Assessment will be performed by a team of personnel at the investigative organization. The QA Manager will be responsible for information in the Data Usability Assessment. Note that the Data Usability Assessment will be conducted on verified/validated data. After the Data Usability Assessment has been performed, data deemed appropriate for use then will be used to support further recommendations. The results of the Data Usability Assessment will be presented in the final DQA.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

Precision—Results of all laboratory duplicates, MS/MSD pairs, LCS/LCSD pairs, and field duplicates will be assessed against measurement performance criteria provided on Worksheet #28. The RPDs exceeding criteria will be identified in the DQA. A discussion will follow summarizing the results of the laboratory precision. Any conclusions about the precision of the analyses will be drawn and any limitations on the use of the data will be described.

Accuracy/Bias Contamination—Results for all laboratory MBs and field QC blanks will be assessed against measurement performance criteria provided on Worksheet #28. Results for analytes that exceed criteria will be identified in the DQA. Any conclusions about the accuracy/bias of the analyses based on contamination will be drawn and any limitations on the use of the data will be described in the DQA.

Overall Accuracy/Bias—The results for the LCS/LCSDs and MS/MSDs will be assessed against measurement performance criteria provided on Worksheet #28. In addition, initial and continuing calibration data will be compared to the requirements provided on Worksheet #24. A discussion will follow summarizing overall accuracy/bias. Any conclusions about the overall accuracy/bias of the analyses will be drawn and any limitations on the use of the data will be described in the DQA.

Sensitivity—Results for all samples will be presented separately in tabular format for each analysis. The results for each analyte will be checked against the laboratory RLs, MDLs, and project action levels. A discussion will follow summarizing the results of the laboratory sensitivity. Any conclusions about the sensitivity of the analyses will be drawn and any limitations on the use of the data will be described in the DQA.

Representativeness—Representativeness will be achieved by using standard sampling and analytical methodologies governing sample collection methods, sample size, preservation and handling, and methodology. Representativeness will be assessed qualitatively by ensuring that sample collection, handling, and analysis methodologies were followed. A discussion will follow summarizing the results of the representativeness of the results. Any conclusions about the representativeness of the analyses will be drawn and any limitations on the use of the data will be discussed in the DQA.

Comparability—Comparability will be achieved by using standard sampling and analysis procedures that can be reproduced in future sampling events. Analytical results also will be compared semi-qualitatively to historical data available for the site and field observations. A discussion will follow summarizing the results of the comparability of the results. Any conclusions about the comparability of the analyses will be drawn and any limitations on the use of the data will be described in the DQA.

Completeness—A completeness check will be done on all of the data generated by the laboratory. Completeness criteria are presented on Worksheet #12. Completeness will be calculated for each analyte as follows. For each analyte, completeness will be calculated as the number of data points for each analyte that are not rejected in the data verification and validation process divided by the total number of data points for each analyte. Any conclusions about the completeness of the data for each analyte will be drawn and any limitations on the use of the data will be described in the DQA.

Reconciliation—Each of the PQOs presented on Worksheet #12 will be examined to determine if the objective was met. This examination will include a combined overall assessment of the results of each analysis pertinent to an objective. Each analysis will first be evaluated separately in terms of the major impacts observed from the data validation, DQIs, and measurement performance criteria assessments. Based on the results of these assessments, the quality of the data will be determined. Based on the quality determined, the usability of the data for each analysis will be determined. Based on the combined usability of the data from all analyses for an objective, it will be determined if the PQO was met and whether project action limits were exceeded. The final report will include a summary of all the points that went into the reconciliation of each objective. As part of the reconciliation of each objective, conclusions will be drawn and any limitations on the usability of any of the data will be described.

QAPP Worksheet #37. Usability Assessment (Continued)

Identify the personnel responsible for performing the usability assessment: QA Manager
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: An analytical DQA report will be generated and will discuss limitations of data usability.

5.2.4 Verification of DQO Attainment

Verifying the attainment of the DQO statements should be conducted as follows:

- Verification should generally be done by the data users' perspective(s) that will be using the data
- Verification of DQO attainment must be completed before the data are used by the data users
- All data quality requirements of a DQO statement should be verified
- Verification of DQO attainment typically is required to ensure contract compliance.

Appropriate CAs should be taken whenever data obtained are inadequate for the intended use(s). After completing an assessment of the effects of a missed DQO, the source or cause for missing the DQO should be investigated and understood by the team. When necessary, and if possible, resampling and/or reanalysis then should be performed at the expense of the responsible party (e.g., government, contractor, and laboratory). The procedures used to assess the overall data usability are provided on Worksheet #37.

5.3 STREAMLINING DATA REVIEW

Data review will be streamlined by performing data validation on 10 percent of the data. Ten percent of all analyses will be validated as outlined in Section 5.2. Only 10 percent of these data will require calculations from the raw data. If any discrepancies are encountered with the calculations performed during the validation, the ARNG Project Manager will be contacted. It may be determined that a greater percentage of the data needs to undergo validation with calculations from the raw data.

5.4 RISK ASSESSMENT

After completion of data verification, data validation, and the data usability assessment, human health and ecological risk assessments will be conducted. The CSMs for the MRS and the human health and ecological risk assessment process are discussed in the following sections.

5.4.1 Conceptual Site Model

The CSM for the MRS was developed by analyzing and interpreting data obtained from the CTT Range Inventory Report (Malcolm Pirnie 2003); the RRTS SI (URS 2007); results of regional sampling efforts (Section 2.7); and subsequent coordination with ARNG, DNREC, and U.S. Army Corps of Engineers (USACE) representatives (i.e., discussions that occurred during the November 3, 2011 DQO scoping meeting and the December 4, 2013 TPP1 meeting). The CSM illustrates the potential pathways for environmental transport of chemical constituents from the source of contamination to human (Figure 15) and ecological (Figure 16) receptors upon firing of small arms at nearshore targets, bullets missing the target would hit the water and rapidly sink to the river bottom and become integrated into the surface sediment. Accordingly, sediments are shown as the source medium where subsequent release of COPCs would primarily occur.

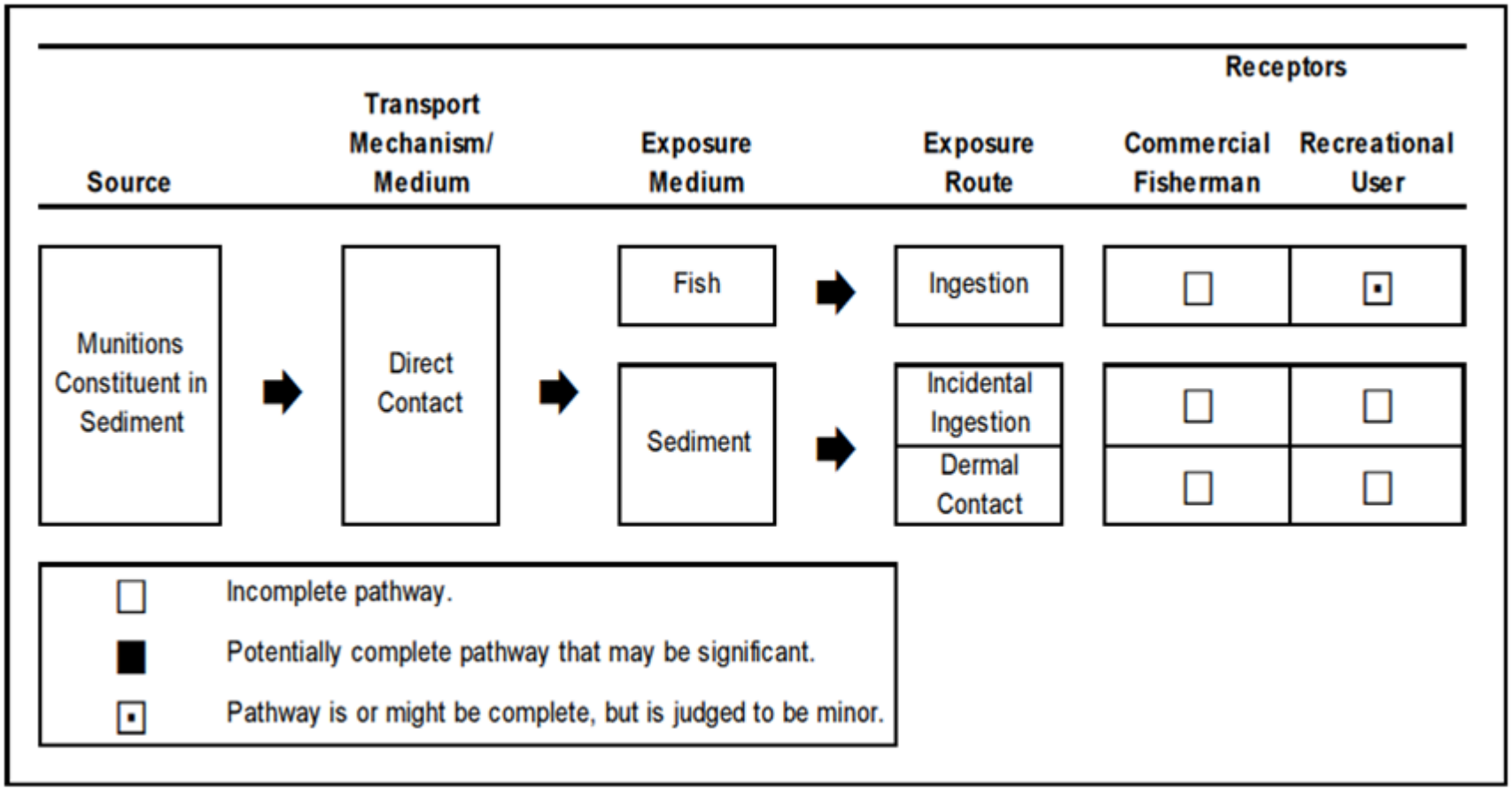

Figure 15. Human Health Conceptual Site Model for the RRTS MRS Site

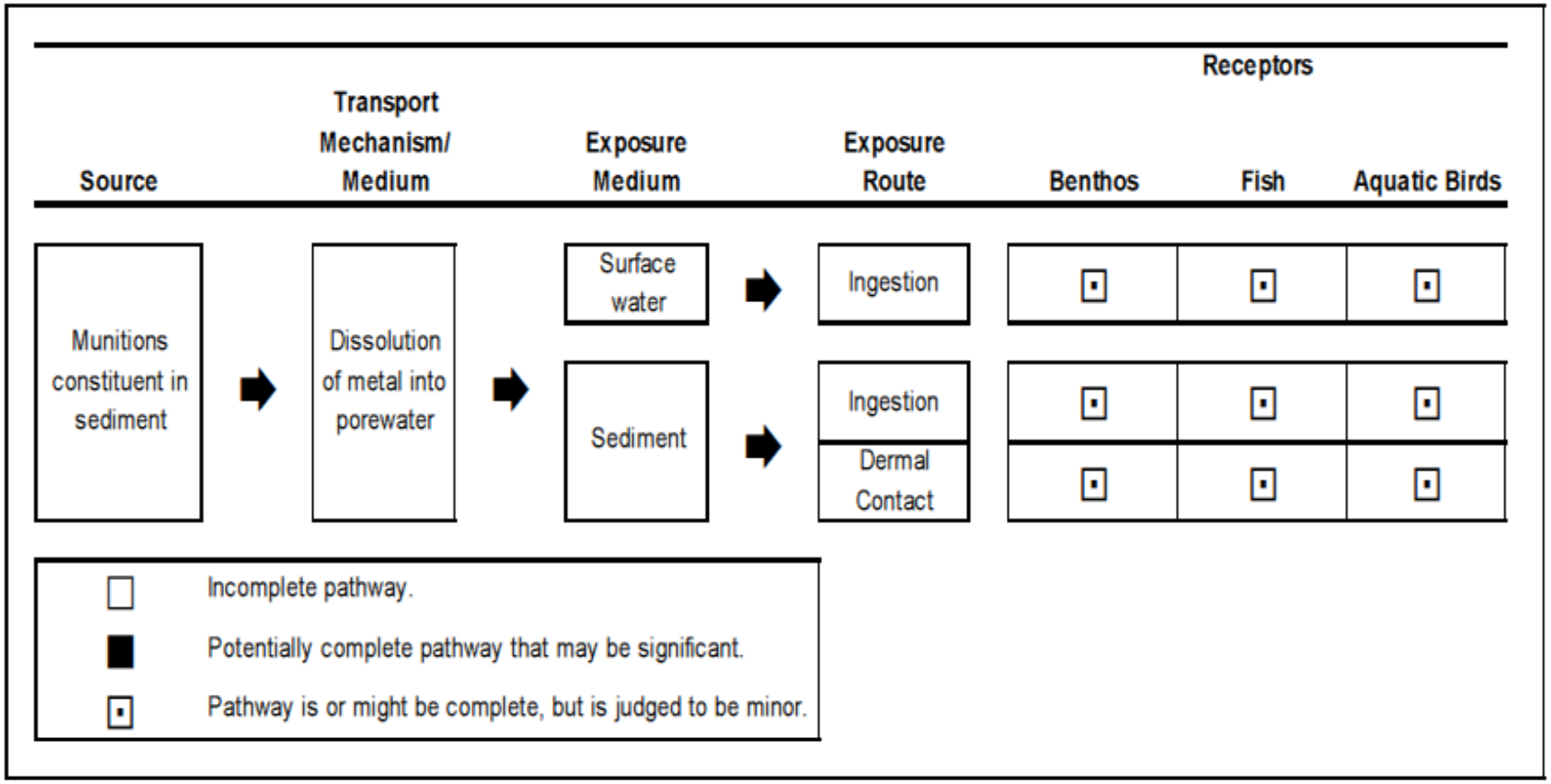

Figure 16. Ecological Conceptual Site Model for the RRTS MRS Site

The fate and transport of MC in relation to the MRS is primarily influenced by the pattern of initial bullet deposition and local sediment dynamics as illustrated in Figure 17. Bullet density is expected to decrease with increasing distance from the RRTS shoreline. As stated in Section 2.5.2.2, the most common weapon used on the former 1,000-yard range was the M1903 Springfield rifle and no evidence was found for any other type of weapon having been used at the RRTS MRS. The M1903 rifle was "sighted" for a target up to 2,500 yards and had a point-blank range of 500 yards. This rifle was highly accurate and although it had a maximum range of 4,890 yards, significant overshot of the target is unlikely beyond the 1,000-yard mark.

A comparison of current (2001) and historical (1983) bathymetry data shows that sediments of the MRS have undergone both significant deposition and erosion over this 19-year period (Figure 18). The transport and deposition of sediments from upstream introduce the possibility for contamination of the MRS by outside sources. Deposition of sediments within the MRS boundary also may have resulted in the burial of bullets and/or MC beyond the biologically active zone (BAZ). The potential for burial of bullets is further enhanced by their high mass density, which would promote a downward migration in soft sediments. In contrast, sediment erosion may have caused the off-range migration of bullets and downstream dilution of MC. The inshore areas of the MRS appear to be stable and therefore have a higher likelihood for MC in surface sediments.

To determine potential human receptors, the land use of the site was evaluated. The MRS is located in the Delaware River Estuary, approximately 10 miles south of Wilmington, Delaware. Current uses of the MRS include general recreation and recreational fishing. The Delaware River Estuary has a large commercial fishery however the fishery is not expected to be significant in the immediate vicinity of the site. The MRS is bisected by the Bulkhead Shoal channel and, as such, is likely also used for commercial and recreational navigation. All areas of the MRS are accessible to the general public although access is limited and only by boat. During certain firing activities on active ranges, RRTS posts a guard on the river for boats that may enter the current SDZ. In the event that a boat does enter an SDZ, the guard radios the range to cease fire until the boat either leaves or is escorted out of the area by the U.S. Coast Guard (URS 2007). Shoreline access to the MRS through the adjacent RRTS is limited by perimeter fencing surrounding the facility. Formal access to RRTS is through a guarded gate. Future land use of the MRS is expected to remain the same as current land use.

Possible exposures to human receptors that could result from contact with the affected media are indicated in the CSM (Figure 15). Based on current and likely future land use, potential human receptors at the MRS are limited to recreational fishermen accessing the MRS by boat. The primary route of exposure to the recreational fisherman involves the ingestion of fish. Possible exposure to sediment through dermal contact or incidental ingestion also was considered for this receptor. However, due to the water depths throughout the MRS and the absence of a wading and/or bathing scenario, exposure of recreational users to sediments was considered an incomplete pathway.

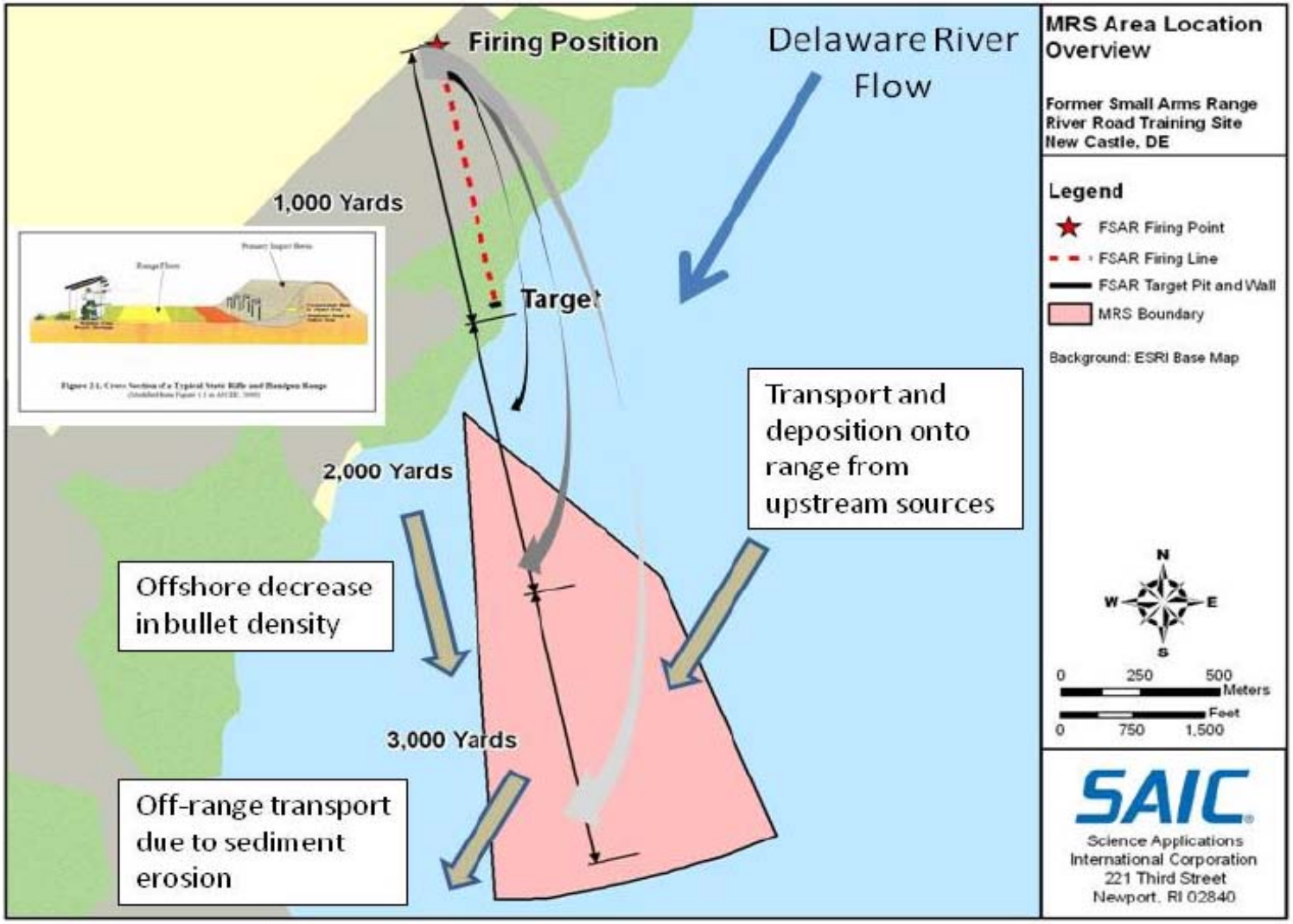

Figure 17. Transport and Fate of MCs in Relation to the MRS

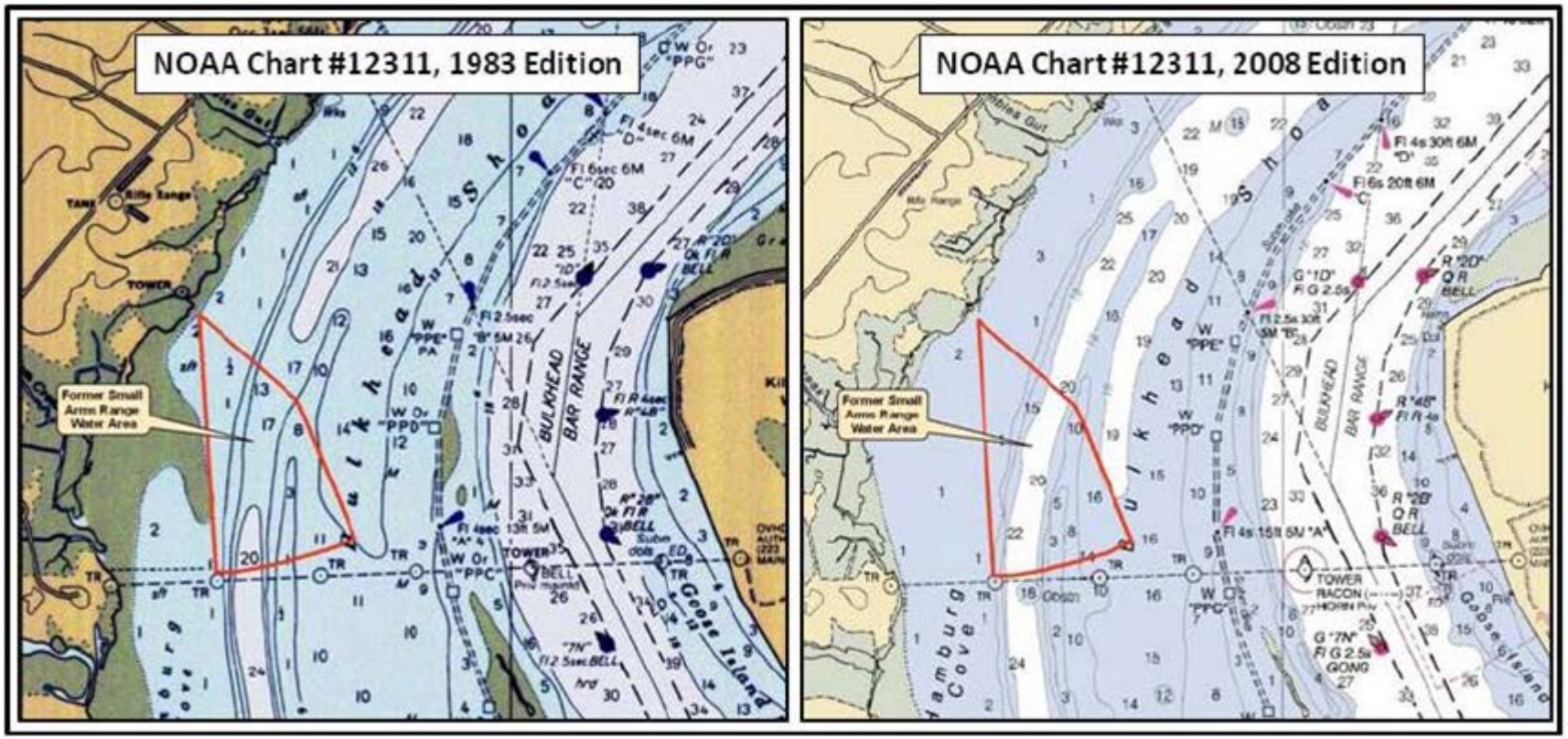

Figure 18. Comparison Between 1983 and 2008 Edition of NOAA Chart #12311 in the Vicinity of the MRS

Aquatic ecological receptors may be exposed to potential contaminants in the sediments through dermal contact, ingestion of sediment, and ingestion of prey items; however, these pathways are considered to be minor (Figure 16). Classes of aquatic ecological receptors that may be exposed to potential contaminants in the MRS include benthic invertebrates, demersal aquatic organisms (e.g., bottom-feeding fish) and avian piscivores (e.g., black-crown night heron). For exposure to MCs in sediment to occur, the benthic organism must be proximal to the bullet jacketing from which the MCs will leach into surrounding sediment. Bullets are expected to reach the river largely intact and therefore will settle rapidly into soft sediments to depth below the BAZ where the benthic organisms live. The nature of the jacketing is known to resist degradation, hence exposure concentrations will be low. The MCs that do leach likely will be bound by sulfides in sediment, reducing bioavailability. Any MCs leaching into surface waters will be rapidly diluted and/or scavenged by the high particle load of the river. In areas where scouring occurs, the bullet may be exposed at the sediment surface, and could be potentially washed down river and therefore transported offsite. For the above reasons, the likelihood of a significant exposure pathway to benthic invertebrates is considered unlikely. Further, exposure to MCs within invertebrate tissues preyed upon by fish, and in turn birds preying upon fish are increasingly more unlikely.

5.4.2 Human Health Risk Assessment Methodology

During Phase 1, a SLHHRA will be conducted as part of the RI for the MRS to determine the potential for adverse effects associated with exposures of lead for the identified pathway (i.e., recreational fisherman consumption of fish; Figure 15). If lead is identified as a human health COPC in the Phase 1 screening, then Phase 2 sampling will be conducted and a baseline HHRA will be performed using only the Phase 2 data. The SLHHRA and baseline HHRA will be conducted in accordance with the process recommended by USEPA in *Risk Assessment Guidance for Superfund (RAGS)* (USEPA 1989 et seq.) as organized into the following sections: Data Collection and Evaluation, Exposure Assessment, Toxicity Assessment, and Risk Characterization.

5.4.2.1 Data Collection and Evaluation

This section provides an overview of the methodology used to conduct the background comparison and the data that will be evaluated in the SLHHRA (i.e., the process used to select COPCs). Human health COPCs are defined as chemicals potentially site related and present at concentrations that may impact human health.

5.4.2.1.1 Data Used in the HHRA

In Phase 1, analytical laboratory data for lead (only) in surface sediments at 82 locations within the MRS will be evaluated for the SLHHRA (Figure 10). Data for sediment lead collected from 20 locations at an area upstream of the MRS (Figure 11) will be used for background comparison. If Phase 2 sampling is required, then 10 samples will be collected from each affected EU along with 6 samples from the background area and submitted for laboratory analyses for all target MCs (lead, copper, nickel).

5.4.2.1.2 Data Aggregation and Exposure Point Concentrations

Data aggregation refers to the manner in which sample data are grouped for analysis and evaluation in the RI. For risk assessment to be meaningful, the evaluation must focus on key receptors at potential risk of exposure within the area and circumstances under which exposure is most likely to occur. The groups into which data are combined are called EUs. EUs have been defined based on professional judgment considering the reasonably anticipated future land uses of the site, the characteristics of the receptors associated with those uses, and the current and anticipated future physical characteristics of the site.

As currently planned, the HHRA will evaluate risks for the MRS at three EUs: EU 1, EU 2, and EU 3 (Section 3.1.1). Using EUs as opposed to location-specific data takes the following into consideration: 1) fish that consume benthic organisms and are subsequently caught by humans and/or birds generally do not remain in one place, but average their exposure over an area (the EU) based on observed or assumed patterns of behavior; therefore, the concentrations to which receptors are exposed (which are used to estimate risk) are an average concentration; and 2) localized areas of contamination (such as a hotspot or an area that may require remediation) may need to be considered separately.

EPCs are the representative chemical concentrations in environmental media (i.e., fish) to which human receptors are exposed when occupying the areas defined by the CSM. The EPC is typically calculated as the 95th percentile UCL on the mean of aggregated data for each EU. These EPCs will be calculated using USEPA's ProUCL software, Version 4.01.01 (USEPA 2009a). The type of UCL calculation will depend on the underlying statistical distribution of the sample population. Note that sediment data will be used to calculate the UCL. The sediment UCL will be used to estimate an EPC in fish tissue.

5.4.2.1.3 Background Comparison

Background comparisons will be conducted on sediment to distinguish naturally occurring metals (i.e., *inorganic* constituents) from site-related metals. In accordance with USEPA guidance (USEPA 2009b), background screening values will be calculated by the tolerance limit method. The UTL is the upper bound of a statistical interval calculated to include a specified proportion of observations from the same population. For this screening, 95 percent UTLs will be used. The 95 percent tolerance interval is the interval within which 95 percent of the distribution lies with 95 percent confidence. The 95 percent UTL is the upper limit of this interval. The 95 percent UTL will be calculated from data collected at the designated background location upstream of the MRS (Figure 11) and this UTL will be used for the background comparison with sediments collected within the three MRS EUs. It is expected that the background area will have a mixture of sandy versus silty sediments, which will in turn have markedly different concentrations of metals because the clay mineralogy of soft sediments tends to contain these metals. Accordingly, MRS to background comparisons will be made for like sediments. Due to the rapid turnaround requirement, grain size will be assessed visually.

Site concentrations that exceed the background UTL will be considered site related. Nondetect results for analytes in the background data set will be counted as one-half the RL in the calculations of the UTL. A background UTL will not be calculated for target analytes that are not detected in any of the sediment samples. The type of UTL selected for the background comparison will differ depending upon the distribution and frequency of detection of the

background data. The types of UTLs that will be selected include nonparametric UTLs or parametric UTLs, which are described below:

- The nonparametric UTL will be calculated when detection frequencies are from 10 to 50 percent, or when detection frequencies are greater than or equal to 50 percent and the distribution of the data cannot be determined (i.e., the data are neither normally nor log- normally distributed). Two different formulas for the nonparametric UTL are recommended depending on the number of samples in the data set.
- The parametric UTL will be calculated when the detection frequency in the background data is greater than or equal to 50 percent and the background data set is characterized by a normal or lognormal distribution.

Regardless of the UTL used, when the EPC concentration of the metal in the EU exceeds the background UTL, the metal will be considered site related for sediments. In instances where the maximum site concentration is the same or below the UTL, the metal will be excluded from further evaluation and not considered a COPC. The EPCs and UTLs will be calculated using USEPA ProUCL software Version 4.01.01 (USEPA 2009a).

5.4.2.1.4 COPC Selection

A COPC is defined in RAGS, Part A (USEPA 1989) as "Chemicals that are potentially site related and whose data are of sufficient quality for use in the quantitative risk assessment." Chemicals are designated as site related based on the results of the background comparison described above. Chemicals above background will be carried further through the risk assessment where analytical data will be compared against USEPA RSLs for fish ingestion in order to identify human health COPCs.

In Phase 1, the lead EPC in sediment for each EU will be converted to a fish tissue value using a bioaccumulation calculation (described below) and then compared to the fish ingestion RSL. If there are no exceedances, then lead will not be considered a human health COPC and NFA will be required. If the lead EPC does exceed the RSL, then lead will be deemed a human health COPC and the Phase 2 assessment will occur with additional sampling and analysis for lead, copper and nickel. The Phase 2 data for all target metals will be subject to the same background comparison and screening-level assessment described above to identify any additional human health COPCs.

5.4.2.2 Exposure Assessment

The exposure assessment estimates the type and magnitude of potential exposures to the COPCs for a given receptor (e.g., recreational fisherman). In general, the exposure assessment consists of the following principal components:

- Characterization of current and future land uses and identification of potentially exposed receptors
- Identification of potential exposure pathways
- Derivation of EPCs
- Development of chemical intake.

Each of these components are described in the following subsections, with the exception of "Derivation of EPCs," which is described above.

5.4.2.2.1 Land Use and Receptors

As described in Section 5.4.1, current use of the MRS is primarily limited to recreational fishing. Future land use of the MRS is expected to remain the same as current land use. Potential human receptors at the MRS are limited to recreational fishermen accessing the MRS by boat.

5.4.2.2.2 Exposure Pathways and Conceptual Site Model

Exposure pathways describe the course a chemical takes from the source to the exposed individual (USEPA 1989). The exposure pathway that will be evaluated in the HHRA involves the consumption of fish by recreational fisherman as shown in the CSM for the MRS (Figure 15) and discussed in Section 5.4.1.

5.4.2.2.3 Chemical Intakes

For the SLHHRA and baseline HHRA, the translation of sediment-based concentrations into tissue- based units for each COPC is needed to assess dietary exposure to recreational fishermen due to the ingestion of fish tissue, as direct measurements of chemical concentrations in indigenous biota across the MRS site are unavailable. The method of translation for metals involves the application of BAFs (USEPA 1997c). The BAF model (tissue/sediment ratio) is the most commonly used model for metals bioaccumulation. The BAF is calculated according to the formula:

$$\text{BAF} = \frac{\text{Tissue concentration}}{\text{Sediment concentration}} \tag{4}$$

Therefore, the tissue based concentration (mg/kg dry tissue) is calculated from the sediment-based concentration (mg/kg dry wt.) according to the formula:

$$\text{Tissue Concentration} = \text{Sediment Concentration} \times \text{BAF} \tag{5}$$

Using this formula, BAFs were calculated for lead, copper and nickel from a large data set of concurrent sediment and fish tissue contaminant measurements collected throughout the Delaware River Estuary during the USEPA NCA (http://www.epa.gov/emap/nca/html/regions/northeast.html). These BAFs were used to back-calculate sediment-based concentrations protective of human health (Table 4).

5.4.2.3 Toxicity Assessment

The toxicity assessment describes the quantitative relationship between the extent of exposure to a chemical and the types of injury or disease that may result. This quantitative relationship generally takes the form of comparisons to published toxicity values that are identified for use in risk characterization. The toxicity values for the SLHHRA and baseline HHRA to be used for the RI are the USEPA fish ingestion RSLs. These RSL for all target metals (lead, copper, nickel) are provided in Table 4.

Table 4. Risk Assessment Screening Values for the RRTS MRS Investigation

Analyte	Screening Values						
	Human Health		Ecological				
	Recreational Fishers		Benthic Invertebrates	Fish		Black-Crowned Night Heron	
	USEPA RSL for Fish Ingestion (mg/ kg)[a]	Sediment Equivalent Concentration (mg/kg)[c]	BTAG Marine Sediment Screening Value (mg/kg)[d]	Fish CBR (mg/kg)	Sediment Equivalent Concentration (mg/kg)[c]	Avian TRV (mg/kg-BW/day)[g]	Sediment Equivalent Concentration (mg/kg)[c]
Copper	54	63.3	18.7	1.68[e]	1.98	2.3	3,434
Lead	8.33[b]	376	30.2	2.55[e]	115.9	0.014	265.2
Nickel	68	2,785	15.9	7.52[f]	313.3	1.38	25,338

[a] Screening value derived from risk-based values for fish ingestion (USEPA 2011b). http://www.epa.gov/reg3hwmd/risk/human/pdf/JUNE_2011_FISH.pdf
[b] In the absence of a USEPA regional screening value for lead, a surrogate value for this chemical was selected from the Texas Commission of Environmental Quality Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data, 2004, Dated August 15, 2003. http://www.tceq.state.tx.us/assets/public/compliance/monops/water/04twqi/04_guidance.pdf (TCEQ 2003)
[c] Represents sediment equivalent concentration back-calculated from tissue residues using BAF values calculated from Delaware River NCA data.
[d] Screening value taken from USEPA Region 3 BTAG marine sediment benchmarks (USEPA 2006a). http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/marsed/screenbench.htm
[e] Highest tissue residue that did not cause an effect to fish (Johnson et al. 2007).
[f] Represents tissue screening value (TSV) based on water quality criteria (WQC) and bioaccumulation factors for aquatic species (Shepard 1998).
[g] Represents no-effect level (TRV-Low) from the Navy/USEPA Region 9 BTAG TRVs for avian receptors (Navy EFA West 1998).

The SLHHRA toxicity assessment constitutes the initial COPC selection process for lead, which will be conducted by comparing predicted contaminant residues in fish to risk-based RSLs for fish ingestion (USEPA 2011b). If necessary, the baseline HHRA toxicity assessment will repeat the COPC selection process using the Phase 2 data for all target metals, with the magnitude of any potential exceedances used to identify COCs. Because fish tissue will not be sampled directly for the RI, Table 4 also shows the equivalent sediment concentration for each metal that would result in a predicted fish tissue concentration equal to the RSL based on the BAF selected for that metal.

5.4.2.4 Risk Characterization

In the HH risk characterization, the decision rules discussed in Figure 8 and Worksheet #11 Step 5 (Analytic Approach) will apply and are summarized here. Sediment lead EPCs will first be compared to the background lead sediment UTL to evaluate whether the observed concentrations are site specific. The predicted fish tissue EPC for lead will then be compared to the fish ingestion RSL. If the fish EPC exceeds the RSL, then lead is a human health COPC such that site-related risks may exist. This process then will be repeated for the Phase 2 data for all target metals, and if the EPC exceeds the RSL for any metal, then that metal is a COC such that site-related risks are likely. If COCs are identified, a WOE evaluation will be conducted on the Phase 2 baseline HHRA findings to assess the magnitude of the screening criteria exceedances and evaluate uncertainty in the risk findings based on comparative lines of evidence. If adverse risks are deemed apparent, more quantitative modeling of MC exposures will be needed. Such analyses would include the use of more site-specific exposure models in accordance with approved methodology as presented in the RAGS (USEPA 1989 et seq.) and other USEPA guidance documents (e.g., USEPA 1997b, 2002, and 2008). In any case where the subject comparisons do not indicate exceedances, no further evaluation would be required.

Uncertainty is inherent in the selection of key input parameters and in every step of the human health risk assessment process. Thus the results of the risk assessment can be understood only in light of the assumptions and methods used in the evaluation. General sources of uncertainty in the baseline HHRA will be discussed qualitatively in the risk characterization. A risk management decision will be made based on the available data as to whether further sampling/analysis is necessary. However, since the current CSM has determined the human health exposure pathway to be minor, the need for such calculations or additional sampling is considered unlikely and therefore not within the scope of the current assessment.

5.4.3 Ecological Risk Assessment

The ERA for the MRS will follow guidance provided in USEPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA 1997a) and USACE's *Environmental Quality Risk Assessment Handbook, Volume II: Environmental Evaluation* (USACE 1996). The ERA format will generally follow the USEPA eight-step process:

- Step 1: Screening-Level Problem Formulation and Ecological Effects Evaluation
- Step 2: Screening-Level Preliminary Exposure Estimate and Risk Calculation
- Step 3: Baseline Risk Assessment Problem Formulation

- Step 4: Study Design and DQOs
- Step 5: Field Verification of Sampling Design
- Step 6: Site Investigation and Analysis of Exposure and Effects
- Step 7: Risk Characterization
- Step 8: Risk Management

The eight-step process is generally sequential; however, each project has unique circumstances as well as availability of existing data that may warrant a modified progression of the risk assessment. Normally, available chemical data are used in Steps 1 and 2 to determine if: 1) there is adequate information to conclude that ecological risks are negligible hence no further action is required, 2) the information is not adequate to make a decision and the ERA process moves to Step 3, or 3) the information indicates a potential for adverse ecological effects and more thorough assessment is warranted (e.g., proceed to Step 3 or Step 8).

Based on the RRTS SI (URS 2007), there is clear evidence that small arms fire from the former 1,000-yard range likely reached the Delaware River. As a result of these findings, a consensus opinion was reached between stakeholders that sufficient evidence existed to warrant a RI (including a BERA) in order to complete MRS characterization. This UFP QAPP contains details concerning the proposed abiotic and biotic sampling at the MRS and will contain both a SLERA and a BERA that includes Steps 2 through 8.

The following sections present problem formulation; exposure assessment; ecological effects assessment; and risk characterization approaches, parameters, or assumptions that will be used to complete the ecological risk assessment.

5.4.3.1 Problem Formulation

Problem formulation includes a preliminary statement of management objectives, and then describes the data to be analyzed and the process to be used to evaluate site-related risks. For the MRS, management must be informed with respect to potential ecological risks at the site to determine if there is a need for remediation. USEPA and USACE guidance cited above will form the basis for defining potential "unacceptable risks."

Section 5.4.1 presented the ecological CSM for the MRS. The CSM is a framework for problem formulation, describing relationships between the potential sources and receptors that may be affected. It presents a pathway analysis, showing how site conditions and receptors, including the exposure and uptake pathways, function as a system. The CSM also is used to formulate hypotheses regarding past, current, and future conditions, and as such provide a basis for structuring management decisions, particularly with regard to temporal and spatial magnitude. The CSM also provides an opportunity for stakeholder consensus, allowing the development of agreed-upon DQOs to test and resolve uncertainties in the CSM, ultimately leading to collection and analysis of data to meet needs for management decisions.

5.4.3.1.1 Selection of Assessment and Measurement Endpoints

Characteristics of the site and its ecological receptors form the basis for the selection of assessment and measurement endpoints. Assessment endpoints are statements specifying the desired ecological attributes or values to be protected in the environment (Suter 1993). Desirable attributes of the environment can be ecosystem functions, such as productivity, or

properties, such as biological diversity. Valued components of the environment can be organisms and trophic groups with symbolic, commercial, recreational, or ecological importance. Measurement endpoints are measurable components of exposure (e.g., concentration of chemical in sediment) or biological response to stressor (e.g., abundance of species per unit area) (USEPA 1997a). Measurement endpoints are generally surrogates for assessment endpoints and are necessary because, in most cases, assessment endpoints cannot be directly measured or observed. Typically, the measurement endpoints are the result of an outcome of the field and/or laboratory methods used to evaluate the assessment endpoints. For example, a measurement endpoint for evaluating the potential for adverse effects to a receptor would be the concentrations of chemicals measured in an abiotic medium. Table 5 presents the policy goals, assessment endpoints, and measurements endpoints proposed for the overall MRS ERA including both the Phase 1 SLERA and Phase 2 BERA.

5.4.3.1.2 Data Screening

The RI analytical results will be screened for ecotoxicity using a phased approach, including only lead in Phase 1 and lead, copper, and nickel in Phase 2 (see Section 2.5.2.3.7). A comparison to background will be conducted first to determine whether observed concentrations are site specific following the methodology described in Section 5.4.2.1.3. If the EPC for a given EU exceeds the background UTL, then the metal will be evaluated further via ecotoxicity screen. The ecotoxicity screen will compare the EPC for each EU to the most conservative ecological screening values protective of benthic invertebrates (i.e., the project screening threshold) presented on Worksheet #15. As per the ERA Process (Steps 1 and 2), only analytes failing the ecotoxicity screen (i.e., the EPC exceeds the screening value) will be evaluated further via baseline risk assessment. These analytes will be identified as COPECs.

5.4.3.2 Exposure Assessment

The CSMs in Section 5.4.1 discussed potential exposure routes and receptors that could occur at the MRS. The aquatic communities are represented by benthic macroinvertebrates, forage fish, and fish eating birds.

Contaminant body-burden data for forage fish, both for direct ecotoxicity evaluation and for use as prey in the upper-level exposure model, will be estimated from sediment concentrations by translating sediment-based concentrations into tissue-based units (mg/kg) using a bioaccumulation calculation, as described in Section 5.4.2.2.3.

The black-crowned night heron (*Nycticorax nycticorax*) is proposed as the avian receptor for food- chain evaluation at the MRS. The black-crowned night heron is confirmed to occur in the vicinity of the MRS (Frithsen, Killam, and Young 1991) and represents an avian aquatic predator that may be exposed to MCs at the site through incidental sediment ingestion and feeding on fish. Dose-based contaminant intake rates (mg/kg-BW/day) will be calculated for this receptor using the exposure equations presented in the *Wildlife Exposure Factors Handbook* (USEPA 1993b). These equations will assume incidental sediment ingestion and fish tissue ingestion as the only exposure pathways. All exposure parameters to be used for the black-crowned night heron are presented in Table 6.

Table 5. Policy Goals, Ecological Assessment Endpoints, Measurement Endpoints, and Decision Rules

Policy Goals	Assessment Endpoint	Measurement Endpoint	Decision Rule
Policy Goal 1: The maintenance and protection of benthic, fish and avian populations and ecosystems.	**Assessment Endpoint 1:** Maintenance of benthic invertebrate community. **Endpoint Species:** Benthic invertebrates.	**Measurement Endpoint 1:** Phase 1: Measured sediment chemical concentrations. Phase 2: Measured sediment chemical concentrations, physical characteristics of sediment, bioassay results, and benthic community surveys.	**Decision Rule for Assessment Endpoint 1:** If the HQ is <1, no sediment toxicity is observed, and the benthic community does not appear to be impaired, the chemical alone is unlikely to cause adverse ecological effects and, therefore, the benthic invertebrate populations and communities are maintained. If the HQ is >1, or toxicity is observed, or the benthic community appears to be impaired, a WOE evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.
	Assessment Endpoint 2: Maintenance of aquatic fish community. **Endpoint Species:** Aquatic fish of various species.	**Measurement Endpoint 2:** Phase 2: Predicted tissue residues based on modeled uptake from chemicals measured in sediment.	**Decision Rule for Assessment Endpoint 2:** If the tissue residue HQ is <1, the chemical alone is unlikely to cause adverse ecological effects and, therefore, aquatic populations and communities are maintained. If the HQ is >1, a WOE evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.
	Assessment Endpoint 3: Maintenance of local populations of avian aquatic predators. **Endpoint Species:** Black-crowned night heron.	**Measurement Endpoint 3:** Phase 2: Modeled chemical uptake rates from food based on measured chemical concentrations in sediment.	**Decision Rule for Assessment Endpoint 3:** If the chemical uptake HQ is <1, the chemical alone is unlikely to cause adverse ecological effects and, therefore, populations of avian aquatic predators are maintained. If the HQ is >1, a WOE evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.

Table 6. Exposure Parameters for Black-Crowned Night Herons

Parameter	Definition	Receptor: *Nycticorax nycticorax*	
		Value	Reference/Notes
BW	Body weight (g)	883	Maximum weight for avian receptors reported in USEPA (1993a).
HR	Home range (km^2)	201	Adults in North Carolina foraged up to 8 km (5 miles) from nesting area (Custer and Osborn 1978).
AUF	Area use factor	0.012	Adults will return to the same area to feed (Parsons 1995). A site-specific area use factor (AUF) was calculated based on the size of the former small arms range water area (212.4 acres) in relation to the total area of water within the 8-km home range of heron nesting at the Pea Patch Island colony (17,117 acres).
IR_F	Food ingestion rate (g-dry/day)	53.6	Daily food ingestion rate (IR_F) has been estimated using an allometric equation based on BW in grams (Nagy 1987), where IR_F (in units of grams dry weight per day) = $0.648 \times bw^{0.651}$.
PF	Plant fraction of diet	0	Literature lists no plant material listed in diet (Howell 1932; Palmer 1962; Wolford and Boag 1971).
AF	Animal fraction of diet	1.0	Dietary fractions obtained from the literature, average intake: 52.5% fish, 21.0% crustaceans, 1.5% insects, and 25.0% other (Howell 1932; Palmer 1962; Wolford and Boag 1971).
SF	Sediment fraction of diet	0.05	No value listed in the literature; Assumed 5% incidental ingestion to be conservative.
$IR_{sediment}$	Sediment ingestion rate (g-dry/day)	2.7	Calculated by multiplying the IR_F (53.6 g-dry/day) by the sediment fraction (0.05) of the diet.

5.4.3.3 Ecological Effects Assessment

Similar to the human health toxicity assessment, the ecological effects assessment generally takes the form of comparisons to published toxicity values that are identified for various receptors of interest at the site. All screening values to be used in the ERA are provided in Table 4. Since fish tissue will not be analyzed directly at the MRS, Table 4 also shows the equivalent sediment concentration for each metal that would result in an exceedance of the corresponding screening value base on the BAFs and exposure parameters selected for the site.

Screening values for benthic invertebrate receptors are the toxicity screening values for marine sediments compiled by the USEPA Region 3 BTAG (USEPA 2006a and USEPA 2006b). Direct comparison of sediment concentrations measured at the site to these screening values will constitute the SLERA and will be used to identify COPECs.

For fish, screening values consist of CBRs, which are defined as the screening value for a contaminant in the tissue of an organism above which adverse effects would occur (McCarty et al. 1992 and Pabst 1999). These values are based on data compiled by USACE in the Environmental Residue- Effects Database (ERED) (USACE 2002) as reported in Johnson et al. (2007). In the case where CBRs are not available, TSVs are used as an ecological benchmark for fish receptors. TSVs, originally developed for conducting SLERAs at Navy sites (Shepard 1998 and Johnson et al. 2007), are back- calculated from WQC based on BAFs for various aquatic species.

For birds, screening values consist of avian TRVs compiled by the Navy/USEPA Region 9 BTAG (Navy EFA West 1998, as reported in DTSC 2000). These values were selected from the published literature following a consensus effort among the Navy, Navy consultants, and several regulatory and natural resource trustee agencies. TRVs represent the dose (mg/kg BW/day) of a metal that results in no observable biological effects to growth, reproduction, survival, or development of avian receptors.

Comparison of calculated fish tissue concentrations and avian dose-based contaminant intake rates to the fish CBRs and avian TRVs, respectively, will constitute the BERA and will be used to identify ecological COCs for the corresponding pathway.

5.4.3.4 Risk Characterization

Baseline risk characterization occurs in Step 7 and will consist of a more in-depth evaluation of overall ecological risk that integrates the ecological effects assessment results with the results of the biological data collection. If COCs are identified and the baseline analyses indicate a potential unacceptable risk to the ecological receptors, a WOE evaluation will be performed as part of the risk characterization process to assess the magnitude of the screening criteria exceedances and evaluate uncertainty in the risk findings based on comparative site-specific analyses. Topics that might be discussed in the WOE include extent of contamination, relation of the site concentrations to background, bioavailability, and the potential for observed HQs to affect receptor populations. This holistic approach to sediment evaluation avoids erroneous conclusions about apparent sediment toxicity due to site contamination when other factors are more likely the cause of toxicity.

The WOE evaluation will rely on the SQT approach, which will integrate the results of the physical (grain size), chemical (SEM-AVS), toxicological (amphipod survival), and biological (taxonomic diversity) properties of the affected location(s) to draw conclusions about the potential for adverse effects to the food chain from exposures to site contaminants. If two or more of these endpoints indicate adverse effects at the site, then it will be concluded that the chemical exposure pathway is complete and that adverse ecological risks are likely with a low degree of uncertainty. If these impacts are occurring at the MRS but not at the reference location, then these ecological risks will be deemed site related.

As noted above (Section 3.1.1), chemical and, if necessary, biological samples also will be collected from a background sampling area upstream of the MRS that is unlikely to be affected by releases from the MRS. The chemical, geotechnical, and biological data will be used as points of comparison between the MRS and the background area to determine whether biological conditions are similar.

Uncertainty is inherent in the selection of key input parameters and in every step of the ecological risk assessment process. Thus the results of the risk assessment can be understood only in light of the assumptions and methods used in the evaluation. General sources of uncertainty in the BERA will be discussed qualitatively in the risk characterization.

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MILITARY MUNITIONS RESPONSE PROGRAM

REMEDIAL INVESTIGATION REPORT
RIVER ROAD TRAINING SITE
DELAWARE ARMY NATIONAL GUARD NEW CASTLE, DELAWARE

FINAL

Submitted to

USACE, Baltimore District
10 South Howard Street
Baltimore, MD 21201

and

Army National Guard Directorate
Arlington Hall Station
111 S. George Mason Drive
Arlington, Virginia 22204

Submitted by

URS Group, Inc.
12420 Milestone Center Drive, Suite 150
Germantown, MD 20876

Contract No. W912DR-09-D-0003
Delivery Order No. 0009

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/g	microgram per gram
ARNG	Army National Guard
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COPC	Chemical of Potential Concern
CSM	Conceptual Site Model
CWM	Chemical Warfare Material
DEARNG	Delaware Army National Guard
DL	Detection Limit
DNREC	Delaware Department of Natural Resources and Environmental Control
DO	Dissolved Oxygen
DoD	U.S. Department of Defense
DQCR	Daily quality control report
DPS	Distinct Population Segment
ELAP	Environmental Laboratory Accreditation Program
EPC	Exposure Point Concentration
EU	Exposure Unit
FS	Feasibility Study
GPS	Global Positioning System
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Level of Quantitation
MC	Munitions Constituent
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
MS	Matrix Spike
mS/cm	milliSiemens per centimeter
MSD	Matrix Spike Duplicate
NCA	National Coastal Assessment
NOAA	National Oceanic and Atmospheric Administration
NS&T	National Status and Trends
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PDE	Partnership for the Delaware Estuary
PQL	Practical Quantification Limit

LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

ppt	Parts Per Thousand
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Remedial Investigation
RPD	Relative Percent Difference
RRTS	River Road Training Site
SDZ	Surface Danger Zone
SI	Site Inspection
SWAT	Special Weapons and Tactics
TPP	Technical Project Planning
U.S.C.	United States Code
UCL	Upper Confidence Limit
UFP	Uniform Federal Policy
URS	URS Group, Inc.
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UTL	Upper Tolerance Limit

EXECUTIVE SUMMARY

This Remedial Investigation (RI) Report presents the methodology and results of a study of munitions constituents (MCs) in sediment conducted at the Former Small Arms Range Water Area Munitions Response Site (MRS) at the River Road Training Site (RRTS) in New Castle, Delaware (DE). URS Group Inc. (URS) conducted the RI under Contract No. W912DR-09-D-0003, Delivery Order No. 0009 with the U.S. Army Corps of Engineers (USACE), Baltimore District, which is providing technical and contractual support to the Army National Guard (ARNG). This report has been prepared following the U.S. Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (USEPA, 1988) and the U.S. Army Military Munitions Response Program (MMRP) RI/Feasibility Study (FS) guidance document (U.S. Army, 2009).

RRTS is a Delaware Army National Guard (DEARNG) site used for small arms training and other logistical and administrative functions. The original MRS was described during the Closed, Transferring, and Transferred Range Inventory (Malcolm Pirnie, 2003) as a composite of the firing fans from a former 1,000-yard range and another shorter former rifle range located to the south. The surface danger zones (SDZs) for active RRTS ranges overlap both historical firing fans on and offshore. Only the portion of the MRS that falls outside the footprint of the current SDZs is eligible for inclusion in the MMRP (URS, 2007). The 212-acre MRS addressed in this RI is, therefore, limited to the wide, south end of the former 1,000-yard range firing fan, located offshore to the southeast of RRTS.

Historical records indicate that small arms bullets may have entered the Delaware River Estuary, with the potential to pose human health or ecological risks due to metals in the sediment (URS, 2007). Environmental data were needed to identify the presence, nature, and extent of MCs (metals) in sediment at the Former Small Arms Range Water Area MRS, evaluate whether MCs are present at concentrations that could pose a potential risk to human and ecological receptors, and guide further management decisions as to whether remedial action is required.

Per the Conceptual Site Model (CSM) in the RI Work Plan/Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP), potentially complete pathways at RRTS included direct exposure to MCs in surface water and sediment by biota and exposure through the food chain by both biota and humans. The food chain exposure route is included for human and animal consumption of potentially contaminated harvested fish or prey living in the river.

RI field work was designed to be completed in two phases. In Phase 1, the focus was on the primary MC component of small arms bullets: lead. Surficial sediment grab samples were collected in stratified areas of the MRS and in a background area to determine the nature and extent of lead concentrations. If lead concentrations within the MRS were elevated above the conservative ecological screening benchmark and above the background Upper Tolerance Limit (UTL), a second phase of sampling was planned to more thoroughly evaluate potential risks to human and ecological receptors.

The background area in relation to the MRS is shown in **Figure ES-1**. As developed in the RI UFP-QAPP, the 212-acre MRS, for data interpretation purposes, was divided into three subareas, called exposure units (EUs), reflecting the expected degrees of potential contamination from

Figure ES-1. MRS Exposure Unit (EU) and Background Sampling Areas

former firing range usage. These EUs (EU1, EU2, and EU3) were delineated subjectively based on the location of the Bulkhead Shoal Channel, distance from the potential source (i.e., the firing point of the Former Small Arms Range), and the presence of various bottom features that may affect MC deposition and, thus, potential exposure. EU1 has the highest likelihood for MC exposure, EU2 has a moderate risk for exposure, and EU3 has the least likelihood of exposure. A 239-acre background reference area, unaffected by current and historical RRTS activities, is located approximately 1 mile upstream from the MRS.

Phase 1 field work was conducted from late March to mid April 2014. A total of 83 sediment samples (including 1 step-out sample) were collected from the MRS and 20 samples were collected from the background (reference) area. All samples were sent to an analytical laboratory for lead analysis. A data usability assessment was conducted and all data were determined useable for this project.

Lead isoconcentration contours (using convenient intervals of 25, 50, and 100 milligrams per kilogram [mg/kg]) in the background area are shown in **Figure ES-2**. Here, lead concentrations ranged from 20.9 to 199 milligrams per kilogram (mg/kg); only three samples had concentrations greater than 50 mg/kg. The highest detected concentrations (BG-01 and BG-19) occurred along the perimeter of the background area. Prior to calculating the background Upper Tolerance Limit (UTL), one outlier was identified (BG-19; 199 mg/kg of lead) and subsequently removed from the data set used in the UTL calculation. With this value excluded, the UTL was calculated to be 86.17 mg/kg, which was used as the background screening value for the MRS samples.

Lead isoconcentration contours (using convenient intervals of 25, 50, and 100 mg/kg) in the entire MRS are shown in **Figure ES-3**. Although lead concentrations in the majority of MRS samples exceeded the USEPA risk-based screening value of 30.2 mg/kg, they were similar to or below background concentrations and all calculated EU Upper Confidence Limits (UCLs) were below the background UTL (**Table ES-1**). Additionally, no bullets or bullet fragments were observed in any sample.

Similar to the background area, isolated clusters of higher lead concentrations were observed in the MRS. Samples collected around and downgradient of these clusters tended to have moderate lead concentrations. The lowest lead concentrations occurred in EU2, within the Bulkhead Shoal Channel.

Munitions Response Site Prioritization Protocol (MRSPP) score sheets were completed for the Former Small Arms Range Water Area MRS. Based on the results of this RI and an updated CSM, lead concentrations in sediment at the MRS are not elevated above background concentrations. There was, therefore, no supporting evidence of an elevated exposure risk to ecological and human receptors from site activities. As directed by the March 2014 MRSPP Implementation Guidance (USACE, 2014), the MRS received an overall MRS Priority of No Known of Suspected Hazards.

The data collected at the MRS were sufficient to delineate the extent of potential site-related lead contamination. Because UCL lead concentrations in EU sediments were below the background UTL, lead is not an MC or Chemical of Potential Concern. Therefore, additional Phase 2 sampling activities and risk assessments at the MRS are not needed.

Figure ES-2. Phase I Background Lead Concentration Contours

Figure ES-3. Phase I MRS Lead Concentration Contours

Table ES-1. Results Summary

Based on the results presented above, a FS is not needed at RRTS. No Further Action is recommended for the RRTS MRS. A proposed plan will be prepared to convey this finding to the public, followed by a decision document to officially conclude work at the MRS.

1.0 INTRODUCTION

This Remedial Investigation (RI) Report presents the methodology and results of a study of munitions constituents (MCs) in sediment conducted at the Former Small Arms Range Water Area Munitions Response Site (MRS) at the River Road Training Site (RRTS) in New Castle, Delaware (DE). RRTS is a Delaware Army National Guard (DEARNG) site used for small arms training and other logistical and administrative functions. The MRS is located offshore to the southeast of RRTS and is a composite of historical firing fans from a former RRTS 1,000-yard rifle range and a shorter former rifle range to the south. Only the portion of the MRS that falls outside of the current Surface Danger Zones (SDZs) is addressed in this RI.

Historical records indicate that small arms bullets may have entered the Delaware River Estuary, with the potential to pose human health or ecological risks due to metals in the sediment (URS, 2007). Environmental data were needed to identify the presence, nature, and extent of MCs in sediment at the Former Small Arms Range Water Area MRS, evaluate whether MCs are present at concentrations that could pose a potential risk to human and ecological receptors, and guide further management decisions as to whether remedial action is required.

This report has been prepared following the U.S. Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (USEPA, 1988) and the U.S. Army Military Munitions Response Program (MMRP) RI/Feasibility Study (FS) guidance document (U.S. Army, 2009). URS Group Inc. (URS) conducted the RI under Contract No. W912DR-09-D-0003, Delivery Order No. 0009 with the U.S. Army Corps of Engineers (USACE), Baltimore District, which is providing technical and contractual support to the Army National Guard (ARNG). All work was conducted in accordance with the Remedial Investigation Work Plan/Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP), which was developed with input from stakeholders.

1.1 Purpose of Report

The principal objective of the RI at the RRTS MRS was to gather environmental data needed to identify the presence, nature, and extent of MCs in sediment at the Former Small Arms Range Water Area MRS. Data collected from the RI were used to evaluate whether MCs are present at concentrations in excess of background levels and, if so, could pose a risk to human or ecological receptors. This report also presents an updated Conceptual Site Model (CSM), updated Munitions Response Site Prioritization Protocol (MRSPP) score sheets, and recommendations.

1.2 Installation Background

1.2.1 Site Description

The RRTS is located adjacent to the Delaware River in the city of New Castle, New Castle County, DE, approximately 10 miles south of Wilmington (**Figure 1-1**). The Site Inspection (SI) conducted by URS (2007) identified the Former Small Arms Range Water Area

Figure 1-1. Location of River Road Training Site

MRS at RRTS as a site requiring further investigation. This investigation focused on MRS NCDE-002-R-01, located offshore and to the southeast of the RRTS. The original MRS was described during the Closed, Transferring, and Transferred Range Inventory (Malcolm Pirnie, 2003) as a composite of the firing fans from a former 1,000-yard range and another shorter former rifle range located to the south (**Figure 1-2**). The SDZs for active RRTS ranges overlap both historical firing fans on and offshore. Only the portion of the MRS that falls outside the footprint of the current SDZs is eligible for inclusion in the MMRP (URS, 2007). The 212-acre MRS addressed in this RI is limited to the wide, south end of the former 1,000-yard range firing fan (**Figure 1-2**).

1.2.2 Site History and Potential Release Mechanisms

The 190 acres occupied by the RRTS was purchased in 1908 with Federal funds authorized under the 1903 Dick Act (URS, 2007). The early history of the site is not well-documented as a result of the loss or destruction of early DEARNG records (3d/Environmental, 1995). Known as the New Castle Rifle Range until 2005, the RRTS historically has been used for field exercises, training encampments, and live-fire exercises (USACHPPM, 2004). The current mission of the RRTS is to provide training, administrative, and logistical support to the DEARNG and its customers, which include the New Castle City and County police, Special Weapons and Tactics (SWAT) teams, and related military and paramilitary police organizations.

The MRS addressed in this RI was in operation from 1910 to 1940 as a 1,000-yard rifle range featuring small arms fire (Malcolm Pirnie, 2003). According to the RRTS SI Report (URS, 2007), a feature of this range is an earthen and concrete embankment that may have been used to elevate targets or as a backstop that is located adjacent to the bank of the Delaware River in the southeastern portion of the property (**Figure 1-3**). The current small arms ranges have remained in the same relative positions since the 1940s and are located north (upstream) of the MRS (Malcolm Pirnie, 2003). In addition, the private Ommelanden Trap and Skeet Range is located along River Road to the southwest of the RRTS, and may be a source of lead not related to RRTS activities. However, the current firing direction at the skeet range is parallel to (and not over) the river; range layout in the past is unknown. Prior to 1970, the small arms rifle ranges at the RRTS did not have target berms or backstops to intercept and trap bullets (Malcolm Pirnie, 2003). Fired bullets were allowed to travel across open and wooded wetland portions of the site toward and into the Delaware River.

According to former RRTS employees, the most common weapon used on the former 1,000-yard range was the Model 1903 Springfield rifle (URS, 2007); no evidence was found for any other type of weapon. Most of the training at the former 1,000-yard range took place at the 100- and 500-yard firing points as these were the optimal combat firing ranges for this rifle. Training at the 1,000-yard distance was for shooting competitions and occurred much less frequently (URS, 2007). The M1903 rifle, at the time of active range operations, fired the .30-caliber model 1906 ball cartridge (.30-06 cartridge) with a bullet composed of a lead core and a jacket of cupro-nickel containing copper, nickel, iron, and manganese. The rifle was “sighted” for a target up to 2,500 yards, although the maximum range of the ball cartridge, when elevated at an angle of 45 degrees, was 4,890 yards. Given that the firing purpose was for tournaments, the actual range of fire would be expected to be far closer to the 1,000-yard mark than the 4,890-yard maximum.

Figure 1-2. Location of Active Water Ranges and MRS

Figure 1-3. MRS Site Map

1.2.3 Previous Investigations

The MRS has not been investigated or surveyed previously to determine if a release of MCs occurred. The 2007 SI (URS, 2007) concluded that the potential existed for MC (in the form of spent bullets) to be present at the MRS. This conclusion was based on personal communication with RRTS personnel who reported that it is common to find spent bullets along the shoreline.

Because spent bullets were observed on the shore, they were presumed as likely to be present in the river sediments. Because the SI demonstrated there is evidence that small arms bullets may have entered the Delaware River and because the river is accessible to the public and also provides habitat for a variety of ecological resources, an agreement among ARNG and stakeholders was reached that an RI was warranted. This decision was made because the environmental sampling of a water-range MRS that would typically be performed during the SI was programmatically moved to the RI phase of work. As the former 1,000-yard range was used only for small arms, the only concern is for MCs in the Delaware River. As documented in the Historical Records Review and SI, there is no evidence that munitions and explosives of concern (MEC) or chemical warfare material (CWM) exist at this site (URS, 2007).

Although field work in support of MC characterization within the MRS had not been previously performed, the results from a number of regional sampling efforts provided information useful to CSM development. Regional sampling efforts include the:

- USEPA National Coastal Assessment (NCA) (USEPA, 2011)
- National Oceanic and Atmospheric Administration (NOAA) National Status and Trends (NS&T) Program (Hartwell, Hameedi, and Harman, 2001)
- USACE Delaware River Main Channel Deepening Project (Versar, 2003 and 2005)
- Partnership for Delaware River Estuary (PDE) Bay Bottom Inventory (PDE, 2011)

Lead concentrations of 13.8 and 20.7 micrograms per gram (μg/g) found within the MRS boundary during previous surveys (USEPA NCA in 2004 and PDE Bay Bottom Inventory in 2008) did not exceed the USEPA Region 3 screening value for marine sediments (30.2 μg/g) (**Figure 1-4**). However, two benchmark exceedances for lead were documented outside of the MRS (39.5 and 62.7 μg/g) at stations sampled in 1997 (NS&T Program) and 2008 (PDE Bay Bottom Inventory).

1.3 Report Organization

This RI report was prepared following USEPA RI/FS guidance (USEPA, 1988). Sections are organized as follows:

- **Section 1: Introduction** – Describes the purpose, scope, and authorization for the RI and provides information on site background and previous investigation findings.
- **Section 2**: **Environmental Setting** – Discusses the environmental conditions of the MRS and current and potential future land uses.
- **Section 3**: **Investigation and Data Evaluation Methods** – Explains the RI objectives and the technical approach to MC characterization and evaluation.

Figure 1-4. Historical Lead Concentrations in the Vicinity of the MRS

- **Section 4**: **Data Quality Assessment** – Provides the data quality requirements and results of Quality Control (QC) activities, including data usability.
- **Section 5**: **Remedial Investigation Results** – Presents the findings of the MC characterization.
- **Section 6**: **Conclusions and Recommendations** – Summarizes the RI approach and results, and provides recommendations.

The following appendices provide supporting materials:

Appendix A: Site Photographs

Appendix B: Field Forms

Appendix C: Laboratory Data

Appendix D: Data Validation Reports

Appendix E: ProUCL Output Sheets

Appendix F: TPP2 Meeting Minutes

Appendix G: MRSPP Score Sheets

2.0 ENVIRONMENTAL SETTING

The MRS is located in a transition zone between the saline waters of Delaware Bay and the tidal freshwater portion of the Delaware River that is characterized by low salinity (3 to 5 practical salinity units) and high turbidity (>100 milligrams per liter [mg/L] total suspended solids) (Frithsen, Killam, and Young, 1991). The climate of New Castle, DE, is influenced by its close proximity to the Atlantic Ocean. Average air temperatures at New Castle range from 32°F (0°C in January) to 75°F (24°C in July) and total annual precipitation averages 41.1 inches (based on 51 years of data as reported by www.weatherbase.com).

2.1 Topography, Elevation, and Surface

The MRS lies entirely below sea level. Bathymetry for the MRS was last collected during a 2001 NOAA multibeam sonar survey (SAIC, 2001) (National Ocean Service Hydrographic Survey H11023). Water depth ranges from 1.4 to 23.4 feet (0.4 to 7.1 meters). The most notable feature is the well-defined, 20- to 23-foot (6- to 7-meters) deep Bulkhead Shoal Channel, which bisects the MRS from approximately north to south (**Figure 1-3**). This channel undergoes periodic maintenance dredging to maintain navigable water depths for commercial barge traffic (USACE, 2009). The shoreline adjacent to the MRS consists of open and wooded tidal wetlands that are subject to river flooding. Sandy beaches intermittently fringe the tidal wetlands, particularly along shoreline features.

2.2 Wildlife and Vegetation

The estuarine habitat of the MRS supports diverse communities of algae, invertebrates, fishes, and birds. Although wildlife and vegetation specific to the MRS have not been described previously, a general description of the biological resources present at the RRTS was included in the installation SI (URS, 2007). In addition, a complete description of the biological resources and ecology of the Delaware River Estuary was provided in a review by Frithsen, Killam, and Young (1991) and in the environmental assessment completed for the Delaware River Main Stem and Channel Deepening Project (USACE, 2009). The following subsections describe noteworthy ecological conditions surrounding the MRS.

Benthic Community—Benthic community composition within the Delaware River Estuary is primarily controlled by salinity, with sediment type and water/sediment quality secondarily influencing the distributional patterns imposed by the estuarine salinity gradient (Frithsen, Killam, and Young, 1991). Stations in the vicinity of the MRS that were sampled during the 2008 PDE Bay Bottom Inventory contained between 4 and 11 species and from 950 to 4,350 individuals per square meter. Dominant fauna in this region of the estuary include Oligochaetes and Arthropods (Frithsen, Killam, and Young 1991).

Aquatic Vegetation—Subtidal aquatic vegetation is not present in the subtidal waters off of the RRTS because the high turbidity of these waters prevents sufficient light to reach the bottom for plant growth.

Significant Wildlife Species—The following wildlife species have been identified in the vicinity of the MRS and are deemed significant to the current investigation:

- ***Invertebrates***—Shrimps, crabs (blue crab, *Callinectes sapidus* in particular), snails, ostracods, oligochaetes, polychaetes, clams, and mussels.
- ***Fish***—Atlantic sturgeon (*Acipenser oxyrhynchus*), shortnose sturgeon (*Acipenser brevirostrum*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), gizzard shad (*Dorosoma cepedianum*), striped bass (*Morone saxatillis*), weakfish (*Cynoscion regalis*), spot (*Leiostomous xanthurus*), Atlantic menhaden (*Brevoortia tyrannus*), white perch (*Morone americana*), bay anchovy (*Anchoa mitchilli*), hogchoker (*Trinectes maculates*), channel catfish (*Ictalurus punctatus*), common carp (*Cyprinus carpio*), fallfish (Semotilus corporalis), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), rock bass (*Ambloplites rupestris*), suckers (*Catostomidae*), and walleye (*Sander vitreus*).
- ***Aquatic or Semiaquatic Birds***—Black duck (*Anas rubripes*), blue-winged teal (*Anas discors*), mallard (*Anas platyrhynchos*), mottled duck (*Anas fulvigula*), northern pintail (*Anas acuta*), brant (*Branta bernicla*), Canada goose (*Branta Canadensis*), rail/king clapper (*Rallus longirostris*), common merganser (*Mergus merganser*), red-breasted merganser (*Mergus serrator*), hooded merganser (*Lophodytes cucullatus*), fulvous whistling/tree duck (*Dendrocygna bicolor*), canvasback (*Aythya valisineria*), greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), redhead (*Aythya Americana*), and wood duck (*Aix sponsa*).
- **Raptors**—Osprey (Pandion haliaetus), bald eagle (Haliaeetus leucocephalus), and peregrine falcon (Falco peregrines).

Pea Patch Island, located 1.3 miles (2.1 kilometers) downriver from the MRS, contains the largest multispecies nesting colony of wading birds found on the eastern seaboard north of Florida (USACE, 2009). According to annual population surveys conducted since 1993 (DNREC, 2001), nine species of wading birds nest on the island, including great blue heron (*Ardea Herodias*), great egret (*Casmerodius albus*), snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), cattle egret (*Bubulcus ibis*), black-crowned night heron (*Nycticorax nycticorax*), yellow-crowned night heron (*Nyctanassa violacea*), and glossy ibis (*Plegadis falcinellus*).

Threatened and Endangered Species—According to the final SI (URS, 2007), a protected species survey conducted between 1993 and 1994 at the RRTS found no State or federally listed or endangered species. However, threatened and endangered species and other species of concern were compiled for the Delaware River Estuary as part of the *Delaware River Main Stem and Channel Deepening Project, Environmental Assessment* (USACE, 2009). The Delaware River Estuary is within the historical range of 13 federally listed threatened or endangered species, including five species of sea turtles, six species of whales, and two species of fish. Federally threatened and endangered species expected to be in the vicinity of RRTS have been taken from the U.S. Fish and Wildlife Service's *Environmental Conservation Online System* (USFWS, 2014). State-listed species have been taken from the Delaware Department of Natural Resources and Environmental Control (DNREC), New Jersey Department of Environmental Protection, and Pennsylvania Game Commission's websites (DNREC, 2013; NJDEP, 2013; and PGC, 2013; respectively).

The five federally listed threatened or endangered sea turtles that occasionally enter the Delaware River Estuary include the endangered Kemp's ridley turtle (*Lepidochelys kempii*), leatherback turtle (*Dermochelys coriacea*), and hawksbill turtle (*Eretmochelys imbricata*), and the threatened green turtle (*Chelonia mydas*) and loggerhead turtle (*Caretta caretta*). All but the hawksbill turtle are listed in the State of Delaware.

The six species of federally listed endangered whales that have been observed along the Atlantic coast and occasionally within the Delaware Bay include the sperm whale (*Physeter catodon*), fin whale (*Balaenoptera physalus*), humpback whale (*Megapter novaeangliae*), blue whale (*Balaenoptera musculus*), sei whale (*Balaenoptera borealis*), and right whale (*Balaena glacialis*). None are listed in the State of Delaware. Given the transient nature of sea turtles and whales within the Delaware River Estuary and the remote location of the RRTS in the brackish waters of the Delaware River Estuary, these species were deemed not to be of concern for the MRS area.

The two federally listed threatened or endangered fish species that can be found in the Delaware River Estuary include the shortnose sturgeon (*Acipenser brevirostrum*) and the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). The shortnose sturgeon is listed in New Jersey and Pennsylvania, but not in Delaware. The New York Bight Distinct Population Segment (DPS) of Atlantic sturgeon has recently been listed as a federally threatened species under the Endangered Species Act. The Delaware River Estuary is within the New York Bight DPS. The final rule for this listing was effective on April 6, 2012. Atlantic sturgeon is a State-listed species in Pennsylvania, New Jersey, and Delaware.

In addition to the marine species described above, four additional avian species are of special concern to the MRS. The bald eagle was listed as a threatened or endangered species throughout the United States in 1978. Bald eagles in the project area are included as part of the Chesapeake Bay Region bald eagle population, which was determined to be threatened in 1995. Based on improvements in bald eagle population figures for the contiguous United States, the U.S. Fish and Wildlife Service removed the bald eagle from the endangered species list in June 2007. Although the bald eagle has been removed from the endangered species list, the bird is still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The bald eagle remains a State-listed species in New Jersey.

Peregrine falcons were listed as a federally endangered species in 1984 and removed from the endangered species list in 1999. The Peregrine falcon continues to be protected by the Migratory Bird Treaty Act and is a State-listed bird in New Jersey and Pennsylvania. This bird is not a listed species in Delaware. The black-crowned night heron (Nycticorax nycticorax) and the yellow-crowned night heron (Nyctanassa violacea) are both State-listed species in Delaware.

2.3 Geology

Based on the available data, sediment type within the boundary of the MRS appears to vary depending on location with respect to the Bulkhead Shoal Channel. Sediments within the channel itself tend to be muddy and dominated by fines (97.5% clay). Coarser material was observed along the slope of the Bulkhead Shoal Channel, where sediments were nearly equal parts sand (47.4%) and clay (52.6%) (PDE, 2011; USEPA, 2011; Versar, 2003 and 2005).

2.4 Hydrology and Hydrodynamics

The mean tidal range in the vicinity of the MRS is 5.4 feet (1.6 meters) (Delaware City NOAA Physical Oceanographic Real Time Station, station #8551762). Current velocity for this region of the Delaware River reaches a maximum of 2.3 knots in the channels (NOAA, 2011). Comparisons of bathymetric change over time reveal dynamic sediment transport conditions. These processes have resulted in highly variable sediment lithology types (i.e., "sand versus clay," as discussed in Section 2.3).

2.5 Current and Potential Future Land Use

Current and potential future uses of the MRS include general recreation and recreational fishing. In addition, because the MRS is bisected by the Bulkhead Shoal Channel, it is likely used for commercial and recreational navigation. Other land use considerations of potential importance to this evaluation include the proximity of the MRS to currently active firing ranges. The MRS is located downrange from the private Ommelanden Trap and Skeet Range and downstream from the SDZs for the active ranges at the RRTS (**Figure 1-2**). Also of importance to this evaluation is the location of the MRS downstream from numerous industrial sources, such as oil refineries, petrochemical plants, and pigment manufacturing facilities. Waste water effluent from such processing activities can contain metals (particularly if operations were conducted prior to the promulgation of the Clean Water Act). These potential sources are addressed in the sampling design by evaluating MC concentrations upstream of the MRS.

3.0 INVESTIGATION AND DATA EVALUATION METHODS

RI field work was designed to be completed in two phases. In Phase 1, the focus was on the primary MC component of small arms bullets: lead. Surficial sediment grab samples were collected in stratified areas of the MRS and in a background area to determine the nature and extent of lead concentrations. If lead concentrations within the MRS were elevated above the conservative ecological screening benchmark, and above the background Upper Tolerance Limit (UTL), a second phase of sampling was planned to more thoroughly evaluate potential risks to human and ecological receptors.

The sections below present the CSM as understood prior to the RI, investigative design/methods, and data evaluation methods. The data quality assessment is discussed in **Section 4**, and results are discussed in **Section 5**.

3.1 Pre-RI Conceptual Site Model

This RI was conducted because of the potential for MC contamination (primarily lead) from historical range activities to cause human or ecological risk. As shown in **Figure 3-1**, the MRS comprises the south end of a historical 1,000-yard range firing fan, and sediment containing bullets and bullet fragments is the potential source medium from which a subsequent release of MC may occur. Lead-contaminated sediments may be eroded, transported, and re-deposited, which may allow for the migration of MC. The sediment sampling design described in **Section 3.2** was stratified by the estimated bullet density in river sediments (density is expected to decrease with distance from the RRTS shoreline).

Human receptors are limited to recreational fisherman that may be exposed to MCs through ingestion of fish. Ecological receptors within and downstream of the MRS include benthic invertebrates, demersal aquatic organisms (e.g., bottom-feeding fish), and avian piscavores (e.g., black-crown night heron). These receptors have the potential to be exposed to MC in sediments via dermal contact, ingestion of sediment, and ingestion of prey. Although ingestion of dissolved phase MC in surface water is a potentially complete pathway, it was determined to be insignificant as a result of rapid dilution by the high river flow. Dermal contact with sediment is considered an incomplete pathway due to water depths throughout the MRS and the absence of a wading/bathing scenario for recreational users. The transport and fate of MC in a flow chart-style CSM is shown in **Figure 3-2**.

3.2 Investigation Design and Methods

Sampling Locations – Sediment sampling at the RRTS was divided into two phases. The purpose of Phase 1 sampling was to determine whether lead is a site-related MC and, if so, to screen for potential MC-related risk within the MRS. The spatial extent of lead in MRS sediments was also to be delineated. A second, more extensive phase of sampling, including additional MCs and chemical, bioavailability, geotechnical, and biological parameter analyses was to occur only if Phase 1 findings indicated a need as described in **Section 3.3**.

The background area in relation to the MRS is shown in **Figure 3-1**. As developed in the RI UFP-QAPP (Section 2.6.1), the MRS, for data interpretation purposes, was divided into three

Figure 3-1. MRS Exposure Unit (EU) and Background Sampling Areas

Figure 3-2. Transport and Fate of MC

subareas, called exposure units (EUs), reflecting the expected degrees of potential contamination from former firing range usage (**Figure 3-3**). These EUs (EU1, EU2, and EU3) were delineated subjectively based on the location of the Bulkhead Shoal Channel, distance from the potential source (i.e., the firing point of the Former Small Arms Range), and the presence of various bottom features that may affect MC deposition and, thus, potential exposure. EU1 is 31 acres and has the highest likelihood for MC exposure, with undisturbed sediment and a location closest to the firing point. EU2 is 99 acres and has a moderate risk for MC exposure due to the presence of the Bulkhead Shoal Channel, which may serve to concentrate bullets that have landed in this area. EU3 is 82 acres and represents the portion of the MRS with the least likelihood of MC exposure because it is located farthest from shore and features disturbed sediments and a high likelihood for MC burial. A 239-acre background reference area, unaffected by current and historical RRTS activities, was located approximately 1 mile upstream from the MRS (**Figure 3-4**). Background area samples were collected prior to samples within the MRS.

The sampling design was based on an evenly spaced, 200- by 200-foot grid with the sample density for each EU correlated to the relative likelihood MCs would be present at that location based on distance from the source and associated bottom features. A total of 35 sample points were located within EU1 at a density of approximately 1 point per acre. EU2 had a total of 37 sampling points placed at a density of about 0.5 points per acre. A total of 10 sampling points were located in EU3 at a density of about 0.1 points per acre. The density of sampling points in the background area was comparable to that of EU3 (0.1 points per acre), which resulted in 20 sampling locations.

The purpose of Phase 1 of the RI was to determine the spatial extent of potential MC-related contamination. Additional step-out sampling was conducted wherever individual lead results along the perimeter of the MRS, but not adjacent to the current SDZ, exceeded the Phase 1 risk screening criterion or the calculated background UTL, whichever was higher. The selection of step-out locations was based on the sample spacing at each EU as described in the RI UFP-QAPP.

Sediment Sampling – Sediment samples were collected from all three EUs and background reference locations over a 3-week period from March 24 through April 9, 2014. All field work, including sample collection, preparation and decontamination, was completed in accordance with the UFP-QAPP and Accident Prevention Plan (URS, 2014).

Weather was closely monitored throughout this period and field work was not conducted on days when weather (i.e., high winds) posed a safety hazard to field staff. Field work was also conducted around RRTS' training schedule. Field days lost due to inclement weather and scheduled training are recorded on the daily quality control reports (DQCRs) in Appendix B. Tidal stage varied during sample collection. For safety and accessibility, shallow sample locations were generally collected at higher tide stages and deeper sample locations were collected during lower tide stages. In general, shallow sampling locations were considered to be located outside of the Bulkhead Shoal Channel and deeper locations within the channel based on previous bathymetric imaging presented in the RI UFP-QAPP.

A total of 83 sediment samples (including 1 step-out sample) were collected from the MRS and 20 samples were collected from the background (reference) area and sent to an analytical laboratory for lead analysis.

Figure 3-3. MRS Sample Locations

Figure 3-4. Background Sample Locations

All background area samples were collected and analyzed first to determine the background UTL. To facilitate comparison with the anticipated variable sediment composition of the MRS (see **Section 2.3**), background sample locations targeted an even distribution of sandy and silty sediment grain size. As described in **Section 5**, sediments at both the background area and the MRS were predominantly composed of silts and clays with smaller fractions of sand and, as such, sample locations were unable to be stratified by grain size.

MRS perimeter samples were collected next. Individual MRS perimeter sample concentrations were screened against the background UTL to determine the need for step-out sampling. The remainder of the EU samples were collected and analyzed last.

Sediment samples were collected from all sites using a stainless steel standard Ponar grab sampler deployed from a shallow draft vessel. Sediment sampling adhered to the standard operating procedures included in the UFP-QAPP. The field team navigated to each proposed sampling location using a Trimble Geo xH 6000 with sub-meter accuracy. To compensate for strong currents, the team dropped the anchor slightly upstream of the sampling location and allowed the boat to drift into the target station. At each target station, sediment samples were collected over an area of approximately 0.5 square feet to a maximum depth of 6 inches below the sediment surface. Once collected, each sample was transferred to a stainless steel pan, visually characterized (i.e., grain size, color, etc.), mixed, and subsampled using stainless steel tools (e.g., spoons) with the target material transferred into the appropriate laboratory-provided sample container. All sampling equipment was decontaminated between sampling locations. Each location's coordinates were recorded using the Trimble. In accordance with the UFP-QAPP (Section 3.1.2.1), excess sediment and decontamination water was returned to the river in the same location at which it was collected. Soiled PPE was bagged and disposed of as municipal waste.

QA/QC Samples – Quality Assurance (QA)/QC samples collected during Phase 1 sampling consisted of duplicate samples, matrix spike/matrix spike duplicate (MS/MSD) samples, and equipment blanks. QA/QC sampling was conducted in accordance with specifications outlined in the UFP-QAPP. Field duplicate samples were collected at a rate of 10%, and MS/MSD and equipment blanks were each collected at a rate of 5%.

Water Quality Analysis – Near-bottom surface water quality parameters were measured in the field at each target sediment sampling station using a portable multi-parameter water quality meter (Horiba U5000). Data were collected for the following water quality parameters: dissolved oxygen, pH, temperature, salinity, conductivity, and turbidity.

Laboratory Analysis – Sediment and QA/QC samples were shipped overnight to ALS Environmental, in Kelso, WA, a U.S. Department of Defense (DoD) Environmental Laboratory Approval Program (ELAP) and DNREC certified laboratory. All laboratory procedures and analyses were conducted in accordance with the UFP-QAPP. Samples were analyzed for lead using USEPA SW-846 method 6010C. Background and EU samples located along the south, east, and west perimeters of the MRS were analyzed within 48 hours of laboratory receipt to establish the project UTL and determine the need for step-out sampling. Step-out samples were also analyzed within 48 hours to determine the need for additional sampling. All remaining samples were analyzed within the standard 28 days of receipt. Results were submitted by ALS as USEPA Contract Laboratory Program–like Level IV (Level D) data packages and electronic

data deliverables. All data were uploaded to the Army's Environmental Restoration Information System.

Analytical requirements for sensitivities are represented by laboratory-specific levels of quantification (LOQs), limits of detection (LODs), and detection limits (DLs). The LOQ is the lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard. For this project the LOQ was 5.0 milligrams per kilogram (mg/kg). The LOD is defined as the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). The LOD for this project was 2.5 mg/kg. The DL is the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99 percent level of confidence. The DL for this project was 2.0 mg/kg.

3.3 Data Evaluation Methods

The decision logic for evaluating the phases of data collected for the RI is shown in flow-chart form in **Figure 3-5**. As indicated in the next sections, the second phase of sampling was not needed.

All data were reviewed as described in **Section 4** to determine their usability. Sample depths, distances from shore, and water quality parameters were also assessed to ensure all samples were representative of MRS and background area conditions.

Statistical evaluations were performed in USEPA's ProUCL Version 5.0. First, an outlier test was conducted to determine non-representative data points. Next, the background 95% UTL and exposure point concentrations (EPCs) were calculated. EPCs were determined for each EU by calculating the 95% Upper Confidence Limit (UCL) of the mean concentration. Each EU EPC was compared to the background UTL to determine whether lead concentrations were elevated above background. If the EPC for an EU was less than the background UTL, then lead in that EU was determined to not be site related. If the EPC for an EU was greater than both the background UTL and the USEPA ecological risk screening criterion, then lead was determined to be chemicals of potential concern (COPCs) thereby triggering a Phase 2 investigation for that EU.

Figure 3-5. Phase I Decision Flow Chart

4.0 DATA QUALITY ASSESSMENT

Field samples were analyzed for lead by SW-846 method 6010C. QA/QC samples were collected to evaluate the field collection methods and laboratory analytical techniques for sediment. No deviations from the UFP-QAPP requiring corrective action occurred. Full data validation reports are presented in **Appendix D**.

4.1 Data Validation and Verification

This section describes data QC parameters and criteria used during the RI, followed by analysis of the data in terms of precision, accuracy, representativeness, comparability, and completeness (PARCC). All data validation and verification activities were completed by Keith Burke and Angela Yannone under the supervision and review of the project chemist, Andrea Sansom.

Holding Time Requirements – Samples are only representative of the area they were taken from for a specific length of time before sample preparation or analysis must begin. All samples must be placed in appropriate containers that are appropriately preserved. The sediment holding time from sampling to analysis for SW-846 6010C is 180 days. All samples were analyzed within the required holding time.

Calibration Criteria – All analyses require that a calibration curve be prepared to cover the appropriate concentration range based on the intended application and prior to establishing the linear dynamic range. Usually, this means the preparation of a calibration blank and mixed calibration standard solutions, with the lowest being at or above the LOQ, and the highest of which would not exceed the anticipated linear dynamic range of the instrument. All calibration curves contained the one calibration blank and five calibration standards at increasing concentrations with calibration correlation coefficients within control limits, and all sample concentrations were within the linear range of the curve. A low level check standard displayed a percent recovery greater than the upper control limit of 120% for lead at 121%. The positive associated field sample results less than two times the practical quantification limit (PQL) were qualified K,w, indicating a positive bias, and the flagged results are listed in **Table 4-1**.

Table 4-1. Qualified Lead Results – Positive Bias

Sample Identification	Laboratory Identification	Date Sampled	Units	Lead Result	Laboratory Qualifier	Validation Qualifier	Reason Code
EU-2-54	R1402354-004	4/3/2014	mg/kg	13.2		K	w
EU-2-58	R1402354-005	4/3/2014	mg/kg	11.8		K	w
EU-2-62	R1402354-006	4/3/2014	mg/kg	9.6	J	K	w
EU-2-66	R1402354-003	4/3/2014	mg/kg	18.0		K	w
EU-2-69	R1402354-002	4/3/2014	mg/kg	8.7	J	K	w

J: concentration is estimated (value between the method detection limit and LOQ)
K: concentration is estimated and biased high
w: low-level check standard recovery
mg/kg: milligram per kilogram

Method Blanks – A method blank is a sample of an analyte-free substance similar to the matrix of interest that is subjected to all of the sample digestion and analytical methodology applied to the samples. The purpose of the method blank is to check for contamination from within the

laboratory that might be introduced during sample preparation and analysis that would adversely affect analytical results. Analytes were not detected in any method blank sample. All method blanks, therefore, met the requirements of having concentrations less than one-half the LOQ, less than one-tenth the amount measured in any sample, and less than one-tenth the regulatory limit.

Equipment Blanks – As per the UFP-QAPP, equipment blanks were to be collected at rate of 5%. With the 103 primary investigative samples and the 10 field duplicate sediment samples analyzed, seven equipment blanks were collected, for a rate of 6.19%. The equipment blank was collected by passing analyte-free deionized water over a decontaminated sediment sampler into the sampling containers.

Lead was not detected in five of the seven equipment blanks. The highest concentration found in an equipment blank was 1.5 µg/L, which is less than the LOD of 2.5 µg/L. No impact on the data is anticipated as a result of carryover from the sediment sampler decontamination process because the amount of lead in the equipment blank is very low (by one to two orders of magnitude lower than sediment results). The acceptance criteria for an equipment blank is that no analytes are detected greater than the Limit of Quantitation (per the RI UFP-QAPP). The detections for lead in the equipment blanks did not display a bias above this threshold and were not used as outliers during data validation.

Laboratory Duplicate Samples – Laboratory duplicates are separate aliquots of a single field sample that are prepared and analyzed concurrently at the laboratory. The primary purpose of the laboratory duplicate is to check the precision of the laboratory analyst, the sample preparation methodology, and the analytical methodology. As per the UFP-QAPP, laboratory duplicates were to be prepared at a frequency of once per 20 samples. Ten laboratory duplicates were performed for the 103 primary investigative field samples for a frequency of once per 10.3 sediment samples collected.

Acceptable relative percent differences (RPDs) for laboratory duplicates are less than 20%. RPDs for Phase 1 sediment samples ranged from 1 to 6%. All laboratory duplicates prepared were, therefore, within QC limits.

Field Duplicates – Field duplicate samples were to be collected at a rate of at least one per 10 samples to assess imprecision encountered in the sampling process. Ten field duplicates were collected for the 103 primary field samples collected for a frequency of one per 10.3 primary sediment samples collected. Duplicate samples were collected simultaneously from the same source under identical conditions, containerized separately, and labeled accordingly.

RPDs less than 50% for field duplicate samples indicate acceptable sampling precision. Of the 10 duplicate pairs collected during Phase 1 field activities, nine of the RPDs ranged from 0 to 4.4%, and one sample pair had an RPD of 12.1%.

Laboratory Control Spike (LCS) Samples – The LCS contains known concentrations of specified target analytes and is carried through the entire preparation and analysis process. The LCS standards prepared in-house must be made from a source independent of that of the calibration standards. The primary purpose of the LCS is to establish and monitor the laboratory's analytical process control. An LCS must be analyzed with each analytical sample batch. The laboratory control limits for the sediment samples were consistent with the UFP-

QAPP and the DoD Quality Systems Manual version 5.0 (81 to 112%). All LCS samples prepared were within QC limits with sample recoveries ranging from 88 to 108%.

Matrix Spike/Matrix Spike Duplicates (MS/MSD) – MS/MSD samples were to be collected at a rate of one set per 20 samples. Ten MSs were performed for the 103 primary investigative field samples for a rate of one per 10 samples. Additional sub-samples were pulled from the primary sample for MS/MSD analysis and subjected to the entire analytical procedure. These QC samples are used to evaluate the effect of the sample matrix on extraction efficiency.

Acceptable limits for MS samples are between 81 and 112%. All MS sample percent recoveries were within QC limits, with sample recoveries ranging from 83 to 91%.

4.1.1 PARCC

Precision – Precision is the degree of agreement among repeated measurements of the same characteristic on the same sample or on separate samples collected as close as possible in time and place. Field sampling precision is measured with the field duplicate RPDs and laboratory precision is measured with laboratory duplicates and MSD RPDs. As noted above, all precision QC parameters were met with acceptable field and laboratory duplicate RPDs.

Accuracy – Accuracy is a measure of confidence in a measurement. The smaller the difference between the measurement of a parameter and its "true" or expected value, the more accurate the measurement. The more precise or reproducible the result, the more reliable or accurate the result. Accuracy is measured through percent recoveries in the LCS/Laboratory Control Sample Duplicate (LCSD) and the MS/MSD. As noted above, all accuracy QC parameters were met with LCD/LCSD and MD/MSD results falling within acceptable ranges.

Representativeness – Representativeness qualitatively expresses the degree to which data accurately reflect MRS conditions. Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences.

In the field, all sampling activities closely followed procedures outlined in the UFP-QAPP, including collection, preservation, and shipping. No quality issues arose during Phase 1 field work. Each sample point was located at the time of collection using a global positioning system (GPS). These locations were plotted on a site map and accurately correspond with the planned locations presented in the UFP-QAPP. Thus, the sampled sediment is known to be located within the MRS and background area.

One sample (EU-2-71) had to be shifted by about 80 feet because the original location was too close to a power line bulkhead to safely maneuver the boat. Planned sample locations were placed on an arbitrary grid, therefore shifting a sample to another arbitrary location within the EU has no predictable effect on representativeness.

As described in Section 3.2 of this report and in the UFP-QAPP, the MRS - for data interpretation purposes - was divided into three EUs that reflect the expected degrees of potential contamination based on distance from historical firing targets and river features. Thus, uniform distribution of MC across the MRS was considered unlikely and subdividing the MRS appropriate. Sampling efforts were prioritized based on the subdivision. For example, it was

anticipated that EU1, closest to shore, would be the most likely affected by historical training and higher density sampling was conducted there. Sample density was established in the UFP-QAPP and based on professional judgment. Samples from within each EU are considered both representative of their EUs and, as a whole, representative of the entire MRS. Additionally, samples collected from the background area are considered representative of baseline conditions because it is upstream of RRTS (unaffected by site activities) and covers a portion of the Delaware River similar to that of the MRS. The number of samples was based on professional judgment and designed to be sufficiently large so that a UTL could be calculated. As noted in Section 3.1.1 of the UFP-QAPP, a statistical basis for the number of samples was not possible because site-specific MC data were not available.

One step-out sample (EU-3-83) was collected in accordance with UFP-QAPP requirements. Step-out sampling was anticipated because the MRS boundaries are only estimated and not precisely defined. Step-out samples are considered part of the delineation of the MRS and, therefore, considered representative of it and included in all analysis. EU-3-84 through EU-3-88 were collected as contingency step-out samples, and were only to be analyzed if sample EU-3-83 exceeded the background UTL. As EU-3-83 was below background, the additional step-out samples were not analyzed, and have no bearing on representativeness.

Use of the standard Ponar grab sampler at each location ensured representativeness of the medium being sampled (sediments) because it allows standardizing grab sample sizes, reliably achieving the targeted sample depth (i.e., material within the top 6 inches of riverbed sediments), and is easy to decontaminate thus minimizing cross contaminating samples. At some locations, recovery was low because the Ponar could not fully penetrate the hard clay sediment encountered (Appendix B). This occurred primarily in EU2 (27% of the locations) where the channel current and/or historical dredging likely eroded/removed the looser sediments. However, the sediment recovered in the Ponar was uniform in content and consistency, and enough volume was recovered to fill the bottleware. Each sample was also mixed prior to bottling, further ensuring the sample sent to the lab is representative of the entire grab sample.In the laboratory, analytical and quality procedures were closely followed, including sample holding times, sample processing, and prescribed analytical methods; no procedural deviations were documented. Lead concentrations in two samples were estimated because they had percent solids less than 30%. These results received data validation flags and are summarized in **Table 4-2**. Results qualified "J" (estimated) are considered positive detections in accordance with Risk Assessment Guidance for Superfund, Volume I. These estimated concentrations introduce a small amount of uncertainty into the representativeness of the data for these two samples. However, the higher moisture content is a reflection of the actual condition encountered and the resulting uncertainty in concentration does not warrant rejection of the data.

Table 4-2. Qualified Lead Results – Estimated Concentrations

Sample Identification	Laboratory Identification	Date Sampled	Units	Lead Result	Laboratory Qualifier	Validation Qualifier	Reason Code
BG-16	R1402043-004	3/24/2014	mg/kg	42.8		J	p
EU-2-45	R1402356-013	4/3/2014	mg/kg	31.8	J	J	p

J: concentration is estimated
p: insufficient percent solids
mg/kg: milligram per kilogram

A few lead results were K-flagged during data validation. Positive associated data less than two times the LOQ were qualified as biased high with a K flag due to the low level check standard for this analytical sequence that displayed a percent recovery above the control limit of 120% for lead at 121%. One percentage point above the acceptance criteria was identified as minor, as opposed to a major anomaly. The true value for this standard converts to 1 mg/Kg where the LOQ is 5 mg/kg and LOD is 0.25 mg/kg. Raw data concentrations were evaluated before adjustment for percent solids. The flagged sample results are EU-2-54 (13.2 mg/kg), EU-2-57 (29.4 mg/kg), EU-2-62 (9.6 mg/kg), EU-2-66 (18.0 mg/kg), and EU-2-69 (8.7 mg/kg). Even with a potential positive bias, all values are well below the calcuated background value for this project. These five results have been identified as having a slight positive bias. By using these data in the EU2 UCL calculation, the resulting UCL may be slightly higher than a data set with no bias. This UCL represents a conservative value with respect to protecting the environment. As discussed above, a small amount of lead was detected in two of seven equipment blanks, but these detections were too insignificant and too low to affect representativeness.

Comparability – Comparability is the extent to which data from one study can be compared directly to either past data from the current project or data from another study. This RI is the first comprehensive study of lead in the MRS. Using standardized sampling and analytical methods, units of reporting, and sample location selection procedures as outlined in the UFP-QAPP helps ensure comparability to future datasets.

Data comparability between the background and MRS sampling data is necessary to accurately screen downstream lead concentrations against the background UTL. Comparability was achieved by implementing identical sampling and analytical procedures in both the background area and MRS. The background area spans the Bulkhead Shoal Channel as does the MRS, and sediment types and water quality parameters were fairly consistent between the two areas.

Sediment sample EU-3-83 was collected as a step-out sample following analysis of EU-3-81, and its water quality parameters were slightly different from those in the rest of EU3. However, water quality parameters are a secondary data source that vary based on time of day, weather conditions, and tide stage. Although these parameters for EU-3-83 vary from other EU3 sample locations, the small differences are attributed to this sample being collected on a different day. This has little to no effect on lead concentrations in the sediment.

Sediment samples were collected over a three week period. Sample collection dates therefore varied by up to a week between samples from a particular EU, and by weeks between samples across the entire MRS. However, the few weeks difference is negligible considering that the sampling program is assessing possible effects from training that occurred over 70 years ago.

As documented in the UFP-QAPP, the aggregate EPC for each EU was established as the point of comparison to the background UTL so that decisions would be based on the overall data distribution for the EU and not a single value (such as a maximum detected concentration). This decision was made during an initial DQO scoping meeting and gained concurrence through stakeholder review of the UFP-QAPP. It was similarly established and documented that individual sample lead concentrations would be compared to the background UTL (calculated per USEPA, 2009b guidance) to determine the extent of lead at the MRS in excess of background.

Completeness – Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data expected under normal conditions. Laboratories are expected to provide data meeting system QC acceptance criteria for all samples tested. Project completeness is determined by evaluating the planned versus actual quantities of data. All (100%) samples as specified in the UFP-QAPP were collected and analyzed. During the data validation and usability review, all data were found to be usable, surpassing the goal of 90% identified in the UFP-QAPP.

Sensitivity – Sensitivity reflects the ability of the analytical method to detect analytes of interest below the level of concern. This goal is achieved by identifying the level of concern, choosing a method with appropriate method detection limit, and ensuring that the laboratory analyzes calibration standards at or below the level of concern. The laboratory was able to achieve a LOQ of 5.0 mg/kg, which was below the project screening threshold of 30.2 mg/kg.

4.1.2 Laboratory Audits/Corrective Actions

The laboratory was asked to provide DoD ELAP and DNREC certifications. The laboratory showed the appropriate, current certifications. In sample delivery group K1402417, the laboratory initially provided continuing calibration blank summary forms with non-detect results at concentrations other than project detection limits. The laboratory provided revised forms and was not asked to perform any other corrective actions.

4.1.3 Field Audits/Corrective Actions

No independent field audit was conducted given (1) the need to make daily last minute mobilization decisions based on weather and river safety conditions and (2) the size of the boat would not safely accommodate a fourth person to conduct a visual audit. However, the field team comprised scientists skilled at the specific sampling methodology and who had assisted in preparing the UFP-QAPP and SOPs. Additionally, the site photographs, standard field forms, and DQCRs show that the proper equipment was being used and calibrated. These documents appear in Appendix B. The DQCRs were submitted daily to the URS project manager, the USACE, and ARNG. The URS project manager reviewed all field documents for completeness and compliance with the UFP-QAPP.

4.2 Data Usability Assessment

As detailed above, all data were found to be usable for the purposes of this RI. All QA/QC requirements outlined in the UFP-QAPP were met and no deviations requiring corrective action occurred. Project data also satisfy all PARCC parameters.

5.0 REMEDIAL INVESTIGATION RESULTS

This section provides the results of the field investigation at the RRTS MRS, including the nature and extent of contamination. Data from the RI, combined with previous information, were used to further develop the CSM and inform recommendations for future site work. A summary of the field activities conducted for this RI is presented first, followed by background and MRS sampling results broken out by area. The nature and extent of contamination across the entire MRS is presented last.

5.1 Field Activities and Conditions

Following the methods described in Section 3, river sediment samples were collected from a background area upstream of the MRS, and from three EUs downstream of the MRS. Sampling occurred over a 3-week period from late March to early April 2014. Tidal stage varied during sample collection and tidal amplitude was approximately 6 to 8 feet across the study area during this period. All sample depths referred to in this section are not corrected for tidal stage but associated tidal stages at the time of sample collection are shown on **Table 5-1**.

The approximately 240-acre background area extended across the Bulkhead Shoal Channel in an effort to mimic the channel features of the MRS. The field team attempted to collect background samples across a variety of grain sizes as dictated by the UFP-QAPP; however, nearly all sediments in this area were fine grained.

5.2 Results

Results from the background area are discussed first, followed by results from each individual EU. Sample descriptions and water quality parameters for each sample location are presented in **Table 5-1** and **Table 5-2**, respectively. Full laboratory analytical results are included in **Appendix C**. All statistical calculations (ProUCL output) are presented in **Appendix E**. The resulting UTL and UCLs discussed below are those recommended by the ProUCL software.

5.2.1 Background

Background Characteristics

Water depths in the background area ranged from 9 to 35 feet at all sample locations. As shown on **Figure 5-1**, the background area spans the secondary river channel, so water depths were generally deeper in the center of the grid (within the channel) and shallower to the northwest (toward shore) and southeast. Background samples were composed mainly of clayey silt, with small amounts of sand found in some samples (**Table 5-1**). Only one sample, BG-19, located in the sampling transect farthest from shore, was predominantly fine to medium grained sand. Sediment colors primarily ranged from olive brown-gray to dark gray. Most observations of benthic fauna were at locations nearest to shore. Four near-shore samples contained live bivalves and three contained faunal shell fragments.

Water quality parameters were similar between sample locations throughout the background area (**Table 5-2**). Dissolved oxygen (DO) concentrations largely ranged from 10 to 12 mg/L, although

Table 5-1. Phase I Sample Physical Descriptions

Table 5-1. Sample Physical Descriptions, cont'd

Table 5-1. Sample Physical Descriptions, cont'd

Table 5-1. Sample Physical Descriptions, cont'd

Table 5-2. Phase I Water Quality Parameters

Table 5-2. Water Quality Parameters, cont'd

Table 5-2. Water Quality Parameters, cont'd

Figure 5-1. Phase I Background Lead Results

BG-04 and BG-16 had concentration greater than 20 mg/L. pH tended to be slightly alkaline, with BG-11, BG-19, and BG-20 being slightly acidic. The average water conductivity and salinity were 1.6 milliSiemens per centimeter (mS/cm) and 0.8 parts per thousand (ppt), respectively, indicating the area is slightly brackish.

No bullets or bullet fragments were observed in any sample, although none were expected in the background area.

Background Lead Results

The background area was sampled prior to MRS sampling in order to determine non-site-related lead concentrations against which MRS lead results were compared. Lead concentrations ranged from 20.9 to 199 mg/kg (**Figure 5-1**), with the majority of concentrations falling between 20.9 and 45 mg/kg. Only four samples had concentrations below the USEPA ecological risk screening value of 30.2 mg/kg. A range of concentrations was found both inside and on either side of the bulkhead shoal channel with the highest and lowest observed concentrations occurring in close proximity to one another (BG-19 and BG-20, respectively).

A 95% UTL was calculated from the background data using USEPA's ProUCL. Prior to calculating the UTL, one outlier was identified (BG-19; 199 mg/kg of lead) and subsequently removed from the data set used in the UTL calculation. With this value excluded, the UTL was calculated to be 86.17 mg/kg, which was used as the background screening value for the MRS samples.

No bullets or bullet fragments were observed in any sample in the background area.

5.2.2 Exposure Unit 1

EU1 Characteristics

As shown on **Figure 5-2**, EU1 is west (shoreward) of the Bulkhead Shoal Channel and, therefore, sample depths were relatively shallow, ranging from approximately 3 to 10 feet depending on tidal stage (**Table 5-1**). Samples were primarily clayey silt with little to no coarse grained material. The majority of samples ranged from olive brown-gray to dark gray in color, with about half of the samples layered with a lighter-colored, softer material on top of a darker colored, stiffer material. About one-third of the samples had an anaerobic odor. Live bivalves were also seen in half of the samples and small amounts of faunal shell fragments were common.

Water quality parameters were similar between sample locations throughout EU1 (**Table 5-2**). DO concentrations ranged from 8 to 10 mg/L, with only one sample having a concentration over 20 mg/L (EU-1-18; 21.04 mg/L). Water pH was neutral to very slightly acidic. The average water conductivity and salinity were lower than in the background area (0.38 mS/cm and 0.17 ppt, respectively).

No bullets or bullet fragments were observed in any sample in EU1.

EU1 Lead Results

Lead concentrations in EU1 ranged from 24.3 to 67.1 mg/kg (**Figure 5-2**). Concentrations were highest in the northwest (upstream) portion of the EU and generally decreased to the southeast

Figure 5-2. Phase I MRS Lead Results – Exposure Unit 1

(downstream). No individual sample exceeded the background UTL of 86.17 mg/kg; therefore, no step-out sampling was required.

The 95% UCL of 44.88 mg/kg was calculated for EU1 using ProUCL. No data points were identified as outliers and all samples were included in the calculation. Since the EU1 UCL is below the background UTL, no further sampling was necessary in EU1.

5.2.3 Exposure Unit 2

EU2 Characteristics

EU2 is the largest exposure unit and spans the Bulkhead Shoal Channel (**Figure 5-3**). Water depths in EU2 ranged from about 3 feet closest to shore, increased toward the middle reaching a maximum depth of 30 feet, and decreased east of the channel. Approximately two-thirds of EU2 sediment samples were composed of clayey silt, with the remaining one-third composed of silty clay (**Table 5-1**). Two samples (EU-2-63 and EU-2-67) were predominantly sand and three samples (EU-2-47, EU-2-51, and EU-2-59) contained small amounts of sand; these were all located on the eastern edge of EU2 where sample depth became shallower east of the Bulkhead Shoal Channel. As in EU1, sample colors ranged from olive brown-gray to dark gray, and three samples displayed iron mottling. About one-quarter of the samples distributed throughout the EU had either an anaerobic or hydrocarbon odor. Live bivalves were only found in a few shallow samples along the western boundary of the EU and faunal shell fragments were rarely encountered.

Water quality parameters were similar between at sample locations throughout EU2 (**Table 5-2**). DO concentrations ranged from approximately 9 to 11 mg/L. Average water pH was neutral with individual samples ranging from slightly acidic to slightly alkaline. The average water conductivity and salinity were very similar to those seen in EU1, with values of 0.40 mS/cm and 0.18 ppt, respectively.

No bullets or bullet fragments were observed in any sample in EU2.

EU2 Lead Results

Lead concentrations in EU2 ranged from 7.1 to 129 mg/kg (**Figure 5-3**). Concentrations generally decreased from west to east across the EU with the lowest concentrations tending to occur in the Bulkhead Shoal Channel. Only one sample, EU-2-38 with a lead concentration of 129 mg/kg, exceeded the background UTL of 86.17 mg/kg. However, this sample was located along the northern boundary of the MRS, adjacent to the currently active SDZ; therefore, no step-out sampling could be implemented, as sampling inside an active SDZ is not necessary..

The mean lead concentration at EU2 was 35 mg/kg and the concentration of 129 mg/kg at EU-2-38 was identified by ProUCL as an outlier. However, to remain conservative, the outlier value was retained in the 95% UCL calculation. The 95% UCL for EU2 is 35.28 mg/kg, which is below the background UTL. No further sampling was necessary in EU2.

Figure 5-3. Phase I MRS Lead Results – Exposure Unit 2

5.2.4 Exposure Unit 3

EU3 Characteristics

Water depths in EU3 ranged from approximately 9 to 26 feet and generally increased from west to east (**Figure 5-4**). Sediment samples from this area were almost entirely composed of silty clay with only trace sand in several samples (**Table 5-1**). Sample colors ranged from olive gray to dark gray, and over half of the samples displayed iron mottling. Three samples also had either anaerobic or hydrocarbon odors. No live bivalves or significant faunal shell fragments were observed in any sample.

Water quality parameters were similar between sample locations throughout EU3 (**Table 5-2**). DO concentrations largely ranged from 9 to 10 mg/L and average water pH was slightly acidic. The average water conductivity and salinity were similar to those in the remainder of the MRS, with values of 0.49 mS/cm and 0.19 ppt, respectively. Sediment sample EU-3-83 was collected a week later as a step-out sample at the first opportunity after receiving the laboratory data on which step-out decisions were based, and its water quality parameters were slightly different from those in the rest of EU3. EU-3-83 had a higher than average temperature, DO content, conductivity, and salinity, and a more acidic pH (**Table 5-2**).

No bullets or bullet fragments were observed in any sample in EU3.

EU3 Lead Results

Lead concentrations in EU3 ranged from 17.2 to 117 mg/kg (**Figure 5-4**). In general, perimeter concentrations tended to be lower than interior concentrations. Two samples, EU-3-77 and EU-3-81, exceeded the background UTL of 86.17 mg/kg with concentrations of 111 and 117 mg/kg, respectively. EU-3-77 was isolated in the interior of the EU, surrounded by six samples with lower concentrations (EU-3-74, 75, 76, 79, 79, and 80). However, EU-3-81 was located along the perimeter of the EU and, therefore, required step-out sampling. EU-3-83 was collected as a step-out sample to delineate the downgradient edge of the potential contamination. The step-out sampling location was chosen based on the pre-established grid for EU-3. A lead concentration of 58.5 mg/kg was detected in this sample, which is below the background screening level. EU-3-81 is, therefore, surrounded by six samples with lower concentrations (EU-2-63, 67, EU-3-78, 80, 82, and 83), indicating that the elevated lead concentration in EU-3-81 is isolated. No further step-out sampling was necessary.

A 95% UCL of 79.5 mg/kg was calculated for EU3 using ProUCL. No data points were identified as outliers and all samples were included in the calculation. Because the EU3 UCL is below the background UTL, no further sampling was necessary in this area.

5.3 Nature and Extent of Contamination

Lead concentrations in sediments across the background area are shown in **Figure 5-5**. The highest detected concentrations (98.4 mg/kg [BG-01] and 199 mg/kg [BG-19]) occur along the perimeter of the background area.

Lead concentrations were contoured in **Figure 5-6** to illustrate its distribution in the MRS; convenient contour intervals of 25, 50, and 100 mg/kg were used in the illustration. Only three isolated samples had lead concentrations exceeding the background UTL of 86.17 mg/kg.

Figure 5-4. Phase I MRS Lead Results – Exposure Unit 3

Figure 5-5. Phase I Background Lead Concentration Contours

Figure 5-6. Phase I MRS Lead Concentration Contours

Similar to the background area, higher lead concentrations were generally detected outside of the Bulkhead Shoal Channel. The lowest lead concentrations occurred in EU2, roughly in line with the Bulkhead Shoal Channel.

Consistent with the expectation that lead preferentially adsorbs to smaller grains, higher lead concentrations were observed in samples with higher percentages of fine-grained (clay) particles. Samples with lead concentrations over 86.17 mg/kg had clay components of over 70%, with the exception of BG-19, which was mostly silty sand.

Although lead concentrations in the majority of MRS samples exceeded the USEPA risk-based screening value of 30.2 mg/kg, they were similar to or below background concentrations (**Table 5-3**). Additionally, no bullets or bullet fragments were observed in any sample. As summarized in **Table 5-3**, EPCs calculated for each EU were below the UTL calculated for the background area, indicating that lead concentrations in sediments within the MRS are not related to site activities and are not a MC. ProUCL outputs are included in **Appendix E**.

Table 5-3. Results Summary

Area	n	Lead Minimum Concentration (mg/kg)	Lead Maximum Concentration (mg/kg)	Lead Mean Concentration (mg/kg)	All Data[b] 95% UCL (mg/kg)	95% UTL Without Outlier Data (mg/kg)	Outliers? (Yes/No)	Outlier Points (mg/kg)
Background	20	20.9	199	40.21[a]	--	86.17	Yes	199
EU1	35	24.3	67.1	41.47	44.88[c]	--	No	--
EU2	37	7.1	129	24.97	35.28[d]	--	Yes	129
EU3	11	17.2	117	63.15	79.5[c]	--	No	--

Notes:

95% Background Upper Tolerance Limit (UTL) is 86 mg/kg
EPA = U.S. Environmental Protection Agency; EU = Exposure Unit; n = number of samples; UCL = upper confidence limit of the mean
EPA's ProUCL Version 5.0 was used to generate the summary statistics and conduct outlier tests. http://www.epa.gov/osp/hstl/tsc/software.htm
(a) Calculated without outlier data
(b) Maximum detected result of sample and field duplicate data was used in the EU data set per EPA Region 3 guidance
(c) 95% Student's-t UCL (Normal distribution)
(d) 95% Chebyshev (MVUE)-UCL (Lognormal distribution)

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Revised Conceptual Site Model

As shown in **Table 5-3**, MRS UCLs were below the background UTL, indicating historical firing at the MRS is not a source of lead contamination. The CSM has been revised to exclude this source, making the exposure pathways for human and ecological receptors at this site incomplete (**Figure 6-1**).

6.2 Munitions Response Site Prioritization Protocol

Under 10 U.S.C. 2710(b), the DoD requires that each defense site in the MRS inventory be assigned a relative priority for response activities based on location-specific safety and environmental hazards. The protocol consists of three hazard evaluation modules (30 tables) to be populated with MRS-specific information: an Explosive Hazard Evaluation (EHE), CWM Hazard Evaluation (CHE), and Health Hazard Evaluation (HHE). Table A provides background information in the MRS, Tables 1–10 present EHE results, Tables 11–20 present CHE results, Tables 21–28 present HHE results, and Table 29 provides the overall priority score.

The MRSPP score sheets for the Former Small Arms Range Water Area MRS were completed as part of this RI and are provided in **Appendix G**. Because only small-arms training occurred within the MRS, scores of No Known of Suspected Hazards (NKSH) were recorded in the summary sheets for the EHE and CHE modules (Tables 10 and 20, respectively), eliminating the need to complete Tables 2–9 and 12–19 (USACE, 2014). Table 27 was also intentionally omitted according to Army guidance. For the HHE modules, worksheets 23 and 25 were completed with information from the RI sediment sampling efforts. Based on the results of this RI and the revised CSM, lead concentrations in sediment at the MRS are not elevated above background concentrations. There was, therefore, no supporting evidence of an elevated exposure risk to ecological and human receptors from site activities. Thus, a rating of No Longer Required was entered for the HHE module. The MRS received an overall MRS Priority of NKSH.

6.3 Conclusions and Recommendations

The data collected at the MRS were sufficient to delineate the extent of potential site-related lead contamination. Because UCL lead concentrations in EU sediments were below the background UTL, lead is not an MC or COPC. Based on this revision of the CSM, the MMSRP rating of NKSH, and decision logic and decision factors presented in **Figure 3-5**, additional Phase 2 sampling activities and risk assessments at the MRS are not warranted.

The results and conclusions presented in this RI were reviewed with project stakeholders, including DNREC, in a Technical Project Planning (TPP) 2 meeting. Meeting minutes are provided in **Appendix F**.

Based on the results presented above, an FS is not warranted at RRTS. No Further Action is recommended for the RRTS MRS. A proposed plan will be prepared to convey this finding to the public, followed by a decision document to officially conclude work at the MRS.

Figure 6-1. Revised Conceptual Site Model

7.0 REFERENCES

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The following document is secured and will be provided separately from this River Road Training Site Complete Appendix A PDF-

- 2019, FY16 Phase 1 Regional Site Inspections For Perfluorinated Compounds: Delaware Air National Guard – 166th Airlift Wing, New Castle Air National Guard Base, New Castle, Delaware, March 2019

DNREC —Site Investigation and Restoration Section
391 Lukens Drive
New Castle, Delaware 19720
Phone: 302-395-2600
Fax: 302-395-2601

Delaware Department of Natural Resources and Environmental Control

New Castle County Airport Area Community Fact Sheet

PFOS/PFOA Detected in Ground Water from New Castle Public Wells

Artesian Water Company and the City of New Castle Municipal Services Commission detected perfluorooctanoic sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in public water supply wells in the New Castle County Airport area that are above the U.S. EPA's 2016 lifetime health advisory level of 0.07 parts per billion. The public drinking water is treated to remove the contaminants.

What is DNREC doing?
DNREC is continuing to investigate the source of the ground water contamination in the public wells. In 2017 DNREC will be working with U.S. EPA to install monitoring wells and sample ground water to help determine the extent of the contamination.

Can I continue to drink the public water?
Yes. Artesian and the City of New Castle Municipal Services Commission have been treating the public drinking water to remove PFOS and PFOA so the water does not exceed the health advisory level. The drinking water supplied by Artesian and the City of New Castle continues to meet Federal and State Safe Drinking Water Act standards.

What are PFOS and PFOA?
PFOS and PFOA are part of a group of chemicals known as per– and polyfluoroalkyl substances (PFAS). They are man-made chemicals that have been used in manufacturing and industrial operations, most prevalently in the 1950s-1970s. PFAS were first developed by companies like DuPont and 3M in manufacturing adhesives and non-stick Teflon™. They have been used in firefighting foams and other products with stain, water, oil and grease repellant properties such as clothing, food-wrappers and carpet. Over time, PFOS and PFOA have become widely distributed in the environment and have been detected in the blood of humans, wildlife, and fish.

What adverse health effects may be associated with exposure to PFOS and PFOA?
In laboratory studies of animals given large doses of PFOS and PFOA, results indicate that the substances can cause developmental, reproductive, and other adverse health effects including increased liver weight in laboratory animals. In humans, more research is ongoing, but the most consistent findings from epidemiology studies are elevated blood serum total cholesterol levels among exposed populations, and limited findings related to low infant birth weights.

Where is the site located?
The contaminated area, known as the New Castle Public Wells Ground Water Plume Site, is approximately seven square miles. The Site is bound by Interstate 295 to the north, the Delaware River to the east, Route 273 to the south, and Route 13 and New Castle County Airport to the west. DNREC's previous investigations in the area refer to the site as the Zero (0) East Basin Road Site (DE-0363).

Delaware Department of Natural Resources and Environmental Control

New Castle County Airport Area Community Fact Sheet

PFOS/PFOA Detected in Ground Water from New Castle Public Wells *Continued...*

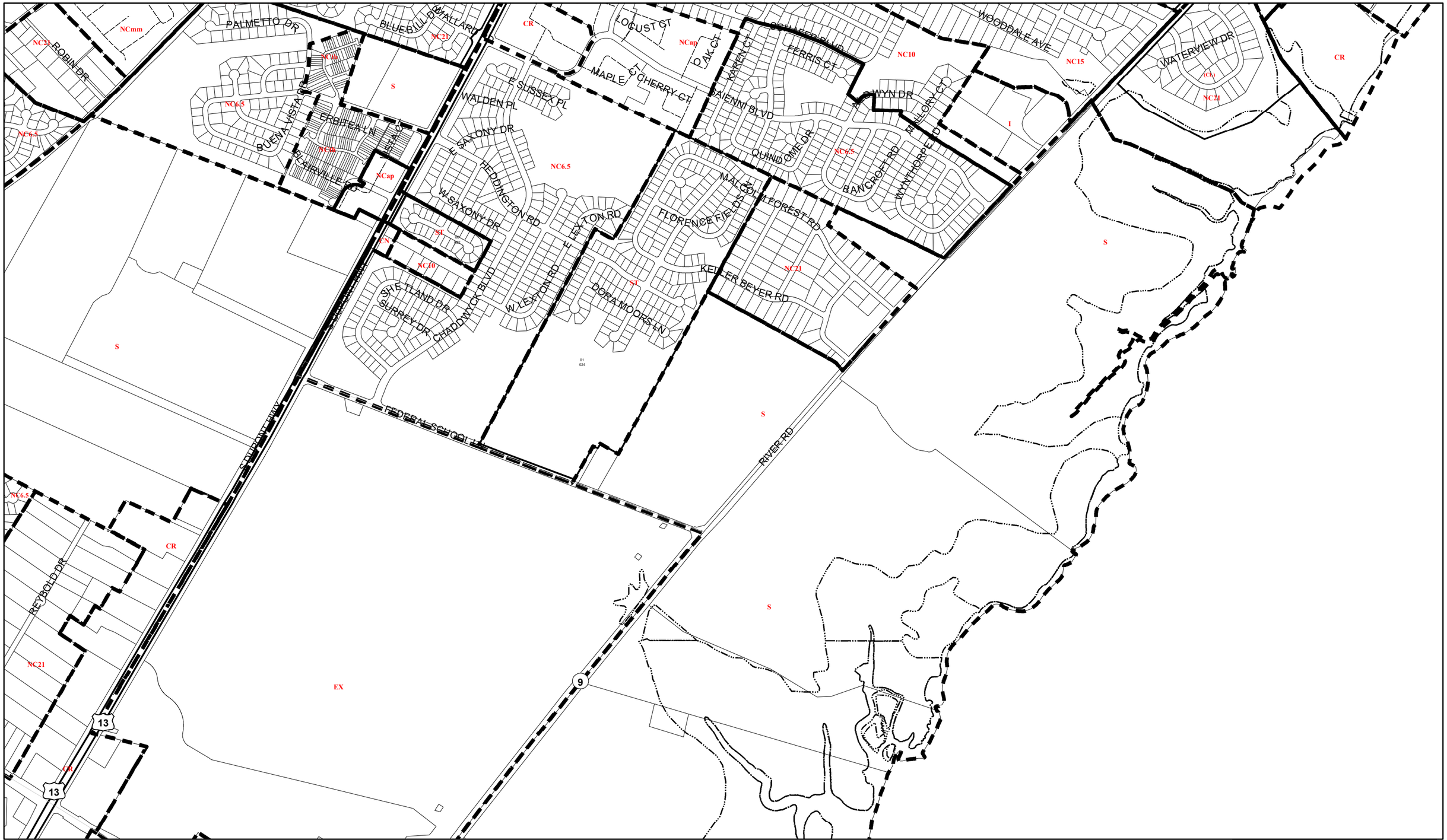
Outline of New Castle Public Wells Ground Water Plume Site.

FOR ADDITIONAL PFAS INFORMATION — SEE EPA AND ATSDR WEBSITES:

- **https://www.epa.gov/chemical-research/research-and-polyfluoroalkyl-substances-pfas**
- **https://www.atsdr.cdc.gov/pfc/**

FOR ADDITIONAL QUESTIONS:

- **Site-related:** Please contact DNREC staff at 302-395-2600, or by email: Todd Keyser at Todd.Keyser@state.de.us or Stephanie Gordon at Stephanie.Gordon@state.de.us.
- **Public Drinking Water:** Please contact the Division of Public Health, Office of Drinking Water at 302-741-8630.
- **City of New Castle Municipal Services Commission:** Please contact Pamela Patone at 302-323-2330.
- **Artesian's Water Quality Department:** Please contact 302-453-6900.



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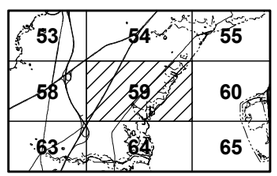
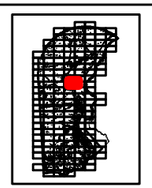




LEGEND

- ZONING LINE
- CORPORATE LIMIT LINE
- HYDROLOGY LINE
- PARCEL LINE
- ZONING EXHIBIT LINE
- REZONING ORDINANCE
- SR ZONING CLASSIFICATION

ZONING CLASSIFICATIONS

NC2A	Single Family (2 ac.)	Ncap	Apartments	ON	Office Neighborhood
NC40	Single Family (40,000 sq. ft.)	Ncpud	Existing Planned Development	OR	Office Regional
NC21	Single Family (21,000 sq. ft.)	NCmm	Manufactured Mobile	BP	Business Park
NC15	Single Family (15,000 sq. ft.)	S	Suburban	I	Industrial
NC10	Single Family (10,000 sq. ft.)	ST	Suburban Transition	HI	Heavy Industrial
NC6.5	Single Family (6,500 sq. ft.)	SE	Suburban Estate	EX	Extraction
NC5	Single Family (5,000 sq. ft.)	SR	Suburban Reserve	OVERLAY DISTRICTS	
NCsd	Semi-Detached	TN	Traditional Neighborhood	H	Historic Preservation
NCth	Townhouses	CN	Commercial Neighborhood	AG	Agricultural Preservation
Ncga	Garden Apartments	CR	Commercial Regional	CL	Development Option
				HT	Hometown Overlay

N

NEW CASTLE COUNTY, DE OFFICIAL ZONING MAP

ADOPTED SEPTEMBER 22, 1998

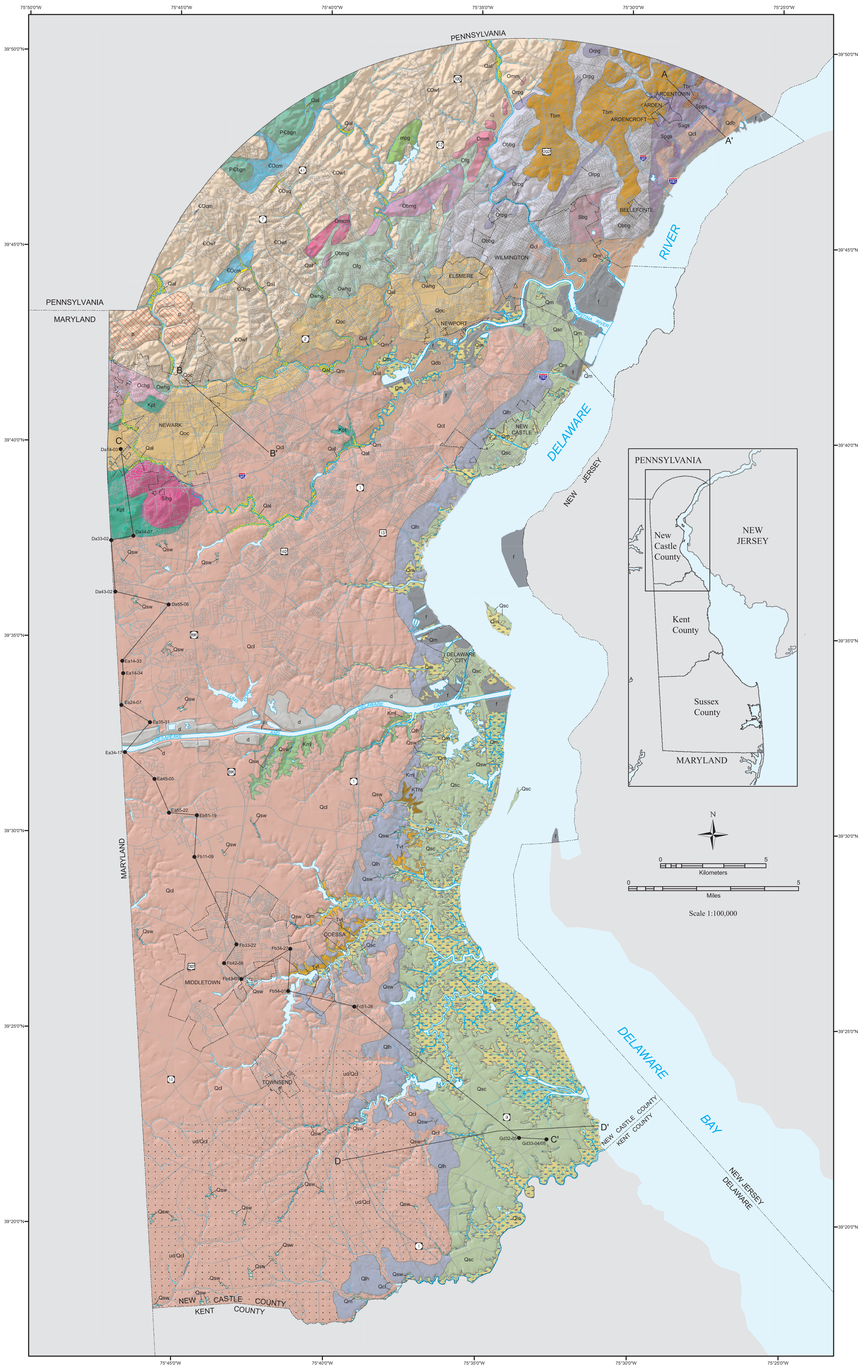
MAP NO. **59**

GRID BASED ON THE DELAWARE STATE PLANE COORDINATE SYSTEM

0 200 400 Feet

Revised: 1/7/2020

DELAWARE GEOLOGICAL SURVEY
University of Delaware, Newark
John H. Talley, State Geologist



Geologic Map of New Castle County, Delaware

by

Kelvin W. Ramsey

2005

MAP CREDITS

Base Map
Projection: Universal Transverse Mercator, Zone 18
North American Datum of 1983 (NAD83)
USGS Delaware Hydrography Lines 2002, http://maps.udel.edu/metadata
USGS Delaware Hydrography Areas 2002, http://maps.udel.edu/metadata
USGS Delaware State Boundary Lines 2002, http://maps.udel.edu/metadata
USGS Delaware Boundaries - County Boundary Lines 2002, http://maps.udel.edu/metadata
The Delaware Office of State Planning Coordination Delaware Municipal Boundaries, 2005
New Castle County, Department of Land Use, Centerline for New Castle County, Delaware, 2005
New Castle DEM 30-meter resolution, http://www.udel.edu/FERC/spatlab/dems/co_dems.html

Other
Cartography by Lillian T. Wang, Delaware Geological Survey
Edited by Stefanie J. Baxter, Delaware Geological Survey
Map layout and design by Lillian T. Wang and Stefanie J. Baxter

Acknowledgements
This work was funded in part by the cooperative agreement between the Association of American State Geologists and the U.S. Geological Survey under STATEMAP Program Grants 02HQPA0003 and 03HQPA0003. Scott D. Standford, A. Scott Andres, Richard N. Benson, and Gerald R. Baum provided helpful reviews of this map.

Descriptions of Map Units

PIEDMONT (from Schenck, Plank, and Srogi, 2000)

Sihg — **Iron Hill Gabbro (Silurian)**
Black to very dark green, coarse- to very coarse-grained, uralitized olivine-hypersthene gabbronorite and pyroxenite with subophitic textures. Primary minerals are calcic plagioclase, orthopyroxene, clinopyroxene, and olivine. Amphibole is secondary, a pale blue-green actinolite. Olivine, when present, is surrounded by coronas similar to those in the Bringhurst Gabbro. The gabbronorite is deeply weathered leaving a layer of iron oxides, limonite, goethite, and hematite, mixed with ferruginous jasper. The jasper contains thin seams lined with drusy quartz. Contacts with the Christiansted Gneiss are covered with sediments of the Coastal Plain.

Sbg — **Bringhurst Gabbro (Silurian)**
Coarse- to very coarse-grained gabbronorite with subophitic textures. Primary minerals are plagioclase, olivine, clinopyroxene and orthopyroxene. Olivine, where present, is surrounded by an inner corona of orthopyroxene and an outer corona of pargasitic hornblende, both with spinel symplectites. The gabbronorites locally contain abundant xenoliths of mafic Brandywine Blue Gneiss.

Sags — **Ardentown Granitic Suite (Silurian)**
Medium- to coarse-grained granitic rocks containing primary orthopyroxene and clinopyroxene; includes quartz norites, quartz monzonorites, opdalites, and charnockites. Feldspar phenocrysts common. Mafic enclaves locally abundant in proximity to gabbronorites.

Spgs — **Perkins Run Gabbronorite Suite (Silurian)**
Fine- to coarse-grained gabbronorite and minor diorite with subophitic to ophitic textures, variably foliated or lineated. Plagioclase, orthopyroxene, clinopyroxene, and hornblende are major minerals; biotite and olivine locally present. Olivine typically surrounded by corona structures as described for the Bringhurst Gabbro. Contemporaneous with the Ardentown Granitic Suite.

Obbg — **Brandywine Blue Gneiss (Ordovician)**
Medium to coarse grained granulites and gneisses composed of plagioclase, quartz, orthopyroxene, clinopyroxene, brown-green hornblende, magnetite, and ilmenite. Mafic minerals vary from < 5-30 modal percent. A lineation due to a preferred orientation of quartz and mafic minerals is obvious on weathered surfaces. Unit contains thin, discontinuous fine-grained mafic layers.

Orpg — **Rockford Park Gneiss (Ordovician)**
Fine-grained mafic and fine- to medium-grained felsic gneisses interlayered on the decimeter scale. Layers are laterally continuous, but mafic layers commonly show boudinage. Felsic layers are composed of quartz and plagioclase with < 10 modal percent pyroxene. Mafic layers contain subequal amounts of plagioclase, pyroxene, and hornblende. Penetrative deformation and granulite facies metamorphism have obscured igneous fabrics and contact relationships.

Omcm — **Mill Creek Metagabbro (Ordovician)**
Coarse-grained gabbroic and metagabbroic rocks, variably metamorphosed and deformed. Primary minerals are hornblende and plagioclase.

Omm — **Montchanin Metagabbro (Ordovician)**
Coarse-grained gabbroic and metagabbroic rocks, variably metamorphosed and deformed. Primary igneous minerals include olivine, clinopyroxene, orthopyroxene, and plagioclase.

Obmg — **Barley Mill Gneiss (Ordovician)**
Coarse-grained, foliated tonalite gneiss. Major minerals are biotite, hornblende, plagioclase, and quartz. Includes mafic enclaves or layers composed of subequal amounts of hornblende and plagioclase. Also includes a coarse-grained granitic lithology composed of biotite, microcline, plagioclase, and quartz.

Ochg — **Christiansted Gneiss (Ordovician)**
Coarse-grained, foliated granodiorite gneiss. Major minerals are biotite, microcline, plagioclase, and quartz. Includes thin layers of fine-grained foliated amphibolite plus large pegmatites.

Ofg — **Faulkland Gneiss (Ordovician)**
Predominantly fine- to coarse-grained amphibolites and quartz amphibolites with minor felsic rocks, probably metavolcanic. Major minerals are amphibole and plagioclase with or without pyroxene and/or quartz. Amphibole may be hornblende, cummingtonite, gedrite, and/or anthophyllite. Halos of plagioclase and quartz around porphyroblasts of magnetite, orthopyroxene, and garnet are common features.

Owhg — **Windy Hill Gneiss (Ordovician)**
Thinly interlayered, fine- to medium-grained hornblende-plagioclase amphibolite, biotite gneiss, and felsic gneiss, possibly metavolcanic. Felsic gneisses contain quartz and plagioclase with or without microcline with minor pyroxene and/or hornblende and/or biotite. Metamorphic grade in this unit decreases from granulite facies in the northeast to amphibolite facies toward the southwest. Correlated with the Big Elk Member of the James Run Formation in Cecil County, Maryland.

p — **Pegmatite (lower Paleozoic)**
Coarse- to very coarse-grained granitic pegmatite with tourmaline crystals locally. Where outcrop is present, pegmatite is tabular and concordant with the regional trend of the underlying Wissahickon Formation. Lenticular xenoliths of Wissahickon gneisses occur locally in the pegmatite.

Є̄Owf — **Wissahickon Formation (Cambrian to Ordovician)**
Interlayered psammitic and pelitic gneiss with amphibolite. Psammitic gneiss is a medium- to fine-grained biotite-plagioclase-quartz gneiss with or without small garnets. Contacts with pelitic gneiss are gradational. Pelitic gneiss is medium- to coarse-grained garnet-staurolite-biotite-plagioclase-quartz gneiss. Unit has a streaked or flaseed appearance owing to the segregation of garnet-sillimanite-biotite stringers that surround lenses of quartz and feldspar. Throughout, layers of fine to medium-grained amphibolite composed of plagioclase and hornblende, several inches to <30 feet thick or as large massive bodies, are in sharp contact with the psammitic and pelitic gneisses. An attempt has been made to show some of the amphibolites mappable at the scale of the map. Granitic pegmatite is ubiquitous and at all scales. Pyroxene bearing quartzite with garnet crystals locally near the contact with the Wilmington Complex. An ultramafic lens composed of cumulus layers of serpentinized peridotite, metapyroxenite, and metagabbro occurs near Hoopes Reservoir. The ultramafic lens may be correlative with the Baltimore Mafic Complex.

mpg — **Metapyroxenite, metagabbro, and Serpentinite (undifferentiated) (Cambrian to Ordovician)**
Light-colored coarse-grained rocks composed of interlocking grains of light colored, fibrous amphiboles, most likely magnesium-rich cummingtonite and/or anthophyllite with possible clinochlor. These rocks become finer grained and darker as hornblende replaces some of the Mg-rich amphiboles. Associated with the metapyroxenites are coarse-grained metamorphosed gabbros composed of hornblende and plagioclase. The metapyroxenites and metagabbros are probably cumulates.

Є̄Ocm — **Cockeysville Marble (Cambrian to Ordovician)**
In Delaware, predominantly a pure, coarsely crystalline, blue-white dolomite marble interlayered with calc-schist. Major minerals in the marble include calcite and dolomite with phlogopite, diopside, olivine, and graphite. Major minerals in the calc-schist are calcite with phlogopite, microcline, diopside, tremolite, quartz, plagioclase, scapolite, and clinozoisite. Pegmatites and pure kaolin deposits and quartz occur locally.

Є̄Osq — **Setters Formation (Cambrian to Ordovician)**
In Delaware, predominantly an impure quartzite and garnet-sillimanite-biotite-microcline schist. Major minerals include microcline, quartz, and biotite with minor plagioclase, and garnet. Muscovite and sillimanite vary with metamorphic grade. Accessory minerals are iron-titanium oxides, zircon, sphene, and apatite. Microcline is an essential constituent of the quartzites and schists and serves to distinguish the Setters rocks from the plagioclase-rich schists and gneisses of the Wissahickon Formation.

P€bgn — **Baltimore Gneiss (Precambrian)**
Granitic gneiss with swirling leucosomes and irregular biotite-rich restite layers is the dominant lithology and constitutes approximately 75 to 80 percent of the exposed rocks. The remaining 20 to 25 percent comprises hornblende-biotite gneiss, amphibolite with or without pyroxene, and pegmatite. Granitic gneiss is composed of quartz, plagioclase, biotite, and microcline. Minor and accessory minerals are garnet, muscovite, magnetite, ilmenite, sphene, apatite, and zircon. The hornblende gneiss contains plagioclase, quartz, hornblende, and biotite with/without orthopyroxene. Accessory minerals are garnet, muscovite, clinozoisite, perthitic orthoclase, iron-titanium oxides, sphene, and apatite. Amphibolites are composed of subequal amounts of hornblende and plagioclase with minor quartz, biotite, clinopyroxene, and orthopyroxene.

COASTAL PLAIN

f — **Fill**
Man-made deposits of natural earth material, including dredge spoil, used to extend shore land and/or to fill a low-lying area such as where a road crosses a valley or marsh. Fill areas include Cherry Island Landfill and Pigeon Point Landfill near Wilmington that were marsh prior to landfill construction. Some construction debris (concrete, bricks, etc.) may be incorporated in the unit.

d — **Dredge Disposal Deposits**
Located on uplands and consist of dredged material from the Chesapeake and Delaware Canal. Primarily a mixture of sand, silt, and clay from Cretaceous geologic units through which the Canal was cut.

Qal — **Alluvial Deposits (Holocene)**
Brown, light yellow-orange, and gray fine to coarse quartz sand, silt, clay, and fine to medium gravel. Usually less than 20 ft thick. Restricted to stream channels and adjacent flood plains. Continuous along stream valleys and depicted on the map where extensive enough to be shown at map scale.

Qsw — **Swamp Deposits (Holocene)**
Structureless, black to brown, organic-rich, silty and clayey, fine to coarse quartz sand with thin interbeds of medium to coarse quartz sand. Organic particles consist of leaves, twigs, and larger fragments of deciduous plants in stream valleys. In stream valleys, swamp deposits fine upward and grade laterally with salt marsh deposits toward the Delaware River. Defined primarily on the presence of deciduous vegetation in stream valleys (Ramsey, 1997). On uplands, consist of dark- to light-gray clayey silt and very fine to coarse sand. Characterized by areas of seasonally standing water, internal drainage, and hydrophyllic trees. From 1 to 20 ft thick.

Qm — **Marsh Deposits (Holocene)**
Structureless to finely laminated, black to dark-gray, organic-rich silty clay to clayey silt with discontinuous beds of peat and rare shells (Ramsey, 1997). In-place or transported fragments of marsh grasses such as Spartina are common. Includes some clayey silts of estuarine channel origin. Map area delineated on the distribution of salt-tolerant marsh grasses. Thickness ranges between 1 and 40 ft.

ud/Qcl — **Undrained Depression Deposits (upper Pleistocene to lower Holocene)**
A belt of upland depressions that stretches across southern New Castle County. Sometimes referred to as Delmarva Bays, are irregular in shape and have internal drainage not integrated with any stream network. Filled with organic-rich woody silts to gray medium to coarse quartz sand (Webb, 1990). Some have a sandy rim at their margins. During wet periods, many are filled with water. Because of the abundance and relative small size (< 500 ft. diameter), individual basins are not mapped; rather, a pattern indicates the extent of these units where they overlie the Columbia Formation. Largest depressions appear as areas of swamp. Radiocarbon dates (Webb, 1990) indicate ages from 11,000 B.P to Recent. Origin is considered by the author to be related to cold-climate periglacial conditions.

Qdb — **Delaware Bay Group (undifferentiated) (upper Pleistocene)**
Grayish brown silt overlying a fine to medium silty quartz sand; lithologies from organic-rich silty clay and peat to sandy gravel common. Consists of Pleistocene alluvial, swamp, marsh, and estuarine deposits along Brandywine Creek, Christina River, White Clay Creek, Red Clay Creek, and Delaware Bay. Combination of the Lynch Heights and Scotts Corners Formations (Ramsey, 1997) where they cannot be differentiated in urbanized areas in vicinity of Wilmington. Overall thickness rarely exceeds 20 ft.

Qsc — **Scotts Corners Formation (upper Pleistocene)**
Heterogeneous unit of light-gray to brown to light-yellowish-brown, coarse to fine sand, gravelly sand and pebble gravel with rare discontinuous beds of organic-rich clayey silt, clayey silt, and pebble gravel. Sands are quartzose with some feldspar and muscovite. Commonly capped by one to two ft of silt to fine sandy silt. Laminae of opaque heavy minerals common. Unit underlies a terrace parallel to the present Delaware River that has elevations less than 25 ft. Interpreted to be a transgressive unit consisting of swamp, marsh, estuarine channel, beach, and bay deposits. Climate during deposition was temperate to warm temperate as interpreted from fossil pollen (Ramsey, 1997). Overall thickness rarely exceeds 15 ft.

Qlh — **Lynch Heights Formation (upper Pleistocene)**
Heterogeneous unit of light-gray to brown to light yellowish brown, medium to fine sand with discontinuous beds of coarse sand, gravel, silt, fine to very fine sand, and organic-rich clayey silt to silty sand. Upper part of unit commonly consists of fine, well-sorted sand. Small-scale cross-bedding within sands is common. Some interbedded clayey silts and silty sands are burrowed. Beds of shell rarely encountered. Sands are quartzose, slightly feldspathic, and typically micaceous where very fine to fine grained. Unit underlies a terrace parallel to present Delaware River that has elevations between 50 and 30 ft. Interpreted to be a fluvial to estuarine unit of fluvial channel, tidal flat, tidal channel, beach, and bay deposits (Ramsey, 1997). Overall thickness rarely exceeds 20 ft.

Qcl — **Columbia Formation (middle Pleistocene)**
Yellowish- to reddish-brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel. Typically cross-bedded with cross-sets ranging from a few inches to over three ft in thickness. Scattered beds of tan to reddish-gray clayey silt common. In places, the upper 5 to 25 ft a grayish- to reddish-brown silt to very fine sand overlying medium to coarse sand. Near base of unit, clasts of cobble to small boulder size found in gravel bed ranging from a few inches to three ft thick. Gravel fraction consists primarily of quartz with lesser amounts of chert. Clasts of sandstone, siltstone, and shale from the Valley and Ridge Province, and pegmatite, micaceous schist, and amphibolite from the Piedmont are present. The Columbia fills an eroded surface and ranges from less than 10 ft thick to over 100 ft. Primarily a body of glacial outwash sediment (Jordan, 1964; Ramsey, 1997). Pollen indicate deposition in a cold climate during middle Pleistocene (Groot and Jordan, 1999).

Qoc — **Old College Formation (middle Pleistocene)**
Reddish-brown to brown clayey silt, silty sand to sandy silt, and medium to coarse quartz sand with pebbles (Ramsey, 2005). Rock fragments of mica or sillimanite quartzose schist are common sand fraction. At land surface, a gray to grayish-brown clayey silt is present. Sands are cross-bedded with laminae of muscovite or heavy minerals defining the cross-sets. Silty beds tend to be structureless, or in the gray clayey silt beds, heavily bioturbated by roots. No fossils other than pollen have been recovered. Pollen indicate a cold climate during deposition of the upper clayey silt unit (unpublished DGS data). Stratigraphic relationships indicate either slightly younger than or contemporaneous with the Columbia Formation. Ranges from 5 to 40 ft in thickness.

Tbr — **Bridgeton Formation (Miocene)**
Reddish-brown to brown, medium to very coarse, poorly sorted sand to silty quartz sand containing scattered gravel beds. Less than 15 ft thick and underlies a relict terrace flat that has elevations between 170 ft and 180 ft and parallels the present Delaware River. More extensive to the north in Pennsylvania (Owens, 1999; Berg et al., 1980).

Tbm — **Bryn Mawr Formation (Miocene)**
Reddish-brown to yellowish-brown silty quartz sand to sandy silt that interfingers with medium to coarse clayey sand with gravel. Sand fraction, where a sandy silt, is fine- to very fine-grained and angular to subangular. Iron-cemented zones are common. Gravel fraction is primarily quartz. Sands are quartzose with minor amounts of weathered feldspar. Opaque heavy minerals form up to 3 percent of the sand fraction. Unit ranges up to 70 ft thick but generally less than 30 ft thick and commonly less than 10 ft thick. Surface forms a distinctive terrace that has elevations between 350 ft and 425 ft, and it overlies saprolite of the Piedmont rocks. No macrofossils have been recovered. Fossil pollen from the York Pit in Cecil County, Maryland (Pazzaglia, 1993; unpublished DGS data) indicate a Miocene age. Owens (1999) considered the unit late Oligocene in Pennsylvania.

Tvt — **Vincentown Formation (Paleocene)**
Glauconitic sand that ranges from slightly silty to moderately silty and slightly to moderately clayey. Dominant constituent is subrounded to subangular clear quartz sand that ranges from medium to fine grained. Fine-grained glauconite is a secondary constituent, which ranges from 5 percent in the clayey zones to 15 percent where cleaner. Towards bottom of unit, glauconite percentages increase to about 50 percent of the sand fraction. Silty and clayey zones are thin to thick laminae ranging from 0.01 to 0.5 ft thick. Olive gray to dark-yellowish-brown in zones where iron cement is present. Interpreted to be marine in origin. Rarely occurs in outcrop and is covered by colluvium along the stream valley bluffs where shown on the map. Ranges from 50 to 100 ft in thickness in the subsurface and less than 50 ft thick where it is cut by younger deposits updip.

COASTAL PLAIN (cont.)

KTht — **Hornerstown Formation (Upper Cretaceous and Paleocene)**
Glauconite sand that is silty and slightly to moderately clayey and contains scattered shell beds. Glauconite approximately 90 percent to 95 percent of the sand fraction and quartz 5 percent to 10 percent. Near the top of unit, silt-filled burrows are present. Lower, the unit is commonly laminated with silty sand and moderately clayey sand. Silt and clay matrix is calcareous. Uniformly a dark-greenish-gray. Interpreted to be marine in origin. The Cretaceous-Tertiary boundary is considered to lie within the formation. Rarely occurs in outcrop and where shown on the map is covered by colluvium along the stream valley bluffs. Ranges between 10 and 50 feet in thickness.

Kml — **Mt. Laurel Formation (Upper Cretaceous)**
Slightly calcareous, glauconitic, quartz sand that is medium to fine grained. Contains about 3 to 5 percent glauconite. Sand is subrounded to subangular and slightly silty with a few moderately silty zones. Scattered belemnites are present as well as a few scattered shell fragments or thin shell beds. Uniform dark olive gray or yellowish-brown where weathered. In outcrop, reported to be extensively burrowed (Owens, et al., 1970). Where it is the surficial deposit south of the Chesapeake and Delaware Canal, the Mt. Laurel can be confused with the Columbia Formation, especially where the color is similar. Can be differentiated by ubiquitous presence of glauconite and generally better sorted sands of the Mt. Laurel. Marine in origin. Ranges from 30 to 100 ft in thickness.

Kpt — **Potomac Formation (Cretaceous)**
Dark-red, gray, pink, and white silty clay to clayey silt and very fine to medium sand beds. Beds of gray clayey silt to very fine sand that contain pieces of charcoal and lignite are common. Deposited in a fluvial setting in a tropical to subtropical environment as indicated by abundant paleosol horizons. Ranges from 20 ft updip to over 1600 ft thick in southern New Castle County.

CROSS-SECTION UNITS (not shown on map)

Qus — **Quaternary (undifferentiated)** *shown on cross-section C-C' only*
Includes the Quaternary surficial units of the Columbia Formation, Lynch Heights Formation, and Scotts Corners Formation. Primarily Sand.

Tc — **Calvert Formation (Miocene)** *subsurface only*
Gray to grayish-brown clayey silt to silty clay interbedded with gray to light-gray silty to fine to coarse quartz sands. Discontinuous beds of shell are common in the sands and in the clayey silts. The unit ranges up to 100 ft in thickness.

Tsr — **Shark River Formation (Eocene)** *subsurface only*
Glauconitic clayey silt and clay, with some glauconite sand and fine glauconitic quartz sand. Deposited in the middle Eocene (Benson and Spoljaric, 1996), and is generally 60 to 70 ft thick. Based on the microfossils (unpublished DGS file data), it can be characterized as an open shelf deposit.

Tmq — **Manasquan Formation (Paleocene to Eocene)** *subsurface only*
Consists of 30 ft of silty, shelly, fine sands that are commonly glauconitic (Benson and Spoljaric, 1996). Deposited during the latest Paleocene to early Eocene (Benson and Spoljaric, 1996). Based on microfossils (unpublished DGS file data), it can be characterized as an open shelf deposit.

Tvt — **Navesink Formation (Upper Cretaceous)** *subsurface only*
Generally a calcareous silt that is slightly to moderately sandy and slightly to moderately clayey. Sand is fine to very fine grained composed of about 50 percent glauconite, 40 percent peloids, and 10 percent quartz. Sediment is laminated, marked by varying amounts of clay and sand. Peloids are yellow to yellowish-brown that to avoid pellets that are calcareous and may contain flakes of chitin and grains of glauconite or quartz. Scattered shell fragments are present but form a minor constituent of the sediment. Uniformly dark-greenish-gray, slightly lighter in color than the overlying Hornerstown Formation. 10 to 20 ft thick.

Kmt — **Marshalltown Formation (Upper Cretaceous)** *mainly in subsurface; in outcrop only at the Chesapeake and Delaware Canal*
Greenish-gray, slightly silty, fine-grained glauconitic quartz sand. Glauconite comprises 30 to 40 percent of the sand fraction. Ranges from 10 to 50 ft in thickness. Extensively burrowed. Interpreted to be marine in origin.

Ket — **Englishtown Formation (Upper Cretaceous)** *mainly in subsurface; in outcrop only at the Chesapeake and Delaware Canal*
Light-gray to white, micaceous, slightly silty to silty, fine-grained, slightly glauconitic quartz sand. In outcrop, it is extensively burrowed with Ophiomorpha burrows. Ranges from 20 to 50 ft in thickness. On the cross-section, the Englishtown is shown only where the sands are well developed. Interpreted to be nearshore marine to tidal flat in origin.

Kmv — **Merchantville Formation (Upper Cretaceous)** *mainly in subsurface; in outcrop only in areas too small to be represented on the map and at the Chesapeake and Delaware Canal*
Light- to dark-gray, very micaceous, glauconitic, very silty fine- to very fine-grained sand to fine sandy silt. Ranges from 20 to 120 ft in thickness. Marine in origin.

Km — **Magothy Formation (Upper Cretaceous)** *mainly in subsurface; in outcrop only in areas too small to be represented on the map and at the Chesapeake and Delaware Canal*
Dark-gray to gray silty clay to clayey silt that contains abundant fragments of lignite; grades downward into a very fine to fine sand with scattered and discontinuous thin beds of clayey silt with lignite fragments. Thickness ranges from 20 to 50 ft. Updip in the vicinity of the Chesapeake and Delaware Canal, the Magothy fills channels incised into the Potomac Formation and is discontinuous in its extent. Interpreted to have been deposited in coastal to nearshore environments.

DISCUSSION

This map shows the surficial geology of New Castle County, Delaware, at a scale of 1:100,000. Maps at this scale are useful for viewing general geologic framework on a county-wide basis, determining the geology of watersheds, and recognizing the relationship of geology to regional or county-wide environmental or land-use issues. This map, when combined with subsurface geologic information, provides a basis for locating water supplies, mapping ground-water recharge areas, and protecting ground and surface water. Geologic maps are also used to identify geologic hazards such as sinkholes and flood prone areas, to identify sand and gravel resources, and for supporting state, county, and local land-use and planning decisions.

The map was compiled from topographic and geologic maps, aerial photographs, geologists' and drillers' logs, geophysical logs, soils maps, and sample descriptions. Samples from drill holes and outcrops were examined for comparison with previous descriptions. Other than the Old College (Ramsey, 2005) and Bridgeton Formations (Owens, 1999; Owens et al., 1970), all geologic units were previously mapped or described in Delaware. Descriptions of geologic units, unless otherwise referenced, were generated by the author after examination of cores, outcrops, and samples from the DGS Core and Sample Repository.

New Castle County encompasses two geologic provinces; the Piedmont, composed of structurally complex bodies of metamorphic and igneous rocks, and the Coastal Plain, composed of seaward-dipping strata of sand, silt, and clay. The boundary between the two provinces is known as the Fall Zone, which, in Delaware, extends from north of Newark to north of the Christina River in Wilmington.

The Piedmont portion of the map not overlapped by Coastal Plain sediments was taken from the previously published map of Schenck, et al. (2000). Some geologic units of limited areal extent and all symbology related to structural geology shown on the Piedmont map do not appear on this map.

The Coastal Plain portion of the map shows the distribution of surficial units that range from the Cretaceous Potomac Formation to modern alluvial deposits in stream valleys. Also shown are large areas of fill where marsh or stream valleys have been covered and where dredge spoil has been placed on uplands along the Chesapeake and Delaware Canal. Coastal Plain deposits along the margins of the Delaware River, such as the Scotts Corners and Lynch Heights Formations, were traced from southern Delaware where they had been previously recognized (Ramsey, 1997). The Delaware Bay Group (undifferentiated) comprises both the Lynch Heights and Scotts Corners Formations where more detailed work is needed to differentiate the two formations in the vicinity of Wilmington.

DISCUSSION (cont.)

The area of the Bryn Mawr Formation on this map is more extensive than that of Woodruff and Thompson (1975). The Bridgeton Formation, of limited extent in Delaware, was traced from Pennsylvania where it had been previously recognized (Owens, 1999; Owens et al., 1970). The Old College Formation (Ramsey, 2005) comprises a significant part of the updip limit of the Coastal Plain along the Fall Zone.

South of the Chesapeake and Delaware Canal, the Cretaceous Mt. Laurel Formation crops out in several broad stream valleys. Other Cretaceous units occur along the Chesapeake and Delaware Canal and in stream valleys both south and north of the canal, but are of limited extent and cannot be depicted on a map of this scale. The Vincentown and Hornerstown Formations are shown where they crop out along tributaries to the Delaware River. These deposits are commonly covered by colluvium but are nevertheless significant enough in extent to be included on the map.

The Columbia Formation, in the southernmost portion of New Castle County, is commonly overlain by scattered, small basins or depressions that have no organized drainage network (undrained). These undrained depressions are commonly filled with water for much of the year and contain organic-rich deposits. Because many of the individual basins are too small to be shown, a dotted pattern on the Columbia Formation indicates the overall distribution of the basins. Basins large enough to be shown on the map appear as swamp (Qsw).

DISCUSSION OF CROSS SECTIONS

A series of four cross sections has been constructed to illustrate the relationship between Piedmont and Coastal Plain units (A-A' and B-B') and the stratigraphic correlations among the Coastal Plain units (C-C' and D-D') in New Castle County. Vertical scale on all cross sections is in feet. Datum on all cross sections is sea level.

Cross Section A-A' is a schematic drawing showing Tertiary and Quaternary fluvial terraces inset into the Piedmont adjacent to the Delaware River. These terraces were created as the Delaware River progressively incised the rocks of the Piedmont over millions of years.

Cross Section B-B' is a schematic drawing showing the relationship of Quaternary surficial deposits in the Newark area. The Old College Formation (Qoc) represents alluvial fan deposits that spread out from the Piedmont onto the Coastal Plain during the Pleistocene and has subsequently been incised by the White Clay Creek (Ramsey, 2005).

Cross section C-C' shows the Cretaceous Potomac stratigraphy to basement along a northwest to southeast trending line. This cross section was developed by R. N. Benson as part of an on-going project to understand the aquifers of the Potomac Formation. The framework for this cross section is based on a geophysical well-log correlation datum that approximates the boundary between the Upper and Lower Cretaceous sediments. The boundary is defined by studies of fossil pollen and spores in samples of sediment cores from two wells near Delaware City and a well near New Castle (McKenna, T. E., et al., 2004). Post-Potomac stratigraphic framework is from Benson and Spoljaric (1996). In this cross section, sedimentary sequences onlap basement in a landward direction. The top of the Potomac Formation is truncated by an erosional unconformity. In updip areas, undifferentiated Quaternary deposits (Qus) overlie the Potomac. Downdip, either the Magothy Formation or the Merchantville Formation overlies the Potomac. Borehole depths are in feet. With the exception of Da55-06, geophysical logs shown are gamma logs; Da55-06 is a spontaneous potential log. Basement identified by boreholes is crosshatched; otherwise, it is inferred and depth is estimated.

Cross Section D-D' is a schematic drawing showing the relationship of the Columbia, Lynch Heights, and Scotts Corners Formations in New Castle County. These units, exclusive of the Old College Formation, form the majority of the surficial geologic units of the Coastal Plain. The Columbia Formation is a widespread fluvial sand deposit that was the result of deposition by glacial melt water. The Lynch Heights and Scotts Corners Formations represent deposition in an estuarine environment during high stands of sea level during the late Pleistocene; the highstand for the Scotts Corners being lower than that of the Lynch Heights.

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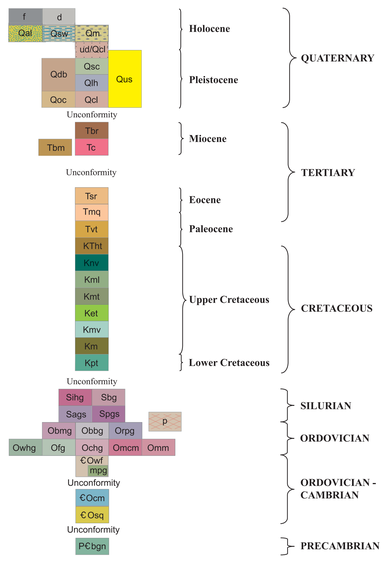
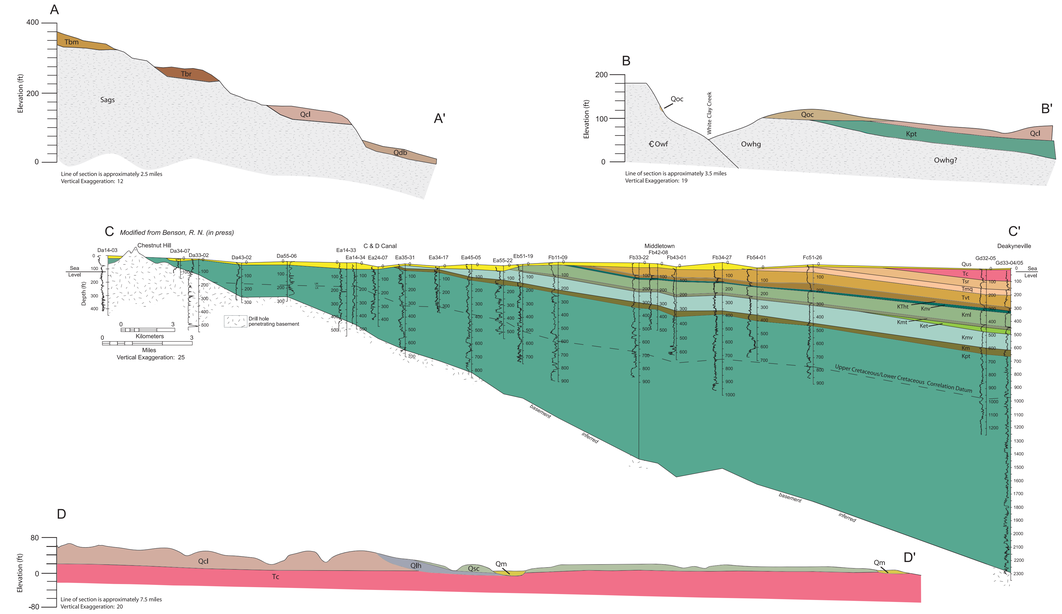
Correlation of Geologic Units





AMENDMENT NO. 2
TO THE 1988 RECORD OF DECISION FOR THE
DELAWARE SAND & GRAVEL LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

Prepared by:

Environmental Protection Agency Region III
1650 Arch Street
Philadelphia, PA 19103

December 2017

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substances and Disease Registry
BCEE	bis(2-chloroethyl)ether
BRA	bioremediation area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	contaminant of potential concern
CSM	Conceptual Site Model
DDA	Drum Disposal Area
DNREC	Department of Natural Resources and Environmental Control
DRBC	Delaware River Basin Commission
DRGHW	Delaware Regulations Governing Hazardous Waste
DS&G	Delaware Sand & Gravel Landfill
eLFExS	enhanced low flow groundwater extraction system
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
ESD	Explanation of Significant Differences
ft-msl	feet above mean sea level
HI	hazard index
HQ	hazard quotient
LFExS	low flow groundwater extraction system
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDL	method detection limit
MNA	monitored natural attenuation
NAPL	nonaqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	non-detect result
NPL	National Priorities List
O&M	operation and maintenance
PFAS	perfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PHE	Public Health Evaluation
PRG	preliminary remediation goal
RCRA	Resource Conservation and Recovery Act
PRM	Potomac Raritan Magothy aquifer system
RAO	remedial action objective
ROD	Record of Decision
RSL	Regional Screening Level
SSDS	sub-slab depressurization system

SVOC	semi-volatile organic compound
SWFT	slurry-wall flood test
TR	target risk
THQ	target hazard quotient
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
UCL	upper confidence limit
UPCU	Upper Potomac Confining Unit
UPCUTZ	Upper Potomac Confining Unit Transition Zone
USACE	United States Army Corps of Engineers
VOC	volatile organic compound

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AMENDMENT NO. 2
TO THE 1988 RECORD OF DECISION FOR THE
DELAWARE SAND & GRAVEL LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

The Delaware Sand & Gravel Landfill (DS&G) Superfund Site (Site or DS&G Site) is located two miles south of the City of New Castle in New Castle County, Delaware. The Site is located along Grantham Lane, east of U.S. Highway 13 (Dupont Highway) and west of Delaware Route 9 (River Road) (see Figure 1). It consists of approximately 27 acres in an area of residential and light-industrial land use and is bounded to the north and northeast by the Norfolk Southern Railroad tracks and to the west by Army Creek which discharges into the Delaware River less than one mile east of the Site. The Army Creek Landfill Superfund Site (Army Creek Landfill) is located immediately west of the Site on the opposite bank of Army Creek.

The National Superfund Database Identification Number for the Site is DED000605972.

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document (ROD Amendment No. 2 or Amendment) modifies the remedy for the Site selected in the April 22, 1988 Record of Decision (1988 ROD), as modified by the September 30, 1993 Amendment to the ROD (ROD Amendment No. 1) and the July 2003 Explanation of Significant Differences (ESD). The U.S. Environmental Protection Agency (EPA) is modifying the remedy for the Site in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. § 9601 et seq. and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, as amended.

The information supporting ROD Amendment No. 2 is contained in the Administrative Record file for the Site which has been developed in accordance with Section 113(k) of CERCLA, 42 U.S.C. § 9613(k). The Administrative Record is available for review online at http://go.usa.gov/xWFuh, at the EPA Region III Records Center located at 1650 Arch Street in Philadelphia, Pennsylvania, and at the Department of Natural Resources and Environmental Control (DNREC) located at 391 Lukens Drive in New Castle, Delaware.

The State of Delaware (State), through DNREC, concurs with modifying the remedy for the Site through ROD Amendment No. 2.

1.3 ASSESSMENT OF THE SITE

The remedy selected in 1988 ROD, as previously amended and as amended by this ROD Amendment No. 2 (Selected Remedy), is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment and

actual or threatened release of pollutants or contaminants which may present an imminent and substantial endangerment to public health or welfare.

1.4 DESCRIPTION OF THE SELECTED REMEDY

The Selected Remedy will address 1) contaminated groundwater in the Upper Potomac Aquifer, including groundwater in the Upper Potomac Confining Unit Transition Zone (UPCUTZ) and groundwater pumped from Artesian Water Company's (Artesian) Llangollen well field; 2) contaminated soil and groundwater within the slurry wall surrounding the former Drum Disposal Area (DDA); and 3) potential vapor intrusion at new construction adjacent to the Inert Area and the Grantham South Area. It does not include response actions that address waste and contaminated soil at the Grantham South Area and the Inert Area, which have already been implemented at the Site as described in the 1988 ROD, ROD Amendment No. 1 and the ESD.

The Selected Remedy consists of components of the remedial action for the Site, which are categorized as follows:

1) Remedial components that were previously selected in the prior decision documents referenced above, but which are not being modified by this ROD Amendment No. 2 (each identified below as an "Existing Component");

2) Remedial components that were previously selected in the prior decision documents, but which are being modified by this ROD Amendment No. 2 (each identified below as a "Modified Component"); and

3) New remedial components that were not previously selected in the prior decision documents (each identified below as a "New Component").

Specifically, the Selected Remedy consists of the following components:

1. Existing Components
   - Slurry-wall system;
   - A composite barrier cap to minimize infiltration of precipitation through contaminated soil contained within the slurry wall surrounding the DDA, and
   - Institutional controls to prevent direct contact with contaminated soil, the installation of drinking water wells on the Site property and other future uses of the Site property which could compromise the effectiveness of the Selected Remedy.

2. Modified Components
   - Hydraulic control of contaminated groundwater within the slurry-wall enclosure using an enhanced low-flow groundwater extraction system (eLFExS);
   - Installation and operation of extraction wells in areas determined to optimize capture and remove contaminant mass from the more highly-impacted areas of the Upper Potomac Aquifer, including the UPCUTZ; and
   - Discharge of groundwater pumped from the DS&G extraction wells to the Wilmington Wastewater Treatment Plant.

3. New Components
   - Pre-design investigations to develop supplemental information regarding source and extent of contamination in the Upper Potomac Aquifer and hydraulic connections between hydrostratigraphic units within the Upper Potomac Aquifer, and confirm target capture zones within the Upper Potomac Aquifer;
   - Continued groundwater extraction at Artesian's Llangollen well field with treatment utilizing existing systems for bis(2-chloroethyl)ether (BCEE) and 1,4-dioxane and, if necessary, additional treatment systems targeting other contaminants of concern (COCs) such as manganese;
   - A groundwater monitoring program to ensure that the remedial action is meeting the short-term goal of plume containment and will meet the long-term goal of aquifer restoration within a reasonable time frame; and
   - Institutional controls to prevent potential future exposure to Site contaminants in indoor air.

The estimated cost of the Selected Remedy is $46,100,000.

1.5 STATUTORY DETERMINATION

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

The Selected Remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

Because this Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be continue to be conducted every five years to ensure that the Selected Remedy is, or will be, protective of human health and the environment. The last five-year review for the Site was conducted in 2015.

1.6 ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Amendment:

- Chemicals of concern and their respective concentrations.
- Baseline risk represented by the chemicals of concern.
- Cleanup levels established for chemicals of concern and the basis for these levels.
- How source materials constituting principal threats are addressed.
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD Amendment No. 2.

- Potential land and groundwater use that will be available at the Site as a result of the Selected Remedy.
- Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy (i.e., a description of how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).

Additional information can be found in the Administrative Record file for this Site.

1.7 AUTHORIZING SIGNATURE

This ROD Amendment No. 2 documents the components of the Selected Remedy for contaminated soil and groundwater remaining at the former DDA, contaminated groundwater in the Upper Potomac Aquifer and potential future vapor intrusion associated with the migration of landfill gas from the Inert Area and Grantham South Area, and is based on the Administrative Record for the Site. EPA selected these components with the concurrence of DNREC. The Director of the Hazardous Site Cleanup Division for EPA Region III has approved and signed this ROD Amendment No. 2.

Karen Melvin

Karen Melvin, Director
Hazardous Site Cleanup Division
EPA Region III

DEC 12 2017

Date

AR319270

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

The Site is located two miles south of the City of New Castle, New Castle County, Delaware. The Site property is located along Grantham Lane, east of U.S. Highway 13 (Dupont Highway) and west of Delaware Route 9 (River Road) (see Figure 1). It consists of approximately 27 acres in an area of residential and light-industrial land use and is bounded to the north and northeast by the Norfolk Southern Railroad tracks and to the west by Army Creek which discharges into the Delaware River less than one mile east of the Site. Artesian's Llangollen well field is located approximately three quarters of a mile southwest of the Site.[1]

The Site property is a former sand and gravel quarry that was later operated as a permitted landfill from 1968 until 1976. It includes four waste disposal areas (see Figure 2). Three of these – the Grantham South Area, the Drum Disposal Area (DDA) and the Inert Area – were unlined gravel pits into which waste materials, including hazardous substances, were disposed. The fourth area, known as the Ridge Area, was used for temporary storage of chemical waste and was impacted by the spillage of hazardous substances. Approximately 550,000 cubic yards of industrial and municipal wastes and construction rubble were disposed of at the Site, including approximately 15,000 drums containing liquids and sludge from chemical production, manufacturing and petroleum refining processes.

The Army Creek Landfill Superfund Site (Army Creek Landfill) is located immediately west of the Site on the opposite bank of Army Creek. The 50-acre Army Creek Landfill is an abandoned sand and gravel quarry that was operated as an unlined landfill for the disposal of 1.9 million cubic yards of municipal and industrial waste from 1960 through 1968. In September 1986, EPA issued a Record of Decision (ROD) for the Army Creek Landfill, selecting a source control and aquifer restoration remedy; in June 1990, EPA issued a ROD for Operable Unit 2 at the Army Creek Landfill, which called for treatment to remove iron from recovered groundwater prior to its discharge to Army Creek.

In addition to the Site property, the Site includes areas to the south and southwest where hazardous substances have been transported in groundwater.

The CERCLA identification number for the Site is DED000605972.

EPA is the lead agency for Site activities, and DNREC is the support agency. The United States, on behalf of EPA, and the State of Delaware, on behalf of DNREC, have reached prior settlements with potentially responsible parties (PRPs) under which the PRPs have performed, and are performing, the response actions selected in the 1988 ROD and ROD Amendment No. 1.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Local officials first discovered groundwater degradation in the Upper Potomac Aquifer in 1971 when landfill leachate constituents were detected in a residential well near the Army Creek

[1] The production wells in Artesian's Llangollen well field are shown in Figure 8 of this ROD Amendment No. 2.

Landfill. In 1973, Army Creek Landfill owner and operator, New Castle County (County), installed groundwater recovery wells in the Upper Potomac Aquifer between the Army Creek Landfill and Artesian's Llangollen well field to intercept and contain the contaminant plume emanating from the Army Creek Landfill. Subsequently, the County modified its groundwater recovery well network, moving pumping locations closer to the Army Creek Landfill to improve system performance.

In 1975, the State installed several monitoring wells at the Site and initiated enforcement action against the Delaware Sand & Gravel Company, owner and operator of DS&G, for violations of the State solid waste permit. In 1976, the State Attorney General's office ordered DS&G closed.

In 1980, the State reduced and capped the permitted groundwater withdrawal rate from Artesian's Llangollen well field, and Artesian extended public water supply lines to residences along Grantham Lane and the Llangollen Estates subdivision south of the Site.

EPA placed the Site on the National Priorities List (NPL) on September 8, 1983. In 1984, EPA and DNREC performed an emergency removal of more than 1,600 drums from the surface of the DDA and Ridge Area. DNREC conducted a remedial investigation and feasibility study at the Site from 1984 to 1987. In April 1988, EPA issued a ROD selecting on-site incineration of contaminated soil and waste materials at the DDA and the Ridge Area, construction of a Resource Conservation and Recovery Act (RCRA) Subtitle C (composite barrier) cap over the Grantham South Area, installation of a RCRA Subtitle D (single barrier) cap over the Inert Area, and collection and treatment of contaminated groundwater with discharge of treated water to Army Creek.

From 1989 to 1991, the United States Army Corps of Engineers (USACE), on behalf of EPA, constructed the landfill cap over the Grantham South Area. The State of Delaware assumed responsibility for monitoring and maintenance of the Grantham South Area in October 1992.

In 1991, 18 PRPs entered into a Consent Decree under Sections 106 and 107 of CERCLA with the United States, on behalf of EPA, and the State, on behalf of DNREC, concerning the adjacent Army Creek Landfill (1991 Consent Decree). Under the 1991 Consent Decree, the County agreed to install and operate a groundwater treatment plant and continue to operate groundwater recovery wells to 1) control the migration of contaminants released from the Army Creek Landfill and DS&G Sites into the Upper Potomac Aquifer and 2) restore groundwater quality downgradient of the Army Creek Landfill property boundary to primary drinking water standards. The additional signatories to the 1991 Consent Decree installed a multilayer cap at the Army Creek Landfill from 1992 to 1993.[2]

Between 1991 and 1993, USACE conducted pre-design investigations at the Site which showed that contamination at the DDA was more widespread and heterogeneous than previously recognized. In 1992, EPA determined that buried drums at the DDA posed an imminent threat

[2] Although the County and the other PRPs agreed in the 1991 Consent Decree to undertake separate tasks, the PRPs therein agreed that they were jointly and severally liable to comply with all of the requirements of the 1991 Consent Decree, including operation and maintenance of the groundwater treatment plant and maintenance of the Army Creek Landfill cap.

and entered into an Administrative Order on Consent under Section 106 of CERCLA with 22 PRPs who agreed to design and construct a subsurface slurry wall around the DDA as an interim removal action.

Based on the results of the pre-design investigations performed by USACE, EPA reassessed the remedy selected in the 1988 ROD and issued ROD Amendment No. 1 in September 1993. ROD Amendment No. 1 upgraded the selected cover system for the Inert Area to a RCRA Subtitle C cap and changed the selected remedy for contaminated soil at the DDA and the Ridge Area from excavation and on-site incineration to enclosure within a slurry wall containment system, including a RCRA Subtitle C cap, with *in-situ* treatment by soil vapor extraction and bioventing.

In 1994, the PRPs installed a three-foot-thick soil-bentonite slurry wall, ranging in depth from 17 to 57 feet and keyed into the underlying clay stratum, around a three-acre area encompassing the DDA and the surrounding soils affected by historical releases from the DDA. EPA accepted the PRPs' certification of completion of slurry wall construction in February 1995.

In June 1995, 31 PRPs, referred to as the DS&G Remedial Trust, agreed in a Consent Decree (1995 Consent Decree) entered under Sections 106, 107 and 113 of CERCLA with the United States, on behalf of EPA, and the State of Delaware, on behalf of DNREC, to implement the modified response actions selected in the 1993 ROD Amendment and to monitor and maintain the Grantham South Area.

From 1996 to 1997, under the 1995 Consent Decree, the DS&G Remedial Trust constructed a RCRA Subtitle C landfill cap over the Inert Area. EPA accepted the Remedial Action Report documenting completion of cap construction in September 1997.

From 1995 to 1997 the DS&G Remedial Trust completed remedial action and construction activities at the DDA and the Ridge Area. Approximately 5,000 tons of PCB-contaminated soil, drum carcasses, contaminated solids, asbestos containing materials and hazardous liquids were excavated or removed and transported to permitted facilities for disposal. The remainder of the soil excavated from the Ridge Area and the DDA was combined with woodchips, sand and di-ammonium phosphate to encourage bioremediation of the soil contaminants and placed in a bio-cell within the slurry wall surrounding the DDA. A dewatering system and a bioventing system were installed to enable circulation of oxygen-enriched air throughout the contaminated soil within the slurry wall, and a temporary cap was constructed over the bioremediation area (BRA). EPA issued a Preliminary Close Out Report documenting the completion of construction activities for all cleanup actions at the Site in August 1997.

The DS&G Remedial Trust began operating the dewatering and bioventing systems at the BRA in 1997. In 1998, the DS&G Remedial Trust's consultant, McLaren/Hart, Inc., noted that upward seepage from the Potomac Aquifer into the Columbia Aquifer due to artesian pressure would likely preclude the complete dewatering of the soil at the BRA.

In 1999, BCEE, a Site-related COC, was detected in groundwater at the Llangollen well field. In 2000, Delaware's Department of Health and Social Services proposed an interim health advisory level for BCEE (0.096 micrograms per liter [µg/L]), and Artesian installed a granular activated

carbon system to remove BCEE from groundwater pumped from the Llangollen well field prior to its distribution to customers.

EPA issued an ESD in July 2003 to clarify and modify the land and groundwater use restrictions previously selected for the Site. EPA then issued Unilateral Administrative Orders (UAOs) under Section 106 of CERCLA to the three separate owners of the Site property in 2004, 2006 and 2008, respectively, requiring the respondents of the respective UAOs to provide Site access and implement institutional controls in order to establish those land and groundwater use restrictions. Respondents to the 2006 and 2008 UAOs have complied with the terms of their respective UAO. EPA is working to secure full compliance from the former operator and current owner of DS&G with the requirements of the 2004 UAO. Toward that end, on September 22, 2017, the United States Department of Justice, on behalf of EPA, filed a complaint to compel the former operator and current owner of DS&G to comply with the 2004 UAO.

In May 2004, the dewatering of the BRA was suspended with EPA approval to allow water levels within the slurry wall to rise during the course of a six-month pilot study proposed by the DS&G Remedial Trust. The primary purpose of the "slurry-wall flood test" (SWFT) was to evaluate the impacts, following several years of bioventing, of the remaining soil contamination on shallow groundwater at the BRA. Groundwater monitoring performed during the SWFT suggested that the soil contamination remaining at the BRA was continuing to impact shallow groundwater.

In July 2004, EPA approved the County's related pilot study proposal to suspend operation of the Army Creek Landfill groundwater recovery and treatment system for one year and refocus groundwater recovery efforts in the area immediately downgradient of the former DDA where the highest BCEE concentrations had been observed. One objective of the pilot study was to determine whether rebounding groundwater elevations in the Upper Potomac Aquifer and the Columbia Aquifer would cause new releases of hazardous substances to groundwater or Army Creek. An additional objective was to evaluate focused source control measures as an alternative to the high-volume groundwater extraction required to maintain a groundwater divide between the two Superfund sites and the Llangollen well field. The County shut down the Army Creek Landfill groundwater recovery wells in October 2004 and began pumping groundwater from extraction well PW-1 to capture releases from the DDA and discharging the groundwater to the City of Wilmington's wastewater treatment plant. The County did so through a cost-sharing agreement with the DS&G Remedial Trust.

During the SWFT and the County's pilot study, groundwater elevations were monitored in the Columbia and Upper Potomac Aquifers in the vicinity of the DDA/BRA. Based on the observed hydraulic connection between the Upper Potomac Aquifer and the Columbia Aquifer, which prevented dewatering of the soil within the slurry wall and resulted in ongoing releases of dissolved-phase contaminants from the DDA/BRA into the Upper Potomac Aquifer, EPA concluded that the remedial action at the DDA was not performing as intended. EPA's Third Five-Year Review Report for the Site, issued in 2005, recommended that the DS&G Remedial Trust reassess the response actions at the DDA/BRA.

In June 2006, DNREC established a groundwater management zone in the vicinity of the Site which placed restrictions and conditions on the installation of new public or domestic water supply wells to prevent potential exposure to contaminated groundwater.

EPA approved several extensions of the County's pilot study and the SWFT through early May 2009. Groundwater monitoring during this period showed that maximum contaminant levels (MCLs) for primary drinking water contaminants promulgated pursuant to the Safe Drinking Water Act, 42 U.S.C. §§ 300f et seq., and codified at 40 CFR Part 141, had been met at the Army Creek Landfill property boundary and that the BCEE groundwater plume originated at the DDA and not the Army Creek Landfill. On May 4, 2009, EPA notified the County that renewed operation of the Army Creek Landfill groundwater collection and treatment system would not be required, consistent with the terms of the 1991 Consent Decree. In order to capture BCEE and other contaminants released from the DDA into the Upper Potomac Aquifer, the County continued to operate extraction well PW-1 until October 15, 2012, when the DS&G Remedial Trust assumed hands-on responsibility for the operation of the well and began implementing measures to maintain more consistent extraction rates. Since October 2012, EPA has provided funding for the operation of extraction well pursuant to a Disbursement Agreement between EPA and the DS&G Remedial Trust and New Castle County. Under the terms of the Disbursement Agreement, EPA reimburses the DS&G Remedial Trust and the County for costs incurred in operating PW-1 with funds from site-specific special accounts for both the Army Creek Landfill and the Site.

In 2008, EPA requested that the DS&G Remedial Trust implement additional response actions at the DDA to provide hydraulic containment of the source area. In May 2009, the DS&G Remedial Trust began operating a low flow groundwater extraction system (LFExS) within the slurry wall to mitigate the release of contaminants from the DDA into the Upper Potomac Aquifer. Groundwater from the system is discharged to the City of Wilmington's wastewater treatment plant in Wilmington, Delaware. Because the LFExS utilizes components of the BRA bioventing system, it was necessary to terminate bioventing operations to implement this interim source control measure. Vertical head differences observed between the Columbia Aquifer and the Upper Potomac Aquifer in the vicinity of the DDA indicate that the LFExS has generally induced an upward gradient across the most impacted portions of the slurry-wall containment area since October 2012 and, as such, has mitigated the release of contaminated groundwater from the DDA into the Upper Potomac Aquifer.

In April 2010, EPA notified the DS&G Remedial Trust of the need to perform additional Site characterization and a feasibility study to evaluate additional response actions for the DDA source area and the impacted Upper Potomac Aquifer, including the Llangollen well field.

2.3 COMMUNITY PARTICIPATION

The Proposed Remedial Action Plan (Proposed Plan) for the Site and supporting documents were made available to the public in September 2016. These documents, including the *Supplemental Site Characterization Report – Revision 2* (Golder Associates, 2016), the *Development of Site-Specific Remediation Goals – Revision 2* (Golder Associates, 2014), the *Final Feasibility Study – Revision 1* (Golder Associates, 2016) (Feasibility Study) and other documents which formed the basis of EPA's remedy selection are located in the Administrative Record file which can be

viewed at http://go.usa.gov/xWFuh and the information repositories maintained at the U.S. EPA Region III office located at 1650 Arch Street in Philadelphia, Pennsylvania, and the DNREC office located at 391 Lukens Drive in New Castle, Delaware. The notice of the availability of these documents was published in the *Delaware News Journal* on September 7, 2016. In addition, EPA sent a fact sheet summarizing EPA's preferred remedial alternative to residences and businesses near the Site in September 2016. From September 7, 2016, to October 7, 2016, EPA held a 30-day public comment period to accept public comment on the remedial alternatives presented in the Feasibility Study and the Proposed Plan and the other documents contained within the Administrative Record file for the Site. On September 21, 2016, EPA held a public meeting to discuss the Proposed Plan and accept comments. A transcript of this meeting is included in the Administrative Record file. The summary of significant comments received during the public comment period and EPA's responses are included in the Responsiveness Summary in Section 3 of this ROD Amendment No. 2.

2.4 SCOPE AND ROLE OF RESPONSE ACTION

Previously implemented response actions addressing groundwater and the DDA have not performed as expected. The response action selected in this ROD Amendment No. 2 modifies the remedy selected for groundwater in the 1988 ROD and the remedy selected for the DDA in the 1993 ROD Amendment, and adds requirements to mitigate potential vapor intrusion due to the migration of landfill gas for habitable new construction.

The Selected Remedy would restore contaminated groundwater in the Upper Potomac Aquifer to beneficial use within a reasonable time frame, prevent exposure to Site contaminants in drinking water, effectively mitigate the release of contaminants from the DDA into the Upper Potomac Aquifer, prevent exposure to contaminated soil at the DDA and eliminate potential future exposure to Site-related contaminants in indoor air.

2.5 SITE CHARACTERISTICS

2.5.1 Surface Features, Land Use, Drainage, Geology and Hydrogeology

Surface Features and Land Use

The Site topography is generally characterized as flat to gently rolling with small isolated areas of steeper slopes which are generally remnants of prior quarrying activities. The elevation at the Site and the surrounding areas vary from about 44 feet above mean sea level (ft-msl) to 4 ft-msl with elevations typically between 20 and 30 ft-msl. Regionally, the area generally slopes to the south and east toward the Delaware River. The majority of the Site is covered by grasses as a result of prior excavation, filling and capping activities. Wooded areas surround the perimeter of the Site in the areas where no prior excavation activities occurred.

The current land use around the Site is residential, light industrial, and commercial in nature. Based on New Castle County's zoning map, the surrounding areas are zoned for mixed residential, commercial, and/or industrial uses; therefore, the current land use is anticipated to continue for the foreseeable future. There are multiple residential developments within one mile of the Site, the closest of which is the Llangollen Estates development located less than a mile

southwest of the Site, between DuPont Parkway and River Road. Commercial and/or industrial properties are located to the east and south of the Site along Grantham Lane and River Road.

Drainage

There are many natural and man-made features at the Site that govern surface water drainage patterns. The Site drainage is dominated by Army Creek, which generally runs west to east and drains into the Delaware River about one mile east of the Site. Tide gates are in place to prevent the tidal surge in the Delaware River from entering Army Creek and Army Pond. Multiple man-made drainages branch off from Army Creek to the north and northwest. The man-made drainages were created during previous Site activities and generally consist of shallow, grassed channels.

Regional Geology and Hydrogeology

The geologic formations present beneath the Site are the Quaternary-age Columbia Formation and the Upper Cretaceous-age Potomac Formation. The Columbia Formation is a narrow, linear upper valley fill and a broader lower valley fill of sands and gravel deposited during the Pleistocene Epoch. The narrow valley fill deposits were transported to the southwest into Delaware along the ancestral channel of the Delaware River as distal glacial outwash. These deposits occur parallel with, and to the west of, the Delaware River in the northern Coastal Plain of Delaware.

The Columbia Formation ranges in thickness from about 10 feet to as much as 100 feet in deeply incised areas. Near the base of the formation, the sands may be fine- to coarse-grained with variable amounts of coarse to fine gravels; the basal section of the gravels may be cemented by iron oxides. In the vicinity of the Site, the base of the lowest gravel horizons resting on the underlying Potomac Formation ranges from elevations of about 12 feet above mean sea level to as much as 25 feet below mean seal level. These varying elevations correspond to the undulating surface of the eroded top of the Potomac Formation. The near surface deposits of the Columbia Formation represent the surficial, water table aquifer in the northern Coastal Plain of Delaware and are referred to as the Columbia Aquifer.

The Potomac Formation is the uppermost hydrogeologic formation of the regional Potomac Raritan Magothy aquifer system (PRM) in the Site area. The PRM dips southeast and east at about 100 feet per mile. The Potomac Formation is several hundred feet thick east and down-dip of the Site, and is further divided into the “upper,” “middle” and “lower” sand deposits separated by intervening and finer grained silty clays and clays. Its stratigraphy is represented by proximal, stream-deposited sands, silts, clays and gravels accumulated in an estuarine, marginal marine basin. The uppermost portion of the Potomac Formation consists of a stiff, red to grey, reddish-grey and occasionally brick red, variegated clay or silty clay overlying proximal, grey to light tan and pale brown sands and gravels. This horizon is highly variable, not only in its depositional thickness, but also because of erosion and incision by channels active during the Pleistocene Columbia Formation time. Site investigations have focused on the upper sand deposit of the Potomac Formation which is referred to as the Upper Potomac Aquifer in Site documents.

Regionally, there are two aquifer units used for water supply, the Columbia Aquifer and the Upper Potomac Aquifer. The Columbia Aquifer is a water table aquifer underlain and separated from the Upper Potomac Aquifer by the Upper Potomac Confining Unit (UPCU), a regionally thick, competent clay unit.

Site-Specific Geology and Hydrogeology

In the Site area, the Columbia Aquifer rests unconformably upon the upper portion of the Potomac Formation. The Site is located in the up-dip feather-edge of the Potomac Formation and its stratigraphy is represented by proximal, stream-deposited sands, silts, clays and gravels accumulated in an estuarine, marginal marine basin. Given these depositional conditions, the lateral and vertical distribution of sand, silt, clay and gravel is quite varied. In the area of the Site, the Upper Potomac Aquifer is generally separated from the overlying Columbia Formation by the UPCU. The top of the UPCU generally slopes to the north and northwest beneath the Site. Subcrop zones (zero-clay areas) where the UPCU has been eroded away and replaced by sands, gravels and cobbles have been identified at and near the Site, as evidenced by the presence of the Columbia basal gravel unit in areas where paleochannels exist. In the subcrop zones, the Columbia Aquifer is in direct contact with the generally fining-upward sequence that is present between the UPCU and the top of the Upper Potomac Aquifer upper sand (discussed below). This key hydrostratigraphic unit, referred to as the UPCUTZ at the Site, displays evidence of bedding/discontinuous sandy layers. Beneath the UPCUTZ, the Upper Potomac Aquifer is approximately 75 to 100 feet thick in the area of the Site. Within the Upper Potomac Aquifer there is an intermittent clay unit, referred to in Site documents as the Upper Potomac Dividing Clay (UPDC), which separates the Upper Potomac Aquifer into two sand units, the upper sand of the Upper Potomac Aquifer and lower sand of the Upper Potomac Aquifer.

In the area of the Site, Columbia Aquifer groundwater is recharged by precipitation, except in areas at the DS&G and Army Creek Landfill Sites where landfill caps reduce infiltration. The groundwater flow direction in the Columbia Aquifer at the Site is generally to the northwest toward Army Creek which discharges to the Delaware River to the northeast of Site. The Upper Potomac Aquifer receives recharge directly from a subcrop zone immediately north and west of the Site and indirectly as vertical leakage from the overlying Columbia Aquifer and the underlying Middle Potomac Aquifer and/or Lower Potomac Aquifer. Groundwater in the Columbia Aquifer at the Site, outside the slurry-wall enclosure at the DDA, drains through the subcrop zone (zero-clay area) into the Upper Potomac Aquifer. The Upper Potomac Aquifer is a confined aquifer except in areas near the zero-clay areas where the Upper Potomac Aquifer is semi-confined. Artesian operates public water supply wells in the Upper Potomac Aquifer at its Llangollen well field located to the south and southwest of the Site. The general groundwater flow direction in the Upper Potomac Aquifer is to the south/southeast or southwest toward Artesian's Llangollen well field. Prior to the groundwater withdrawals in this area, the natural groundwater flow was probably from the Columbia Aquifer through the zero-clay areas, into the Upper Potomac Aquifer and toward the Delaware River located to the east of the Site.

The head differences measured between wells screened in the Columbia Aquifer and the Upper Potomac Aquifer generally indicate a downward vertical gradient between the Columbia Aquifer and the Upper Potomac Aquifer, except where the operation of the LFExS is creating upward vertical gradients within the slurry-wall containment area at the DDA. Due to extraction

predominantly from the Upper Potomac Aquifer lower sand at Artesian's Llangollen well field, there is typically a downward vertical gradient from the Upper Potomac Aquifer upper sand to the Upper Potomac Aquifer lower sand between the well field and the DS&G and Army Creek Landfill Sites.

2.5.2 Previously Implemented and Ongoing Remedial Measures

Several remedial measures have been undertaken at the Site, some of which have been incorporated into, or modified by, the Selected Remedy. As discussed in Section 2.2, herein, EPA and DNREC removed drummed chemical wastes from the surface of the DDA and the Ridge Area in 1984 and disposed of this material at a permitted off-site facility. From 1989 to 1991, EPA installed a landfill cap at the Grantham South Area.

In 1991, New Castle County agreed to operate the groundwater recovery wells it had installed to capture releases from the Army Creek Landfill so that contaminants released from the DS&G Site into the Upper Potomac Aquifer would also be captured. In 1994, the DS&G Remedial Trust installed a slurry wall, which is keyed into the underlying UPCU, around the DDA.

From 1995 to 1997, the DS&G Remedial Trust conducted the following additional response actions at the Ridge Area and the DDA: excavation of buried wastes and highly contaminated soil and disposal of the material at permitted off-site facilities; excavation of additional contaminated soil from the Ridge Area and consolidation of this material with the contaminated soil remaining at the DDA; installation of dewatering and bioventing systems within the slurry-wall enclosure; and construction of a temporary cap above the area contained within the slurry wall. From 1996 to 1997, the DS&G Remedial Trust installed a landfill cap above the Inert Area. The DS&G Remedial Trust operated the bioventing system within the slurry-wall enclosure from 1997 until 2009. When the bioventing system was shut down in 2009, the DS&G Remedial Trust began operating the LFExS to provide hydraulic containment at the DDA.

In 2004, New Castle County shut down the Army Creek Landfill groundwater recovery wells and began pumping groundwater from extraction well PW-1 at the DS&G Site and discharging the groundwater to the City of Wilmington's wastewater treatment plant (through the cost-sharing agreement with the DS&G Remedial Trust); in 2012, the DS&G Remedial Trust assumed hands-on responsibility for the operation and maintenance of extraction well PW-1.

From July to September 2017, the DS&G Remedial Trust installed a landfill gas mitigation system along the perimeter of those sections of the Inert Area and the Grantham South Area that are adjacent to existing habitable structures, to prevent the migration of landfill gas toward potential receptors.

The slurry wall, LFExS and groundwater extraction well PW-1 are components of the Selected Remedy.

2.5.3 Supplemental Site Characterization

Summary and Findings of Recent Investigations

Additional Site characterization was performed in accordance with Golder Associates' October 2011 *Feasibility Study Work Plan – Revision 2*, submitted on behalf of the DS&G Remedial Trust, to support the evaluation of additional response actions for the DDA and the impacted Upper Potomac Aquifer. Toward that end, the following activities were performed from 2011 through 2013:

- Soil borings were advanced at five locations within the slurry-wall containment area and soil samples were collected and analyzed for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Soil samples were also collected and visually inspected to evaluate the micro-stratigraphy of the UPCU beneath the DDA.
- A new monitoring well was installed in the Columbia Aquifer between the northern section of the slurry wall and the railroad track. A soil sample collected from the well borehole was analyzed for VOCs and SVOCs.
- 25 new monitoring wells were installed in the Upper Potomac Aquifer at and downgradient of the DDA. Borings were advanced using rotosonic drilling with vertical aquifer profiling to assist in the selection of screened intervals. Soil samples were collected from the UPCUTZ and analyzed for VOCs and SVOCs to evaluate the potential for contaminants to leach into the upper sand and the potential presence of non-aqueous phase liquid (NAPL). Well screens were set across the UPCUTZ (11 wells) and the upper (11 wells) and lower (3 wells) sand units of the Upper Potomac Aquifer.
- Groundwater samples were collected from new and previously existing monitoring wells and analyzed for VOCs, SVOCs and metals.
- Aquifer testing was performed to determine aquifer hydraulic properties.

The results and findings of the field activities and data evaluations are described in detail in the *Supplemental Site Characterization Report - Revision 2* and are summarized below:

- Contaminants, including benzene, ethylbenzene, xylenes and BCEE, are present in both saturated and unsaturated soil within the slurry-wall containment area.[3] The maximum concentrations of these contaminants detected in soil samples collected in 2011 are 1,100 micrograms per kilogram (µg/kg), 12,000 µg/kg, 59,000 µg/kg and 330 µg/kg, respectively. Benzene, ethylbenzene and xylenes were also found in the soil sample collected between the slurry wall and the railroad track, but the concentrations were one to two orders of magnitude lower than the concentrations within the slurry-wall containment area.
- Contaminants, including benzene, ethylbenzene, xylenes and BCEE, are present in soil in the UPCUTZ at concentrations that are lower than those detected in soil at the DDA. The

[3] Analytical results for 1,4-dioxane in soil samples collected within the slurry-wall containment area are not available because 1,4-dioxane was not included on the target analyte list when the samples were collected. The presence of 1,4-dioxane in groundwater within the containment area suggests that 1,4-dioxane is also present in the soil.

maximum concentrations of these contaminants detected in UPCUTZ soil samples collected in 2012 and 2013 are 1,000 µg/kg, 120 µg/kg, 400 µg/kg and 12 µg/kg, respectively. 1,4-dioxane is also present in soil in the UPCUTZ (up to 390 µg/kg).

- A plume of groundwater contaminants extends from the DDA through the Upper Potomac Aquifer to the Llangollen well field, nearly one mile downgradient.[4] The primary organic COCs are BCEE and 1,4-dioxane.[5] EPA's Integrated Risk Information System (IRIS) characterizes BCEE as a B2 probable human carcinogen and 1,4-dioxane as likely to be carcinogenic to humans. BCEE and 1,4-dioxane are particularly mobile in the subsurface because they are highly soluble in water and do not readily adsorb to soil. The highest BCEE concentrations are found in the UPCUTZ immediately downgradient of the DDA (up to 690 µg/L) and in the upper sand of the Upper Potomac Aquifer (180 µg/L at monitoring well P-6). The highest 1,4-dioxane concentrations are also found in the UPCUTZ immediately downgradient of the DDA (up to 2,800 µg/L) and in the upper sand (390 µg/L at monitoring well P-6). BCEE (160 µg/L) and 1,4-dioxane (850 µg/L) are also found in the UPCUTZ near monitoring well P-6 which is located immediately east of the Grantham South Area.[6] The highest concentrations of BCEE and 1,4-dioxane detected in the lower sand of the Upper Potomac Aquifer are 36 µg/L and 150 µg/L, respectively, at monitoring well UPA-03D. BCEE and 1,4-dioxane concentrations in groundwater in the Upper Potomac Aquifer in 2013 are depicted in Figures 3A - D and 4A - D, respectively. The minimum and maximum detected concentrations of all of the groundwater COCs is included in Table 1 in Appendix A[7] of this Amendment.
- Elevated concentrations of dissolved metals, particularly iron, manganese, arsenic and cobalt, in groundwater within a portion of the Upper Potomac Aquifer have resulted from redox conditions in the aquifer caused by releases from both DS&G and the Army Creek Landfill. The extent to which each site is contributing to elevated redox-sensitive metals concentrations in areas of the Upper Potomac Aquifer has not been confirmed. The highest concentrations of these metals observed in the Upper Potomac Aquifer, excluding the UPCUTZ, are as follows: iron at 31,000 µg/L at monitoring well DDA-01; manganese at 12,800 µg/L at monitoring well DDA-03; arsenic at 6.6 µg/L at monitoring well MW-28; and cobalt at 180 µg/L at monitoring well DDA-03.[4]
- Manganese concentrations in the downgradient portion of the plume (monitoring wells UPA-02D and MW-26N) have been generally increasing since 2011, and manganese was detected at 1,900 µg/L in the sample collected from monitoring well MW-26N in April 2016. Dissolved manganese concentrations in groundwater in the Upper Potomac Aquifer in 2013 are depicted in Figures 5A - B.
- Concentrations of certain contaminants (e.g., ethylbenzene, 1,2,4-trimethylbenzene and xylenes) in soil and/or groundwater suggest the potential presence of residual NAPL in

[4] Unless otherwise noted, reported concentrations are for samples collected during the March/April 2013 groundwater monitoring event.

[5] In 2014, Artesian installed an ultraviolet/hydrogen peroxide treatment system to remove 1,4-dioxane from groundwater pumped from the Llangollen well field.

[6] The reported concentrations were detected in groundwater samples collected from monitoring well UPA-101-TZ in December 2013.

[7] Appendix A includes Tables 1-7 of Golder Associates' *Revised Addendum to Development of Site-Specific Preliminary Remediation Goals – Revision 2*, October 2017.

the Columbia Aquifer at the DDA. In addition, xylene concentrations in groundwater suggest the potential for residual NAPL in the UPCUTZ in the immediate vicinity of the DDA.

Groundwater Modeling

A groundwater flow model was developed for the Site to further evaluate the conceptual site model (CSM), which is discussed in Section 2.5.4, below, and to support the development and analysis of remedial alternatives for the Feasibility Study. The groundwater flow simulations were performed using MODFLOW-NWT and particle tracking was performed with MODPATH Version 5. The model was used for two purposes. First, it was used to evaluate key aspects of the CSM, such as groundwater flux through the UPCUTZ and contaminant migration from the Upper Potomac Aquifer upper sand unit to the Upper Potomac Aquifer lower sand unit. Second, the model was used to predict capture zones for potential future groundwater extraction scenarios to optimize capture and containment and provide mass removal within the more highly contaminated areas of the UPCUTZ and the Upper Potomac Aquifer. A detailed description of the groundwater flow model can be found in Golder Associates' April 2015 *Detailed Analysis of Alternatives* which can be found in Appendix K in the Feasibility Study.

Aquifer restoration time frames for the remedial alternatives evaluated in the Feasibility Study were also estimated based on particle tracking using the Site-specific groundwater flow model and the application of modifying factors based on pore volume exchanges calculated with the assistance of simplified one- or two-dimensional transport models which accounted for retardation, dispersion and initial concentrations of contaminants. A detailed description of the methodology for estimating restoration time frames can be found in Appendix O of the Feasibility Study.

Vapor Intrusion Investigation

Vapor intrusion is the migration of VOCs from the subsurface into overlying buildings. Soil and groundwater contaminated with VOCs can emit vapors that may migrate through subsurface soil and eventually enter buildings through cracks or other conduits in basement floors, walls or foundations. In 2006, the DS&G Remedial Trust evaluated the potential for contaminated groundwater at the DS&G Site to adversely affect indoor air quality at buildings in the immediate vicinity of the Site. The study concluded that contaminated groundwater within the Upper Potomac Aquifer did not present unacceptable risks, due to potential vapor intrusion, to residents or workers in buildings near the Site. In August of 2006, the DS&G Remedial Trust expanded the scope of the vapor intrusion investigation: their consultant collected soil gas samples from shallow vapor probes and landfill gas monitoring wells near buildings in proximity to the Site and analyzed the samples for VOCs. VOC concentrations in indoor air were modeled based on VOC concentrations in the soil gas, and the estimated indoor air levels were used in a risk assessment.[8] The study concluded that VOCs in soil gas did not present an unacceptable risk, as a result of potential vapor intrusion, to residents or workers in the buildings near the Site. However, conditions encountered in the field during the investigation (shallow groundwater at

[8] Indoor air concentrations were estimated with Version 3.1 of the Johnson and Ettinger vapor intrusion model.

depths of 4 to 5 feet below ground surface) precluded collection of sub-slab soil gas samples at an office building adjacent to the Inert Area. In addition, the presence of shallow groundwater prevented the collection of soil gas samples from vapor probes installed between the office building and the Inert Area.

In April and June 2013, the DS&G Remedial Trust collected indoor and outdoor ambient air samples at the office building adjacent to the Site when the low levels of methane detected in the building's basement during quarterly monitoring of the Inert Area exceeded the threshold for additional monitoring established by EPA. The samples were submitted to a laboratory for analysis of VOCs. The following VOCs were detected at concentrations above EPA's industrial screening levels in one or both indoor air samples which were collected from the basement of the office building: benzene, 1,4-dichlorobenzene, ethylbenzene, trichloroethene, 1,1,2,2-tetrachloroethane, 1,2,4-trimethylbenzene, 1,2-dibromoethane, 1,2,3-trichloropropane and xylenes. 1,4-dichlorobenzene was also found in the outdoor air sample at a concentration above the screening level. It was not determined whether the VOCs detected in the indoor air samples were caused by landfill gas migration from the Inert Area into the basement of the building, other potential sources within or near the building, or a combination of the two. However, due to the persistent detection of methane at 100 percent of the lower explosive limit along the perimeter of the Inert Area near the building, and the detection of methane outside the building near the window wells, it was evident that landfill gas migration was occurring.

In November 2014, the DS&G Remedial Trust installed and began operating a sub-slab depressurization system (SSDS) in the office building and the adjoining automotive repair shop to mitigate the potential for migration of vapors, including methane, into the building. Confirmatory indoor air samples and an ambient air sample were collected in December 2014, 30 days following installation of the SSDS. The indoor air samples were collected from both the unfinished basement and the first floor of the office building, as well as the office space in the repair garage.

EPA reviewed the confirmatory sample analytical results and found that the VOCs detected in the indoor air while the system was in operation were within EPA's acceptable risk range. Based on EPA's evaluation of the performance testing results, the SSDS is operating as designed and is inducing vacuum conditions beneath the slab to mitigate the potential for sub-slab vapors to enter the building.

The DS&G Remedial Trust is sampling indoor air at the office building and adjoining repair shop every five years during the heating season in accordance with the operation and maintenance (O&M) plan for the Inert Area.

Additional Groundwater Monitoring Performed by EPA

In October 2013 and April 2015, EPA obtained groundwater samples from selected Site monitoring wells and analyzed the samples for perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS) and other perfluoroalkyl substances (PFAS). PFOA was detected in these samples at concentrations up to an estimated 273 nanograms per liter (ng/L). PFOS was detected at concentrations up to an estimated 26.8 ng/L. The DS&G Remedial Trust began monitoring groundwater for PFAS in fall 2016. EPA will oversee the monitoring and conduct or oversee a

risk analysis to determine if these contaminants need to be addressed by the response actions at the Site in the future.

2.5.4 Conceptual Site Model

During implementation of the *Feasibility Study Work Plan – Revision 2*, additional investigations, data evaluations and groundwater flow modeling were performed to update the Site-wide CSM. The CSM, presented in detail in the Feasibility Study, describes contaminant sources, release mechanisms and migration routes, exposure pathways, and potential human and ecological receptors. The Selected Remedy for this Site is based on the CSM.

Contaminant Sources

There are three potential source areas associated with the DS&G Site: the DDA, the Grantham South Area, and the Inert Area. The primary source of organic COCs in the Upper Potomac Aquifer is the DDA. Because elevated dissolved metals concentrations within an area of the Upper Potomac Aquifer appear to be related to releases from both the DS&G Site and the Army Creek Landfill Site, groundwater contamination from both Superfund sites is addressed in the CSM.

The DDA was an unlined pit which was used for the disposal of drummed chemical wastes. Several response actions have been undertaken at the DDA, as discussed in Section 2.2 of this document, and the DS&G Remedial Trust is continuing to operate the LFExS within the slurry-wall containment area to provide hydraulic control of contaminated groundwater at the DDA. In addition to the impacts in the Columbia Aquifer at the DDA, historical releases from the DDA have impacted the underlying UPCUTZ. Because of its hydraulic properties, the contaminated UPCUTZ has become a persistent secondary source of contamination to the Upper Potomac Aquifer upper sand unit.

Site documents state that cardboard, wire, pallets, cork dust, expanded polystyrene (e.g., Styrofoam), construction rubble and "scattered chemical wastes" were disposed of at the Inert Area and the Grantham South Area. A multilayer cap with a passive gas venting system is in place at each of these landfills; however, both are sources of subsurface vapors, primarily methane, as evidenced by elevated levels of landfill gas in the gas monitoring wells around the perimeter of the landfills. EPA has not identified the Inert Area and the Grantham South Area as ongoing sources of groundwater contamination based on available information; however, groundwater monitoring data indicates there is a potential that one or both of these landfills may contribute contaminant mass to the Columbia Aquifer and/or the UPCUTZ and Upper Potomac Aquifer upper sand.[9]

[9] As discussed in the *Supplemental Site Characterization Report - Revision 2*, inorganics were detected in Columbia Aquifer groundwater samples collected from temporary wells near these landfills in 2011 (wells GMW-GSNW and GMW-11) and inorganics and organics are present in the UPCUTZ and UPA upper sand near these landfills (wells MW-34, MW-18, P-6, UPA-101-TZ and UPA-101-US).

The Army Creek Landfill Site is located immediately west of the DS&G Site on the opposite bank of Army Creek/Army Pond. A multilayer cap is in place at the landfill; however, groundwater monitoring data indicates that the Army Creek Landfill is a source of 1,2-dichloroethane and dissolved metals, primarily iron, manganese and cobalt, in the Upper Potomac Aquifer.

Contaminant Release Mechanisms and Migration Routes

The following discussion focuses on contaminant release mechanisms and contaminant migration routes at the DDA.

The original release was the result of disposal of drummed wastes and liquid wastes into the unsaturated soil of the Columbia Aquifer at the DDA. Free-phase liquids, or NAPL, would have migrated downward to the top of the UPCU. Upon encountering the UPCU, the NAPL likely migrated horizontally along the surface of the clay and followed the downward sloping surface of the UPCU to the zero-clay areas located north and northwest of the DDA. Dissolution of NAPL constituents in the Columbia Aquifer would have occurred as a result of infiltration of precipitation through the waste materials in the vadose zone and upon migration of NAPL into the saturated zone. A portion of the free-phase and dissolved-phase impacts would have sorbed onto or diffused into finer-grained materials encountered in the Columbia Aquifer. Vertical migration of impacts into the underlying UPCUTZ would have occurred at the zero-clay areas. The figure in Appendix B illustrates the current interpretation of the extent of the zero-clay areas based on available data.[10] It is expected that observations during future field activities will provide additional information about subsurface conditions at the two Superfund sites.

Contamination migration within the UPCUTZ would have occurred preferentially within the sandier portions of the unit, with a portion of the contaminants sorbing onto or diffusing into finer-grained materials encountered in the UPCUTZ. Because the UPCUTZ consists of fine-grained materials with horizontal bedding, vertical migration of NAPL into the Upper Potomac Aquifer upper sand is considered to have been unlikely. Due to the age of the release, a high degree of NAPL attenuation has occurred through natural processes. An evaluation of analytical data for soil samples collected in 2011 and 2012 and groundwater samples collected in 2013 indicates that the potential for the presence of NAPL in the Columbia Aquifer and the UPCUTZ is generally low. However, as discussed in Section 2.5.3, above, concentrations of certain contaminants in soil and/or groundwater suggest the potential presence of residual NAPL in the Columbia Aquifer at the DDA and the UPCUTZ in the immediate vicinity of the DDA.

Dissolved-phase contaminants, upon encountering the saturated zone within the UPCUTZ and/or the upper sand of the Upper Potomac Aquifer, would have migrated in the direction of groundwater flow along preferential pathways (sands) and diffused into the interspersed lower

[10] This figure shows slide 8 from Attachment 1 to Tetra Tech's April 9, 2015 Technical Memorandum Re: Summary of Groundwater Modeling Performed in Support of the Detailed Analysis of Alternatives (DAA). The Technical Memorandum, which specifies criteria for identifying zero-clay areas for the Site-specific groundwater model, is included in Appendix B of the *Detailed Analysis of Alternatives*.

permeability materials (silts and clays). The understanding of the interaction between the sandy portions of the UPCUTZ and the underlying Upper Potomac Aquifer upper sand is incomplete; however, groundwater modeling and water quality data indicate on-going mass flux from the UPCUTZ into the upper sand at the Site.[11] In the immediate vicinity of the DDA, extraction well PW-1 captures some of the contaminant mass in the upper sand, including contaminant mass migrating from the UPCUTZ into the upper sand. Downgradient of extraction well PW-1, contaminated groundwater in the upper sand migrates horizontally and vertically in response to hydraulic gradients. Groundwater contamination has entered the Upper Potomac Aquifer lower sand unit as a result of downward vertical gradients induced by withdrawals from the Llangollen well field and other well fields in the area and potential discontinuities in the UPDC. At Artesian's Llangollen well field groundwater contamination is observed in both the upper and lower sands of the Upper Potomac Aquifer.

Releases from the Columbia Aquifer at the DDA have been mitigated by remedial measures described in Section 2.5.2, above. Despite these efforts at the DDA, the back diffusion of contaminants from the finer-grained layers in the UPCUTZ into the coarser-grained layers of the UPCUTZ and the Upper Potomac Aquifer upper sand is an ongoing transport mechanism.

The distribution of dissolved-phase contamination in groundwater has been strongly influenced by local and regional groundwater extraction from the Upper Potomac Aquifer. In addition to extraction by Artesian at its Llangollen well field, historic aquifer use in the vicinity of the Site has included operation of production wells at the former Amoco Polymer Plant and other industrial facilities to the east of the DS&G Site and extraction from New Castle County's recovery wells between 1973 and 2004. The production wells in use by Artesian at the Llangollen well field have also changed over time causing shifts in the groundwater flow direction. Variations in withdrawal rates and extraction well locations over time have caused significant changes in head, horizontal and vertical gradients and groundwater flow directions, thereby exerting a strong influence on the distribution of contaminants observed within the UPCUTZ and the upper and lower sand units of the Upper Potomac Aquifer.

The foregoing discussion pertains primarily to the release and transport of organic wastes disposed of at the DDA. Releases from additional source areas at the DS&G Site and the adjacent Army Creek Landfill Site have also resulted in elevated levels of inorganic solutes, particularly iron and manganese, in groundwater between the two Superfund sites and Artesian's Llangollen well field. Iron and manganese occur naturally in minerals within the aquifer matrix. These minerals become electron acceptors and dissolve under the anoxic conditions which develop as organic wastes decompose and aerobic biodegradation of organic compounds depletes oxygen within the aquifer, releasing iron and manganese into the groundwater. The western portion of the groundwater plume migrating from the DS&G Site overlaps the eastern portion of dissolved metals contamination in groundwater at Army Creek Landfill.

[11] The mass flux from the UPCUTZ to the UPA upper sand is predominantly observed in the vicinity of extraction well PW-1. It is assumed that operation of well PW-1 is influencing flux from the UPCUTZ to the UPA upper sand between the DDA and well PW-1.

Exposure Pathways and Potential Receptors

Landfill caps and fences in place at the DDA, Grantham South Area and Inert Area have removed exposure pathways involving direct contact with contaminated soils for potential human receptors, except for any workers performing construction or excavation activities in these areas; the landfill caps are also preventing potential exposure of ecological receptors to contaminated soils. DNREC's implementation of a groundwater management zone in the area of the Site and Artesian's treatment of water at its Llangollen well field have eliminated exposure pathways involving direct (dermal, ingestion and/or inhalation) contact with contaminated groundwater. However, absent the measures implemented by the State and Artesian, contaminated groundwater would represent a complete exposure pathway for current and potential future human receptors.

Migration of landfill gas beyond the perimeter of the Inert Area and the Grantham South Area has been documented in quarterly O&M reports.[12] The potential for landfill gas to migrate into buildings or trenches represents a possible explosion hazard. As noted in Section 2.5.2 of this ROD Amendment No. 2, the DS&G Remedial Trust installed a landfill gas mitigation system along sections of the perimeters of the Inert Area and the Grantham South Area to address this potential hazard and prevent vapor intrusion, due to landfill gas migration, at existing buildings. In addition, operation of the SSDS in the office building adjacent to the Inert Area has mitigated the exposure pathway for vapor intrusion into that building. However, the potential exists for future exposure to Site-related contaminants in indoor air for any new construction in areas adjacent to the Inert Area and Grantham South Area where the landfill gas mitigation system is not being operated and migration of landfill gas may be occurring.

Potential Site receptors include individuals who may be exposed to contaminants in soil, ground water and indoor air. Based on the current understanding of the nature and extent of contamination, and the current and anticipated future remediation and use of the DS&G Site, the potential human receptors and exposure pathways are presented in Appendix C and summarized below:

Industrial/Commercial Workers

- Dermal contact and ingestion of impacted Upper Potomac Aquifer groundwater via tap water
- Inhalation of soil vapor and/or landfill gas due to migration into structures

Construction/Excavation Workers

- Dermal contact, ingestion and inhalation (particulates) of impacted subsurface soils
- Dermal contact and ingestion of impacted Columbia Aquifer and/or Upper Potomac Aquifer groundwater
- Inhalation of VOCs and/or landfill gas that may accumulate in trench air during excavation activities

[12] The quarterly O&M report for the first quarter of 2015 (Environmental Alliance, Inc., 2015) is available in the Administrative Record file.

Residents

- Dermal contact, ingestion and inhalation of impacted Upper Potomac Aquifer groundwater via tap water
- Inhalation of soil vapor and/or landfill gas resulting from migration into structures

Additional Investigation

The source and full extent of impacted groundwater observed in the UPCUTZ near monitoring well P-6 and the extent of impacted groundwater in the UPCUTZ to the east, west and south of extraction well PW-1 require further investigation. The upward vertical gradient between the Upper Potomac Aquifer upper sand and the UPCUTZ in the well P-6 area suggests that the UPCUTZ impacts in this area may be caused by the localized upward migration of contaminants from the Upper Potomac Aquifer upper sand into the UPCUTZ. However, the origin of contaminated groundwater observed in the UPCUTZ in the vicinity of well P-6, and the Upper Potomac Aquifer groundwater mounding observed in the well P-6 area, require additional investigation.

Despite the preference for the groundwater and COCs to migrate horizontally within the relatively coarser-grained layers of the UPCUTZ, rather than vertically through relatively finer-grained layers out of the UPCUTZ into the Upper Potomac Aquifer upper sand, it is apparent that the groundwater and COCs eventually migrate out of the UPCUTZ and into the Upper Potomac Aquifer upper sand. This downward migration may be facilitated by a downward vertical hydraulic gradient downgradient of extraction well PW-1, pinching out of the UPCUTZ, and/or interconnection of the coarser-grained layers within the UPCUTZ with the Upper Potomac Aquifer upper sand. The specific areas where mass transfer occurs from the UPCUTZ to the Upper Potomac Aquifer upper sand are not known.

Detections of metals in Columbia Aquifer groundwater samples collected in 2011 from temporary monitoring wells near the Grantham South Area and the Inert Area (wells GMW-GSNW and GMW-11) and the presence of metals and organic COCs in the Upper Potomac Aquifer upper sand and UPCUTZ near these landfills (at wells MW-34, MW-18, P-6, UPA-101-TZ and UPA-101-US) indicate a potential for the Inert Area and/or the Grantham South Area to contribute COC mass to the Columbia Aquifer and/or the Upper Potomac Aquifer upper sand. The uncertainty regarding the source of impacts to the Upper Potomac Aquifer in the vicinity of the Grantham South Area (elevated concentrations of VOCs and SVOCs at wells P-6/UPA-101-US and elevated manganese concentrations at MW-18) will be addressed as appropriate during remedial design.

Areas of uncertainty identified in the updated CSM will be addressed during pre-design investigations.

2.6 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The Site property has various current land uses. The owner of a majority of the Site property, Vincent Dell'Aversano, uses a 5-acre portion of the 11-acre, fenced Inert Area (the Surface Barrier Area) to store impounded vehicles, propane tanks and salvage material. Mr.

Dell'Aversano also maintains a residence adjacent to the Grantham South Area. Portions of the Site property are fenced off and currently unused, including a 3-acre area containing the DDA, where ongoing remediation work presently precludes use of the land, and the steeply sloped 2-acre Grantham South Area.

Land uses surrounding the Site are well established and include commercial and light industrial uses to the east, residential areas to the south, wildlife habitat at the Army Creek Landfill Site to the west, and open space to the north. EPA expects that a similar mix of land uses will continue into the future.

The Upper Potomac Aquifer is used regionally as a drinking water supply. Locally, Artesian operates the Llangollen well field, an active well field approximately three quarters of a mile southwest of the Site property. Artesian supplies water to area homes and businesses.

2.7 SUMMARY OF SITE RISK

The Public Health Evaluation (PHE) performed in support of the 1988 ROD identified unacceptable risks associated with potential future exposure to contaminated groundwater (due to the presence of benzene, BCEE, chlorobenzene, 1,2-dichloroethane, ethylbenzene, methylene chloride, toluene, xylenes, phenol, styrene, methyl ethyl ketone and methyl isobutyl ketone) and direct contact with surface soil (due to the presence of antimony, arsenic, barium, copper, lead and polychlorinated biphenyls) at the Ridge Area. Surface soil at the Inert Area, Grantham South Area and DDA, and Site surface water, sediment and ambient air, were found not to present unacceptable risks to human health or the environment. Risks associated with potential direct contact with subsurface soil were not evaluated in the PHE.

ROD Amendment No. 1 further identified contaminated soil at the DDA and the Ridge Area as sources of groundwater contamination that would present unacceptable risks to any exposed individuals, and established risk-based soil cleanup standards for groundwater protection for each of these areas.

In 2014, Golder Associates performed a human health risk assessment for groundwater in the Upper Potomac Aquifer using a risk ratio approach as discussed in Section 2.7.1, below. Golder Associates updated the risk assessment in October 2017, at EPA's request, using revised target organs and toxicity values from recent (2016-2017) updates in EPA's IRIS database and Regional Screening Level (RSL) tables. The calculated cumulative carcinogenic risk for all the groundwater contaminants of potential concern (COPCs) was 1.8×10^{-2} and the calculated cumulative hazard index (HI), encompassing multiple target organs, was 45. Preliminary remediation goals (PRGs) were then developed for groundwater COCs, as discussed in Section 2.7.2, below.

2.7.1 Risk Assessment Approach for Groundwater

COPCs were identified in groundwater samples collected between April 2012 and April 2014 from monitoring wells in the core of the Upper Potomac Aquifer groundwater contaminant plume. EPA's RSLs for residential tap water were used as the primary source for human risk- and health-based screening levels based, respectively, on a target cancer risk of 1.0×10^{-6} and a target hazard quotient (HQ) of 0.1. Groundwater analytes with a maximum concentration

exceeding an RSL were considered COPCs and carried forward in the risk assessment process. In addition, groundwater concentrations were compared to EPA's MCLs for primary drinking water contaminants promulgated pursuant to the Safe Drinking Water Act, 42 U.S.C. §§ 300f et seq., and codified at 40 CFR Part 141, for public drinking water supplies. Groundwater analytes with a maximum concentration exceeding their respective MCLs were also retained as COPCs.

For each COPC, a conservative 95% upper confidence limit (UCL) of the mean concentration, calculated using EPA's ProUCL software Version 5.0, was generally selected as the exposure point concentration (EPC).[13] Both cancer risks and non-cancer hazards were determined through the comparison of EPCs to the applicable RSL value.

Cancer risk was estimated by calculating the ratio of the COPC-specific EPC to the residential tap water carcinogenic RSL for that COPC and multiplying that value by a target risk (TR) level of 1.0×10^{-6}. The equation used to estimate carcinogenic risk for each COPC is presented below:

$$\text{Risk} = \frac{\text{EPC} \times \text{TR}}{\text{Carcinogenic RSL}}$$

The calculated cumulative carcinogenic risk for all of the COPCs was 1.8×10^{-2} (see Table 3 in Appendix A).

Similarly, for non-carcinogens, non-carcinogenic HQs were estimated by taking the ratio of the EPC to the ingestion/dermal and inhalation non-cancer RSLs and multiplying by a target hazard quotient (THQ) of 1.0. The equation used to estimate non-carcinogenic hazard for each COPC is presented below:

$$\text{HQ} = \frac{\text{EPC} \times \text{THQ}}{\text{Non} - \text{carcinogenic RSL}}$$

To assess the potential for non-cancer effects posed by exposure to multiple contaminants, a hazard index (HI) approach was used in accordance with EPA guidance. This approach assumes that the non-cancer hazards associated with exposure to multiple contaminants are additive for each target organ. Therefore, in cases where the overall HI was greater than 1.0, the HQs were separated by target organ to estimate the target organ-specific HI. Since the ingestion/dermal and inhalation pathways may involve different target organs, the total ingestion/dermal HQs and inhalation HQs were evaluated separately. Summing the ingestion/dermal and inhalation HQs for all of the COPCs, the calculated cumulative HI, encompassing multiple target organs, was 45 (see Table 4 in Appendix A).[14]

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[13] If the calculated 95% UCL exceeded the maximum detected concentration, then the maximum concentration was substituted as the EPC.

[14] The cumulative HI of 45 was calculated using EPA's 2017 RSLs. EPA's Proposed Plan reported a cumulative HI of 37, which was based on the risk assessment documented in Golder Associates' *Development of Site-Specific Preliminary Remediation Goals – Revision 2*, December 2014, which utilized EPA's 2014 RSLs.

2.7.2 Development of Preliminary Remediation Goals for Groundwater

To facilitate the development of remedial alternatives in the Feasibility Study, Site-specific risk- and health-based PRGs were developed for COCs identified in groundwater in the Upper Potomac Aquifer.[15] COCs were selected from among the COPCs based on the calculation of cancer risk and non-cancer hazard. Consistent with EPA risk assessment guidance, a COPC was considered a significant contributor to risk and was identified as a COC if, at the EPC, one or both of the following conditions were met: 1) its carcinogenic risk contribution exceeded one in a million (1.0×10^{-6}); 2) its non-carcinogenic HQ was either greater than 1.0 or, where the HI for a target organ exceeded 1.0, greater than 0.1 for that target organ. In addition, certain COPCs were not retained as COCs based on their low frequency of detection. Based on these criteria, the following COCs were identified in Site groundwater: 1,2,4-trimethylbenzene; 1,2-dichloroethane; 1,3,5-trimethylbenzene; 1,4-dichlorobenzene; 1,4-dioxane; benzene; BCEE; chloroform; ethylbenzene; N,N-dimethylaniline; naphthalene; xylenes; arsenic; cobalt; iron; and manganese.

PRGs based on carcinogenic risk were calculated using the following equation:

$$\text{PRG} = \frac{\text{EPC} \times \text{TR}}{\text{Calculated Cancer Risk}}$$

Carcinogenic PRGs were calculated for TR values of 1.0×10^{-6}, 1.0×10^{-5}, and 1.0×10^{-4}.

PRGs based on non-carcinogenic HQs were calculated using the following equation:

$$\text{PRG} = \frac{\text{EPC} \times \text{THQ}}{\text{Calculated HQ}}$$

PRGs for individual non-carcinogenic COCs were calculated using a THQ between 0.1 and 1.0. Fractional THQs were used to calculate PRGs for those COCs that contribute to a target organ-specific HI greater than 1.0.

PRGs were selected to comply with MCLs for primary drinking water contaminants and to achieve a cumulative cancer risk of one in 10,000 (1.0×10^{-4}) or less and/or a target organ-specific HI of 1.0 or less, assuming the presence of all of the COCs in groundwater. The risk-based groundwater PRGs are initial guidelines and not final cleanup standards. Remedial action performance standards, including final groundwater cleanup standards, are presented in Section 2.12 of this Amendment.

[15] Under the 1991 Consent Decree for the Army Creek Landfill, the currently enforceable groundwater remediation standards for the Upper Potomac Aquifer at the DS&G and Army Creek Landfill Sites are National Primary Drinking Water Regulations, or MCLs, established under the Safe Drinking Water Act, 42 U.S.C. Section 300g-1, for certain contaminants in public water systems.

The PRGs for groundwater in the Upper Potomac Aquifer are presented in Table 1.[16]

Table 1

Chemical of Concern	Selected PRG (µg/L)	Selection Criterion
1,2,4-Trimethylbenzene	5.7	Target HQ of 0.1
1,3,5-Trimethylbenzene	6.1	Target HQ of 0.1
1,4-Dioxane	4.6	Target Risk of 1.0×10^{-5}
Arsenic	0.52	Target Risk of 1.0×10^{-5}
Benzene	4.6	Target Risk of 1.0×10^{-5}
Bis(2-chloroethyl)ether	0.14	Target Risk of 1.0×10^{-5}
Cobalt	6.0	Target HQ of 1.0
Ethylbenzene	15	Target Risk of 1.0×10^{-5}
Iron	13,939	Target HQ of 1.0
Manganese	260	Target HQ of 0.6
N,N-Dimethylaniline	25	Target Risk of 1.0×10^{-5}
Naphthalene	0.63	Target HQ of 0.1
Xylenes (total)	21	Target HQ of 0.1

The methodology for identifying COCs and deriving the PRGs is more fully described in Golder Associates' Technical Memorandum, *Development of Site-Specific Preliminary Remediation Goals – Revision 2* (December 2014), and Golder Associates' Addendum, *Revised Addendum to Development of Site-Specific Preliminary Remediation Goals – Revision 2* (October 2017). Tables 1 through 7 of the Addendum document the occurrence and distribution of COPCs, EPCs, carcinogenic risks, non-cancer HQs, target organ-specific non-cancer HIs, selection of COCs and the summary of PRGs, and are included in Appendix A of this document.

Uncertainty Analysis

Risk assessment provides a systematic means of organizing, analyzing and presenting information on the nature and magnitude of risks posed by chemical exposures. Uncertainties are present in all risk assessments because of the quality of available data and the need to develop inferences based on incomplete information about existing conditions and future circumstances. These uncertainties are addressed by making conservative assumptions so that the risks are more likely to be overestimated than underestimated. The primary areas of uncertainty and associated limitations are qualitatively discussed below.

- The inclusion of infrequently detected COPCs in the risk assessment has the potential to overestimate risk through the inclusion of analytes which may be anomalous or unrelated to the Site.
- If a 95% UCL of the mean could not be calculated by ProUCL, then "non-detect" results (NDs) were replaced with half the method detection limit (MDL) in order to calculate the

[16] PRGs were not developed for groundwater COCs with EPCs that present a cancer risk below 1.0×10^{-5}; however, cancer risk associated with these COCs was taken into account when developing PRGs for the remaining COCs to ensure cumulative risk will be below EPA's risk criteria.

EPC. In cases where there were infrequent detections of a COPC, the majority of the values used to calculate the EPC were based on the MDL and the uncertainty associated with the EPC is likely biased high.

- For those COPCs with a single detection, the use of the maximum detected concentration overestimates exposure since a single sample result does not reflect overall groundwater conditions. By treating all ND results as half of the MDL, a conservative 95% UCL can be calculated and this approach results in a more appropriate EPC statistic than use of the sole-detected (maximum) concentration. However, this approach is based on the assumption that the COPC in question is present in numerous samples, which may not be the case and may result in an overestimation of risk.
- The use of the EPA carcinogenic and non-carcinogenic RSLs to calculate cancer risk and non-cancer hazard, respectively, has the potential to overestimate risk because the conservative exposure factors that are used to calculate the RSLs were applied instead of Site-specific exposure parameters.
- Estimated cancer risk and non-cancer hazard relies upon the use of toxicity values developed by EPA to evaluate potential chronic toxicity of COPCs. While these values may be estimated from human experimental or epidemiological data, they are more likely to be based on animal data generated from a variety of toxicological studies. In addition, toxicity values are not available for all COPCs. The result of this uncertainty is that the estimated total cancer risks and cumulative non-cancer hazards have the potential to be both overestimated and/or underestimated.

2.7.3 Vapor Intrusion Risk Assessment

As discussed in Section 2.5.3 of this ROD Amendment No. 2, VOCs were detected in outdoor and indoor air samples collected at a business adjacent to the Inert Area in April and June 2013. While the source of the VOCs was not confirmed, several of the VOCs detected in the June 2013 indoor air sample at concentrations that exceed the industrial air screening level (benzene, 1,4-dichlorobenzene, ethylbenzene, trichloroethylene, 1,2,4-trimethylbenzene and xylenes) are COCs or COPCs in Site groundwater. These contaminants were also detected in soil gas samples collected at the Site in 2006, and their presence in soil gas is most likely due to landfill gas migration.

EPA performed conservative calculations of potential health risks using the test results for the air samples collected in June 2013. The estimated risks for exposure to outdoor air did not exceed EPA's criteria for acceptable risk. However, the estimated risks from exposure to indoor air exceeded EPA's acceptable cancer and non-cancer risk criteria as summarized below:[17]

- Estimated risks for office building basement indoor air:
  - Carcinogenic risk of 2.0×10^{-4}
  - Non-carcinogenic HI of 4.8

[17] These risk estimates were based on the assumption that office workers are exposed to levels found in the basement air sample 8 hours a day for 250 days a year, over 25 years. However, the basement is used for storage and the office workers occupy the ground floor of the building where lower concentrations of Site-related VOCs would be expected to be found.

The estimated human health risk is attributable primarily to 1,2-dibromomethane, 1,2,3-trichloropropane and 1,2,4-trimethylbenzene. 1,2,4-trimethylbenzene is a COC in groundwater and is present in landfill gas at the Site.

2.7.4 Basis for Taking Action

The Site presents unacceptable risks to human health associated with potential future exposure to impacted groundwater via tap water and/or landfill gas constituents in indoor air,[18] and additional response actions are necessary to reduce the risks to levels that are within or below EPA's acceptable risk range. EPA has determined that the additional response actions selected in this Amendment are necessary to protect human health and the environment from actual or threatened releases of hazardous substances.

2.8 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives for Groundwater

The 1988 ROD does not explicitly provide a remedial action objective (RAO) for groundwater impacted by releases from the Site. Instead, it states that the selected remedy includes continued operation of the New Castle County groundwater recovery wells until "the groundwater at the site boundary has consistently met the acceptable water exposure levels," which are given in Table 7 of the 1988 ROD. However, as discussed in Section 2.2 of this ROD Amendment No. 2, New Castle County, upon entering into the 1991 Consent Decree, agreed to operate groundwater recovery wells in the Upper Potomac Aquifer to attain primary drinking water standards beyond the Army Creek Landfill property boundary. The discrepancy between the groundwater cleanup levels given in the 1991 Consent Decree for the Army Creek Landfill and those in the 1988 ROD for this Site is discussed in EPA's September 2015 *Five-Year Review Report for Delaware Sand & Gravel Landfill Superfund Site* which is part of the Administrative Record for the Site. An additional inconsistency involves the Area of Attainment: the 1991 Consent Decree for the Army Creek Landfill specifies that groundwater cleanup levels are to be met beyond the Army Creek Landfill property boundary, while the 1988 ROD for this Site states that the groundwater cleanup levels are to be met beyond the DS&G Site property boundary. This ROD Amendment No. 2 clarifies the points of compliance for the DS&G Site.

Remedial Action Objectives for the DDA

The 1993 ROD Amendment identified the following RAOs for the DDA:

- Prevent direct contact with contaminated soil;
- Protect groundwater from hazardous substances leaching from contaminated soil;
- Reduce the soil contaminant concentrations to levels that would not cause groundwater contaminant concentrations in the Upper Potomac Aquifer to:

[18] As discussed in Section 2.5.4 of this ROD Amendment No. 2, construction and excavation workers have the potential to be exposed to contaminated subsurface soil and groundwater during Site remediation activities. Accordingly, these potential exposure risks will be managed through compliance with Occupational Safety and Health Administration requirements for workers engaged in response or other hazardous waste operations (29 CFR § 1910.120).

- present an exposed individual with a cumulative excess lifetime cancer risk above "the 10^{-6} risk range"; or
- cause adverse health effects in an exposed individual (i.e., result in an HI greater than or equal to 1.0).

Modified Remedial Action Objectives

Since implementation of the remedial actions selected in the 1988 DS&G ROD, as amended by the 1993 ROD Amendment and 2003 ESD, and the 1986 Army Creek Landfill ROD, MCLs have been attained at the Army Creek Landfill property boundary and the temporary cap and fencing at the DDA have prevented direct contact with contaminated soil. However, the existing remedies have not achieved the remainder of the RAOs for the Site. Furthermore, the RAOs do not address contamination in the UPCUTZ which represents a secondary source of long-term impacts to the Upper Potomac Aquifer sands. Nor do the RAOs address COCs in groundwater at the Llangollen well field or the potential for exposure to Site-related contaminants in indoor air due to potential future vapor intrusion. In addition, the RAOs do not address all of the groundwater COCs listed in Table 1 of this ROD Amendment No. 2. Therefore, the following modified RAOs were developed for this Amendment:

- Prevent direct contact with contaminated soil enclosed within the slurry wall at the DDA.
- Prevent migration of contaminants from the DDA that would cause contaminant concentrations in the groundwater of the Columbia Aquifer outside the DDA or the Upper Potomac Aquifer within the Area of Attainment (as defined below) to exceed MCLs, non-zero maximum contaminant level goals (MCLGs) or acceptable risk- and health-based concentrations.
- Prevent direct contact with groundwater containing contaminants from the DS&G Site at levels that exceed MCLs, non-zero MCLGs or acceptable risk- and health-based concentrations.
- Restore groundwater within the Area of Attainment (throughout the contaminant plume, at and beyond the boundary of the Waste Management Area[19]) to its beneficial use in a reasonable time frame. The Waste Management Area and the current approximation of the Area of Attainment are shown in Figure 6.
- Prevent contaminant migration from subsurface vapor intrusion into indoor air that would result in unacceptable levels of risk.

2.9 DESCRIPTION OF ALTERNATIVES

This section summarizes the portion of the remedy selected in the 1988 ROD, as amended by the 1993 ROD Amendment and 2003 ESD, that pertains to contaminated groundwater in the Upper Potomac Aquifer and contaminated soil at the DDA and Ridge Area (Previously Selected Remedy), and the Selected Remedy, which was developed to meet the modified RAOs presented in Section 2.8 of this ROD Amendment No. 2. The Selected Remedy is one of six remedial

[19] The DS&G Site includes three areas where wastes are being managed on-site (DDA, Inert Area and Grantham South Area) and one former waste storage area (Ridge Area) in close proximity. These areas and the small parcels which connect them constitute the Waste Management Area at the Site.

alternatives (including No Action) evaluated in the Feasibility Study and briefly described below. This remedial alternative was presented as the Preferred Alternative in EPA's Proposed Plan released for public comment in September 2016. The Selected Remedy, which is described below in greater detail, addresses: 1) contaminated groundwater in the Upper Potomac Aquifer, including groundwater in the UPCUTZ and groundwater pumped from Artesian's Llangollen well field, 2) contaminated soil and groundwater within the slurry wall surrounding the former DDA and 3) potential vapor intrusion at new construction adjacent to the Inert Area and the Grantham South Area.

Previously Selected Remedy:

The Previously Selected Remedy includes those components of the remedy selected in the 1988 ROD, as amended by the 1993 ROD Amendment and 2003 ESD which address waste and contaminated soil at the DDA and the Ridge Area and contaminated groundwater in the Upper Potomac Aquifer. It does not include the response actions that address waste and contaminated soil at the Grantham South Area and the Inert Area. The Previously Selected Remedy includes the following components:

- Construction of a slurry wall, keyed into the underlying natural clay layer,[20] around the DDA and the surrounding contaminated soil and groundwater in the Columbia Aquifer;
- Installation and operation of a groundwater extraction system to dewater the soil contained within the slurry-wall enclosure;
- Excavation and off-site treatment or disposal of buried drums, waste and highly contaminated soil at the DDA and the Ridge Area;
- Transfer of the remaining contaminated soil excavated from the Ridge Area to the slurry-wall containment area;
- Treatment of the soil within the containment area using soil vapor extraction and bioventing;
- Construction of a composite barrier (RCRA Subtitle C) cap over the slurry-wall enclosure;
- Installation of perimeter fencing around the containment area;
- Installation of a soil cover over the Ridge Area;
- Continued operation of the Army Creek Landfill groundwater recovery wells until cleanup levels are met at the DS&G Site property boundary;
- On-site treatment of groundwater and discharge of treated groundwater to Army Creek; and
- Institutional controls to prevent future use of the Site property which could compromise the effectiveness of the Previously Selected Remedy and the installation of drinking water wells on the Site property.

Estimated Capital Cost:	*$29,241,300* [21]
Estimated Annual O&M Cost:	*$380,500* [21]
Estimated Present Worth Cost:	*$33,540,100* [21]

[20] A hanging slurry wall was constructed above the zero-clay area northwest of the DDA.
[21] These figures are the sum of the estimated costs in the 1993 Amendment for remediation of the DDA and Ridge Area and the estimated costs in the 1988 ROD for Upper Potomac Aquifer groundwater recovery and treatment. No adjustment was made to account for the time value of money and these costs are not directly comparable with the estimated costs for the Alternative Remedy.

All elements of the Previously Selected Remedy have been implemented with the exception of soil vapor extraction, the installation of a RCRA Subtitle C cap at the DDA and the Site property owner's implementation of several provisions of the 2004 UAO pertaining to institutional controls.

Remedial Alternatives Evaluated in the 2016 Feasibility Study:

Alternative A - No Action
Existing institutional controls would remain in place, there would be no collection and treatment of groundwater and the temporary cap at the DDA would not be upgraded or maintained.

Alternative B - DDA Containment and Groundwater Extraction from Upper Potomac Aquifer with Direct Discharge to Publicly Owned Treatment Works (POTW)
Alternative B represents a limited-action alternative which includes continuation of interim response actions (operation of the LFExS within the slurry-wall containment area and operation of groundwater extraction well PW-1 with discharge to the POTW), construction of a composite barrier cap over the slurry-wall enclosure, treatment at the Llangollen well field and institutional controls to prevent potential future exposure to contaminants capable of migrating into indoor air.

Alternative C - DDA Enhanced Containment and Groundwater Extraction from UPCUTZ and Upper Potomac Aquifer with Direct Discharge to POTW
Alternative C would provide reliable containment of contaminants at the DDA with an enhanced LFExS (eLFExS) and construction of a composite barrier cap over the slurry-wall enclosure. It includes continued groundwater extraction and the installation of additional groundwater extraction wells in the Upper Potomac Aquifer, including the UPCUTZ, with discharge of extracted groundwater to the POTW. Alternative C would also include treatment at the Llangollen well field and institutional controls to prevent potential future exposure to Site contaminants in soil vapor or landfill gas capable of migrating into indoor air.

Alternative D - DDA Soil Flushing and Groundwater Extraction from UPCUTZ and Upper Potomac Aquifer with Direct Discharge to POTW
Alternative D includes the same components as Alternative C plus treatment of contaminated soil at the DDA using soil flushing.

Alternative E - DDA Targeted In-situ Chemical Oxidation (ISCO) and Groundwater Extraction from UPCUTZ and Upper Potomac Aquifer with Direct Discharge to POTW
Alternative E includes the same components as Alternative C plus treatment of contaminated soil in targeted areas of the DDA using ISCO.

Alternative F - DDA Excavation and ISCO and Groundwater Extraction from UPCUTZ and Upper Potomac Aquifer with Direct Discharge to POTW
Alternative F includes the same components as Alternative C plus excavation and disposal, in an on-site lined landfill, of unsaturated soil at the DDA and treatment of saturated soil at the DDA using ISCO.

In the Proposed Plan, EPA identified Alternative C as its preferred alternative for comparison with the Previously Selected Remedy. Alternative C would achieve all the revised RAOs, address the secondary source of contamination in the UPCUTZ and remediate groundwater throughout the Area of Attainment within a reasonable time frame.[22] The operating history of the LFExS indicates that the remaining contamination at the DDA can be reliably contained by operation of the eLFExS and the installation of a permanent cap included in Alternative C. Alternative A would not be protective of human health and the environment. Alternative B would not address contamination in the UPCUTZ or remediate groundwater throughout the Area of Attainment within a reasonable time frame.[23] Alternatives D through F, like Alternative C, would achieve all of the revised RAOs, address contamination in the UPCUTZ and remediate groundwater within a reasonable time frame. Alternatives D through F also include additional treatment of the remaining soil contamination at the DDA. However, it is anticipated that long-term operation of the eLFExS would be necessary because of uncertainty regarding achievable mass reductions, the potential for long-term back diffusion of contaminants from clay-rich layers at the DDA, and the potential for mobilization of residual mass or the formation of unacceptable reaction byproducts (e.g., hexavalent chromium). In addition, Alternatives D through F would not accelerate the groundwater restoration time frame because significant contaminant mass exists outside the DDA in the fine-grained materials of the UPCUTZ.

Selected Remedy (Alternative C in the Feasibility Study):

The Selected Remedy will provide reliable containment of contamination remaining at the DDA through enhancements to the LFExS which is currently operating within the slurry wall and installation of a composite barrier cap. This alternative would also include the installation and operation of groundwater recovery wells in the Upper Potomac Aquifer, including the UPCUTZ, and extraction and *ex-situ* treatment of Upper Potomac Aquifer groundwater utilizing existing and potentially additional treatment systems at the Llangollen well field in order to restore groundwater to its beneficial use. In addition, this alternative would employ institutional controls to prevent potential future exposure to Site-related contaminants in indoor air at levels that would present unacceptable risks.

The Selected Remedy addresses the three remediation targets enumerated below and includes the following remedial components:

1. <u>DDA/Columbia Aquifer soil and groundwater</u>

- Existing slurry-wall system;[24]

[22] The estimated aquifer restoration time frame for Alternative C is approximately 25 years as presented in Appendix O of the *Final Feasibility Study – Revision 1*.
[23] The estimated aquifer restoration time frame for Alternative B is approximately 60 years as presented in Appendix O of the *Final Feasibility Study – Revision 1*.
[24] Costs associated with the slurry wall are not included in the cost estimate for the Selected Remedy.

- Enhanced LFExS (eLFExS) pumping at an estimated 25 gallons per minute (gpm)[25] and equipped with a backup generator and instrumentation and telemetry for real-time containment monitoring to maintain inward and upward hydraulic gradients;
- A groundwater monitoring program to ensure that the eLFExS is operating as designed;
- A composite barrier cap to minimize infiltration of precipitation through contaminated soil contained within the slurry wall surrounding the former DDA; and
- Institutional controls to prevent direct contact with contaminated soil, the installation of drinking water wells on the Site property and other future uses of the Site property which could compromise the effectiveness of the remedial action.

2. Upper Potomac Aquifer

- Installation and operation of extraction wells in areas determined to optimize capture and remove contaminant mass from the more highly-impacted areas of the Upper Potomac Aquifer, including the UPCUTZ. The anticipated locations of the proposed new extraction wells are shown in Figures 7 and 8. The actual configuration of the groundwater recovery well network and groundwater extraction rates would be determined by EPA, in consultation with DNREC, during the remedial design.
- Discharge of groundwater pumped from the DS&G Site extraction wells to the Wilmington Wastewater Treatment Plant.
- Continued groundwater extraction at Artesian's Llangollen well field with treatment utilizing existing systems for BCEE and 1,4-dioxane and, if necessary, additional treatment systems targeting other COCs, such as manganese.
- A program to monitor performance of the groundwater extractions wells, confirm they are preventing migration of the groundwater contaminant plume and evaluate progress toward the attainment of long-term groundwater remediation goals.
- Institutional controls to prevent future use of the Site property which could compromise the effectiveness of the remedial action and the installation of drinking water wells on the Site property.[26]

3. Potential vapor intrusion

There are several nearby buildings located within 300 feet of the on-site waste management areas. There may also be future construction within several hundred feet of those sections of the Inert Area and Grantham South Area where a landfill gas mitigation system is not being operated. Due to the documented migration of landfill gas beyond the perimeters of the Grantham South Area and the Inert Area, and the potential for vapor intrusion into nearby buildings and any future construction, the Selected Remedy includes use restrictions to prevent potential future exposure to Site contaminants in soil vapor and landfill gas that have the potential to migrate into indoor air. The use restrictions would be implemented through an

[25] The LFExS currently operates at a rate of 8 to 10 gpm.

[26] Additional groundwater use restrictions have been in effect in the area surrounding the Site since June 2006, when DNREC established a groundwater management zone encompassing several hazardous waste disposal facilities near the Site. The groundwater management zone places restrictions on the installation of new water supply wells throughout the known extent of the Upper Potomac Aquifer contaminant plume.

enforceable institutional control such as a judicial consent decree, an administrative order or an environmental covenant, and would ensure that all new habitable buildings constructed on or adjacent to the Site property in areas potentially impacted by landfill gas have, at a minimum, a foundation vapor barrier and subsurface piping for a SSDS. The institutional controls would require testing of indoor air in any buildings subject to the controls prior to occupancy and, should indoor air concentrations equal or exceed EPA risk-based criteria, activation and operation of a SSDS until such time that EPA determined that landfill gas migration no longer posed a vapor intrusion risk. The areas subject to these use restrictions would be determined prior to the remedial design.

Estimated Capital Cost:	*$16,200,000* [27, 28]
Estimated Annual O&M Cost:	*$2,400,000* [27, 28]
Estimated Present Worth Cost:	*$46,100,000* [27, 28]

Common Elements

The Previously Selected Remedy and the Selected Remedy share several common elements, including the slurry wall which was installed in 1994, a composite barrier cap and institutional controls restricting land and groundwater use.

2.10 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The Previously Selected Remedy and the Selected Remedy were evaluated using the nine criteria set forth in the NCP, 40 CFR § 300.430(e)(9)(iii). The first two criteria [overall protection of human health and the environment, and compliance with applicable or relevant and appropriate requirements (ARARs)] are threshold criteria. The selected remedy must meet both of these threshold criteria (except when an ARARs waiver is invoked). The next five criteria (long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost) are the primary balancing criteria. The remaining two criteria (state and community acceptance) are referred to as modifying criteria and are taken into account after public comment is received on the Proposed Remedial Action Plan. The following discussion summarizes the relative performance of each alternative with respect to the nine evaluation criteria.

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[27] The cost estimate for the Preferred Alternative in the Proposed Plan includes costs for operation of the SSDS at the office building on Grantham Lane, but does not include costs for treatment to address manganese at Artesian's Llangollen well field. Operation of the SSDS is not part of the Selected Remedy and the costs for operation of the SSDS are not included in the cost estimate for the Selected Remedy in this ROD Amendment No. 2. Because a future need for treatment to reduce manganese concentrations in groundwater pumped from the Llangollen well field is reasonably anticipated, the costs for this treatment are included in the cost estimate for the Selected Remedy in this ROD Amendment No. 2. These changes do not significantly alter the cost of the remedy.

[28] These cost figures include estimated capital ($3,800,000), annual O&M ($300,000) and present worth ($7,540,000) costs for treatment at the Llangollen well field to address BCEE and 1,4-dioxane, beginning in 2014. The Delaware Public Service Commission approved Artesian's applications for base water rate increases to recover these investments.

Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that a selected remedial action be protective of human health and the environment. A remedy is protective if it reduces to acceptable levels current and potential future risks associated with each exposure pathway at a site.

DDA/Columbia Aquifer Soil and Groundwater

The Previously Selected Remedy includes institutional controls (groundwater and land use restrictions), land use controls (fencing, locked gates) and engineering controls (a temporary cap at the DDA) which prevent direct contact with contaminated soil and groundwater. If installation of a RCRA Subtitle C cap were completed in accordance with the 1993 ROD Amendment, the Previously Selected Remedy would also minimize infiltration and leaching of soil contaminants into groundwater in the Columbia Aquifer and prevent potential exposure of ecological receptors to contaminated soil. However, because transmissive zones and gaps occur in the UPCU beneath the slurry-wall containment area, the Previously Selected Remedy has not prevented contaminant releases from the DDA to groundwater in the Upper Potomac Aquifer.

Existing land use controls and the temporary cap at the DDA prevent direct contact with contaminated soil and groundwater. The Selected Remedy includes additional engineering controls (a composite barrier landfill cap over the DDA and an eLFExS) which would further protect human health and the environment. Operation of the eLFExS would provide hydraulic control of the groundwater within the slurry-wall enclosure, effectively eliminating future releases from the DDA to groundwater in the Upper Potomac Aquifer. Installation and maintenance of a composite barrier cap would continue to eliminate risk associated with direct contact with DDA soils, and would also minimize infiltration that results in leaching of contaminants to groundwater in the Columbia Aquifer and prevent potential exposure of ecological receptors to contaminated subsurface soil.

Upper Potomac Aquifer

The Previously Selected Remedy called for continued operation of the Army Creek Landfill groundwater recovery wells to attain “acceptable water exposure levels” beyond the DS&G Site boundary. That remedial component does not provide long term protection of human health and the environment for the following reasons: it does not address 1,4-dioxane and other groundwater COCs; it does not address contamination in the UPCUTZ; it does not restore groundwater throughout the Area of Attainment to its beneficial use; and it does not include treatment to address Site-related COCs in groundwater at the Llangollen well field.

EPA expects that the Selected Remedy will restore groundwater in the Upper Potomac Aquifer to its beneficial use within a reasonable time frame. Site-related COCs would be reduced to acceptable risk-based concentrations within the Area of Attainment through the installation and operation of groundwater extraction wells in areas determined to optimize capture and continued groundwater extraction at the Llangollen well field. Groundwater treatment currently provided by Artesian at the Llangollen well field and existing groundwater use restrictions prevent exposure to contaminated groundwater. The Selected Remedy includes treatment of

groundwater pumped from the Llangollen well field to remove Site-related COCs prior to distribution to customers.

Potential Vapor Intrusion Mitigation

The DS&G Remedial Trust is operating a SSDS at an office building adjacent to the Site and will continue to monitor indoor air at the building in accordance with the O&M plan for the Inert Area. However, the Previously Selected Remedy does not address potential vapor intrusion and would not prevent potential future exposure to Site contaminants in indoor air.

The Selected Remedy will prevent potential future exposure to Site contaminants in the indoor air of any new habitable buildings constructed on or adjacent to the Site in areas potentially impacted by landfill gas.

Compliance with ARARs

This criterion evaluates whether each alternative will meet all of the applicable or relevant and appropriate requirements (ARARs) of federal and state environmental statutes and regulations that pertain to a site or provides a basis for invoking a waiver.

Key ARARs pertaining to the Previously Selected Remedy and the Selected Remedy are discussed below; a complete list of ARARs for the Selected Remedy is included in Appendix D of this ROD Amendment No. 2.

DDA/Columbia Aquifer Soil and Groundwater

During implementation of the Previously Selected Remedy, the on-site storage of hazardous waste and soil containing hazardous waste excavated at the DDA and the Ridge Area complied with federal and State regulations for owners and operators of facilities that treat or store hazardous waste. Drum contents, highly contaminated soil and groundwater extracted from the Columbia Aquifer within the slurry wall were evaluated in accordance with federal and State regulations for identification of hazardous waste; materials determined to be hazardous waste were handled in accordance with federal and State regulations governing generators and transporters of hazardous waste. The 1993 ROD Amendment identifies State regulations governing air emissions [Delaware Regulations Governing the Control of Air Pollution (Section 6003)] and federal regulations governing emissions from process vents (40 CFR §§ 264.1031-.1034) as ARARs. However, there was no discharge from process vents during operation of the bioventing system and, therefore, air emission controls were not implemented.

The Selected Remedy will comply with State standards for owners and operators of hazardous waste landfills and federal and State standards governing discharges to publicly owned treatment works (POTWs) which accept and treat sewage and industrial wastewater. In particular, the design, construction and O&M of the composite barrier cap to be installed at the DDA would meet federally authorized State requirements for closure and post-closure care of hazardous waste landfills [7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsections 264.310(a) and (b)(1) and (5)] and for monitoring and inspection during the installation of the cover system [7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsection 264.303(a)]. Groundwater extracted from the Columbia Aquifer and discharged to the

Wilmington Wastewater Treatment Plant would comply with effluent limitations established by New Castle County and the City of Wilmington to meet the requirements of Delaware's National Pollutant Discharge Elimination System Program (7 DE Admin. Code 7201 Regulations Governing the Control of Water Pollution, Section 6.0) and would meet any pretreatment standards established by New Castle County and the City of Wilmington in accordance with the NPDES General Pretreatment Regulations for Existing and New Sources of Pollution (40 CFR Part 403).

Upper Potomac Aquifer

The 1988 ROD identifies MCLs as ARARs for groundwater remediation and states that the Previously Selected Remedy "would assist in meeting MCLs at or near the site boundary" within 10 years. However, benzene concentrations within the Area of Attainment in the Upper Potomac Aquifer continue to exceed the MCL for that contaminant. In addition, the Previously Selected Remedy may not have been compliant with all ARARs for the protection of surface water. While the Army Creek Landfill groundwater recovery wells were operating, the treatment plant reduced iron concentrations in the extracted groundwater to levels that met the established discharge limit for iron; however, estimated levels of BCEE in the treatment plant effluent exceeded the State water quality standard for the protection of human health (based on fish consumption) on several occasions. However, the Previously Selected Remedy did not require treatment to remove BCEE from extracted groundwater prior to its discharge to Army Creek, unless monitoring confirmed that the level of BCEE was contributing to the excursion of the applicable Delaware Surface Water Quality Standards for BCEE.

The MCLs for primary drinking water contaminants and non-zero MCLGs for public drinking water supplies established under the Safe Drinking Water Act are considered to be relevant and appropriate standards for groundwater remediation under the Superfund program. The Selected Remedy will achieve MCLs and non-zero MCLGs for groundwater contaminants within the Area of Attainment in a reasonable time frame. Groundwater extracted from the Upper Potomac Aquifer and discharged to the Wilmington Wastewater Treatment Plant would comply with effluent limitations established by New Castle County and the City of Wilmington to meet the requirements of Delaware's National Pollutant Discharge Elimination System Program (7 DE Admin. Code 7201 Regulations Governing the Control of Water Pollution, Section 6.0) and would meet any pretreatment standards established by New Castle County and the City of Wilmington in accordance with the NPDES General Pretreatment Regulations for Existing and New Sources of Pollution (40 CFR Part 403). Any pretreatment of groundwater discharged to the POTW, and treatment to remove COCs from groundwater extracted from the Llangollen well field, may result in the generation of hazardous waste. Generated hazardous waste would be managed in accordance with Delaware's standards applicable to generators of hazardous waste, including storage and manifesting of hazardous waste (7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsections 262.11-42).

Potential Vapor Intrusion Mitigation

The Previously Selected Remedy did not address potential vapor intrusion. Therefore, the 1988 ROD and the 1993 ROD Amendment identified no ARARs for vapor intrusion mitigation.

The Selected Remedy includes institutional controls to prevent potential future exposure to Site contaminants in soil vapor or landfill gas capable of migrating into the indoor air of any new habitable buildings constructed near those sections of the Inert Area and the Grantham South Area where the migration of landfill gas has not been mitigated.

Long-Term Effectiveness and Permanence

The evaluation of alternatives under this criterion considers the ability of an alternative to maintain protection of human health and the environment over time and takes into account the adequacy and reliability of containment systems and institutional controls needed to manage the residual risk posed by untreated waste at the conclusion of remedial activities.

The Previously Selected Remedy has not satisfied the criterion of long-term effectiveness and permanence. Engineering controls selected in the 1993 ROD Amendment and implemented at the DDA have not prevented the migration of contaminants from the DDA into the Upper Potomac Aquifer. In addition, the operation of the Army Creek Landfill recovery wells was not effective in preventing the migration of Site-specific COCs to the Llangollen well field and did not reduce the magnitude of residual risk from potential exposure to contaminated groundwater to acceptable levels. These failures are primarily attributable to unknown conditions in the subsurface at the time of remedy selection. In particular, unidentified gaps and transmissive zones in the UPCU beneath the DDA prevented adequate containment and treatment of contaminants at the DDA/BRA and the previously selected groundwater response action was not designed or intended to address a persistent secondary source of contamination in the UPCUTZ.

The Selected Remedy will use containment (a cap and the existing slurry wall) and hydraulic control (eLFExS with instrumentation and telemetry for real-time monitoring) to prevent exposure to contaminated soil and minimize the migration of contaminants from soil and groundwater within the Columbia Aquifer at the DDA into the Upper Potomac Aquifer. A properly installed and maintained cap and slurry wall and carefully monitored and maintained eLFExS would provide adequate long-term containment of contaminated soil and groundwater at the DDA. However, permanent land use restrictions and perpetual maintenance activities would be required to ensure the long-term effectiveness and permanence of the containment system.

The Selected Remedy will reduce the risks that would result from the use of groundwater located within the Area of Attainment, including groundwater extracted from the Llangollen well field, to acceptable levels through the extraction and treatment of groundwater. The installation and operation of groundwater extraction wells in the UPCUTZ would also mitigate the migration of contaminants from the UPCUTZ into the upper and lower sand units of the Upper Potomac Aquifer. Upon attainment of the groundwater cleanup standards throughout the Area of Attainment, the scope of the current restrictions on groundwater use could be reevaluated. However, restrictions on the use of groundwater beneath the Waste Management Area would be needed for the foreseeable future to prevent unacceptable future exposure risks. It is anticipated that continued operation of groundwater extraction wells would be required for some time after the groundwater cleanup standards were met in order to prevent contaminants beneath the Waste Management Area from migrating to downgradient areas of the Upper Potomac Aquifer.

Migration of landfill gas from the Inert Area and the Grantham South Area may present a source of unacceptable indoor air quality should new habitable buildings be constructed adjacent to the landfills. The Selected Remedy includes institutional controls to reduce any such risks to acceptable levels.

The long-term effectiveness and permanence of the Selected Remedy will be dependent upon the adequacy of the operation, maintenance and monitoring of the response actions and the implementation of institutional controls. Because wastes would be left in place, reassessment of the effectiveness of the Selected Remedy will be necessary at five-year intervals as required by CERCLA § 121(c).

Reduction of Toxicity, Mobility or Volume

This evaluation criterion evaluates an alternative's use of treatment technologies that permanently and significantly reduce the toxicity, mobility or volume of hazardous substances at a site.

The Previously Selected Remedy provided treatment to reduce the toxicity of contaminants at the DDA and treatment of extracted groundwater to remove iron and reduce the aquatic toxicity of effluent discharged to Army Creek. However, groundwater was not treated to remove organic COCs before it was discharged to Army Creek. In addition, the Previously Selected Remedy did not include treatment of groundwater extracted from the Llangollen well field.

Bioventing implemented at the DDA as a component of the Previously Selected Remedy has already produced significant and permanent reductions in the concentrations of hazardous substances at the DDA. The Selected Remedy includes operation of an eLFExS to provide hydraulic control at the DDA, with discharge of the extracted groundwater to the POTW for treatment.[29] The Selected Remedy also includes extraction of contaminated groundwater from the Upper Potomac Aquifer with discharge of extracted groundwater to the POTW or treatment of extracted groundwater at the Llangollen well field, which would further reduce the toxicity of contaminants and the volume of contaminated groundwater in the Upper Potomac Aquifer.

Short Term Effectiveness

This evaluation criterion considers the length of time needed to implement an alternative, as well as risks to the community, on-site workers and the environment during the construction and implementation phase.

The Previously Selected Remedy employed fencing, a temporary cap at the DDA and institutional controls to prevent unacceptable risks from potential exposure to contaminated soil and groundwater on the Site property. However, it did not include treatment of groundwater extracted from the Llangollen well field to reduce the concentrations of COCs to acceptable risk- and health-based standards or address potential future exposure to contaminants in indoor air and, therefore, does not adequately address short-term risks.

[29] It is expected that permanent reductions in the toxicity of some COCs would occur during secondary (biological) treatment at the POTW.

Artesian's treatment of groundwater at the Llangollen well field, previously implemented institutional controls, and perimeter fencing and a temporary cap at the DDA are currently preventing unacceptable exposure risks. Short-term risks associated with the implementation of the Preferred Alternative would be minimal because of the limited scope of required excavation activities. The installation of a composite barrier cap over the DDA would provide an immediate reduction in the migration of contaminants from unsaturated soil at the DDA into groundwater. The Selected Remedy includes the treatment of groundwater extracted at the Llangollen well field and would reduce the concentrations of COCs to acceptable risk- and health-based levels. Groundwater cleanup standards would ultimately be met throughout the Area of Attainment in the Upper Potomac Aquifer, and institutional controls are in place to prevent exposure to contaminated groundwater until the RAOs are met. The Selected Remedy also includes institutional controls that would prevent potential exposure to Site contaminants in indoor air for any new construction in areas adjacent to the Inert Area and Grantham South Area where landfill gas may be migrating.

Implementability

The evaluation of an alternative under this criterion considers the technical and administrative feasibility of implementing the alternative, including factors such as the availability of materials and services.

The Previously Selected Remedy has been implemented with the exception of soil vapor extraction and the installation of a composite barrier cap. However, the Previously Selected Remedy did not perform as designed. Subsurface conditions prevented dewatering of the soil at the DDA/BRA, impeding bioremediation in the saturated zone, and allowed the continued release of dissolved-phase contaminants from the DDA/BRA into the Upper Potomac Aquifer. Groundwater response actions did not address contamination in the UPCUTZ or restore groundwater quality in the Upper Potomac Aquifer downgradient of the Site property boundary.

The Selected Remedy will use technology, equipment and materials that are readily available, generally proven to mitigate the migration of contaminants from the slurry-wall containment area and expected to attain groundwater cleanup standards throughout the Area of Attainment within a reasonable time frame. Pre-design investigations would be required prior to the installation of groundwater extraction wells and the installation of extraction wells would be phased in order to optimize the design and performance of the groundwater collection system. Treatment systems to remove COCs from groundwater extracted at the Llangollen well field are either already in place and operating effectively or, with respect to manganese, available and proven technologies. Mechanisms exist within the State and County governments to institute and enforce land use restrictions to prevent potential exposure to Site contaminants in indoor air.

Cost

The estimated present worth cost of the Previously Selected Remedy, $29,241,300, is the sum of the estimated costs in the 1993 ROD Amendment for remediation of the DDA and Ridge Area and the estimated costs in the 1988 ROD for Upper Potomac Aquifer groundwater recovery and treatment. No adjustment was made to account for the time value of money and these costs are not directly comparable with the estimated costs for the Selected Remedy. The Previously Selected Remedy has been implemented with the exception of soil vapor extraction and

installation of a composite barrier cap at the DDA. The actual costs for implementation are not readily available to EPA since the DS&G Remedial Trust implemented the remedies and are not obligated to provide cost information to EPA.

The estimated present worth cost of the Selected Remedy is $46,100,000. This 30-year present worth estimate was calculated using a seven percent discount rate.

State Acceptance

The State of Delaware concurs with the Selected Remedy but has expressed concerns regarding its long-term effectiveness and permanence. EPA's response to these concerns is included in the Responsiveness Summary, which is a part of this Amendment.

Community Acceptance

The Proposed Plan and supporting documents were made available to the public in the Administrative Record file in September 2016. From September 7 to October 7, 2016, EPA held a 30-day public comment period to accept public comment on the remedial alternatives presented in the Proposed Plan and the other documents contained within the Administrative Record file for the Site. On September 21, 2016, EPA held a public meeting to discuss the Proposed Plan and accept comments. A transcript of this meeting is included in the Administrative Record file.

The local community generally supports the Selected Remedy. During the public comment period, no one objected to EPA's Preferred Alternative, although members of the local community expressed concerns regarding the on-site management of waste which is a component of the Selected Remedy, the aquifer restoration time frame and continued use of the Llangollen water supply wells while the groundwater is being remediated, and the adequacy of groundwater monitoring.

EPA received extensive comments on the Proposed Plan from the DS&G Remedial Trust and its consultant, Golder Associates, which support the Selected Remedy. A summary of significant comments received during the public comment period and EPA's responses are included in the Responsiveness Summary which is part of this ROD Amendment No. 2.

2.11 PRINCIPAL THREAT WASTE

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable [40 CFR § 300.430(a)(1)(iii)(A)]. The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, surface water or air, or acts as a source for direct exposure. Contaminated ground water generally is not considered to be a source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur.

Principal threat wastes which were present at the DDA have been addressed through prior remedial actions, including off-site disposal of drummed chemical waste and impacted soil and

in-situ treatment of soil at the BRA. As discussed in the *Supplemental Site Characterization Report – Revision 2*, a comparison of laboratory analytical data for soil samples collected at the DDA between 2011 and 2013 with principal threat soil screening levels indicates a low potential for remaining principal threat material at the DDA. EPA expects that the remaining contamination at the DDA source area can be reliably controlled in place through the installation of a composite barrier cap above the slurry-wall enclosure and enhanced hydraulic control measures, which are components of the Selected Remedy.

2.12 SELECTED REMEDY

Following review and consideration of the information in the Administrative Record, the requirements of CERCLA and the NCP, and public comment, EPA has selected the remedy identified as EPA's Preferred Alternative in the Proposed Plan *(Alternative C - DDA Enhanced Containment and Groundwater Extraction from UPCUTZ and Upper Potomac Aquifer with Direct Discharge to POTW*) to address contamination remaining at the Site which was not adequately addressed by the Previously Selected Remedy.

Summary of the Rationale for the Selected Remedy

EPA expects that the Selected Remedy will be protective of human health and the environment, will cost-effectively achieve the RAOs, including restoration of groundwater throughout the Area of Attainment within a reasonable time frame, and will comply with ARARs.

The Selected Remedy consists of components of the remedial action for the Site, which are categorized as follows:

1) Remedial components that were previously selected in the prior decision documents referenced above, but which are not being modified by this ROD Amendment No. 2 (each identified below as an "Existing Component");

2) Remedial components that were previously selected in the prior decision documents, but which are being modified by this ROD Amendment No. 2 (each identified below as a "Modified Component"); and

3) New remedial components that were not previously selected in the prior decision documents (each identified below as a "New Component").

Specifically, this ROD Amendment No. 2 selects the following components of the Selected Remedy:

1. Slurry-wall system (Existing Component);
2. Pre-design investigations to develop supplemental information regarding source and extent of contamination in the Upper Potomac Aquifer and hydraulic connections between hydrostratigraphic units within the Upper Potomac Aquifer, and confirm target capture zones within the Upper Potomac Aquifer (New Component);
3. Hydraulic control of contaminated groundwater within the slurry-wall enclosure using an enhanced low-flow groundwater extraction system (eLFExS) (Modified Component);

4. A composite barrier cap to minimize infiltration of precipitation through contaminated soil contained within the slurry wall surrounding the DDA (Existing Component);
5. Installation and operation of extraction wells in areas determined to optimize capture and remove contaminant mass from the more highly-impacted areas of the Upper Potomac Aquifer, including the UPCUTZ (Modified Component);
6. Discharge of groundwater pumped from the DS&G extraction wells to the Wilmington Wastewater Treatment Plant (Modified Component);
7. Continued groundwater extraction at Artesian's Llangollen well field with treatment utilizing existing systems for BCEE and 1,4-dioxane and, if necessary, additional treatment systems targeting other COCs (New Component);
8. A groundwater monitoring program to ensure that the remedial action is meeting the short-term goal of plume containment and will meet the long-term goal of aquifer restoration in the Area of Attainment within a reasonable time frame (New Component);
9. Institutional controls to prevent direct contact with contaminated soil, the installation of drinking water wells on the Site property and other future uses of the Site property which could compromise the effectiveness of the Selected Remedy (Existing Component); and
10. Institutional controls to prevent potential future exposure to Site contaminants in indoor air (New Component).

The Selected Remedy and mandatory performance standards are described in detail below.

2.12.1 Slurry-wall System

The existing slurry wall, constructed in 1994 and keyed into the underlying UPCU, will remain in place as a passive containment system at the DDA, with added instrumentation, as indicated in Section 2.12.3, below, to monitor performance.

2.12.2 Pre-design Investigations

Areas of uncertainty at the Site identified in the Feasibility Study will be addressed during pre-design investigations which will include but not be limited to the following activities:

- Delineation of the extent of contamination in the UPCUTZ;
- Verification of target capture zones for extraction wells to be installed in the UPCUTZ and the upper and lower sand units of the Upper Potomac Aquifer;
- Evaluation of the interaction between the UPCUTZ and Upper Potomac Aquifer upper sand, including the area of greatest contaminant mass flux from the UPCUTZ to the Upper Potomac Aquifer;
- Evaluation of the continuity and/or extent of the UPDC and the connection between the upper and lower sand units of the Upper Potomac Aquifer between source areas and the Llangollen well field;
- Additional characterization to evaluate the simulated silt feature near well P-6 in the Site-specific groundwater flow model;

- Assessment of the source of impacts (e.g., BCEE, 1,4-dioxane and/or manganese) in the vicinity of monitoring wells P-6, MW-18 and MW-34, BW-2 and MW-26N; and

- Delineation of areas beyond the boundary of the Inert Area and the Grantham South Area impacted by subsurface migration of landfill gas in order to ensure that institutional controls are in place to prevent potential future exposure to all areas where Site-related vapor intrusion adversely affects indoor air.

These pre-design activities will include the advancement of borings and installation of monitoring wells using rotosonic drilling methods with vertical aquifer profiling[30] and baseline groundwater sampling to confirm target capture zones. Aquifer testing will be performed in the potential extraction well locations to confirm the modeled groundwater extraction rates and evaluate the connections between hydrostratigraphic units within the Upper Potomac Aquifer. The results of the sampling and testing will be used to update the CSM and the numerical groundwater flow model, refine the simulated capture zones and develop design extraction rates for the groundwater extraction wells.

Performance Standards for Pre-Design Investigations

Wells installed during pre-design investigations will be constructed, modified and repaired in accordance with the substantive requirements of Delaware's regulations governing construction and use of wells (7 DE Admin. Code 7301). Wells and pumps will be installed and repaired by persons licensed by the Water Well Licensing Board pursuant to 7 DE Admin. Code 7302.

Drill cuttings identified as hazardous waste and other generated hazardous waste will be managed in accordance with Delaware's standards applicable to generators of hazardous waste, including storage and manifesting of hazardous waste (7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsections 262.11-42).

2.12.3 Enhanced Low-Flow Groundwater Extraction System

The LFExS, which is currently operating within the slurry-wall containment area, will be upgraded to ensure that the system will provide reliable source containment and migration control at the DDA.

Additional groundwater extraction wells will be installed in the Columbia Aquifer within the slurry-wall enclosure. The new wells and existing LFExS wells will be operated at an estimated 25 gpm, instead of the current extraction rate of 8 to 10 gpm, to increase the rate of contaminant mass removal from the DDA and provide reliable hydraulic containment of contaminated groundwater at the DDA. Instrumentation will be installed on the inside and outside of the slurry-wall system with telemetry to monitor head differences and the effectiveness of hydraulic containment in real-time. In addition, an emergency backup generator will be installed to provide power for the eLFExS in the event of electrical service interruption.

[30] During advancement of the borings, groundwater will be sampled using the Push-Ahead™ groundwater sampling system (vertical aquifer profiling) used with sonic drilling methods.

Performance Standards for eLFExS

The eLFExS will provide hydraulic containment at the DDA by inducing inward (horizontal) gradients in the Columbia Aquifer across the slurry wall, and upward (vertical) gradients between the Upper Potomac Aquifer and the Columbia Aquifer, thereby maintaining a lower potentiometric head within the DDA. The eLFExS will be operated until EPA, in consultation with DNREC, determines that operation of the system is no longer required to prevent contaminant releases from the DDA into the Upper Potomac Aquifer.

Additional extraction wells installed in the Columbia Aquifer at the DDA will be constructed, modified and repaired in accordance with the substantive requirements of Delaware's regulations governing construction and use of wells (7 DE Admin. Code 7301). Wells and pumps will be installed and repaired by persons licensed by the Water Well Licensing Board pursuant to 7 DE Admin. Code 7302.

Drill cuttings identified as hazardous waste and other generated hazardous waste will be managed in accordance with Delaware's EPA-authorized standards applicable to generators of hazardous waste, including storage and manifesting of hazardous waste (7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsections 262.11-42).

2.12.4 Installation of Composite Barrier Cap

Bioventing wells and vapor probes within the slurry-wall enclosure will be decommissioned. A composite barrier cap system, designed to minimize water infiltration, will be installed over the entire DDA, including the "containment" and "partition" areas of the slurry-wall enclosure at the DDA.[31]

Performance Standards for Installation of Composite Barrier Cap

Bioventing wells and vapor probes will be decommissioned in accordance with State requirements for well sealing (7 DE Admin. Code 7301 Regulations Governing the Construction and Use of Wells, Section 10.0).

The cap will comply with State standards for owners and operators of hazardous waste landfills. In particular, the design, construction and O&M of the composite barrier cap will meet Delaware's EPA-authorized requirements for closure and post-closure care of hazardous waste landfills [7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsections 264.310(a) and (b)(1) and (5)] and for monitoring and inspection during the installation of the cover system [7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsection 264.303(a)].

[31] The area within the slurry-wall system is divided by a partition wall, which isolates the portion of the DDA with contaminated soils (containment area) from the area where the clay is thin, discontinuous or not present (partition area), as discussed in the Feasibility Study.

2.12.5 Installation and Operation of Extraction Wells in the Upper Potomac Aquifer

Groundwater extraction wells shall be installed and operated in areas determined to optimize capture and removal of contaminant mass from the Upper Potomac Aquifer and shall be sufficient to control the migration of contaminants and to attain the groundwater cleanup standards throughout the Area of Attainment within a reasonable time frame.

The location and number of recovery wells in the UPCUTZ and the upper and lower sand units of the Upper Potomac Aquifer will be determined by EPA, in consultation with DNREC, based on the results of the pre-design investigations and performance monitoring during remedy implementation.[32]

The effectiveness of the groundwater extraction system in capturing and containing contaminant mass will be routinely evaluated and the system will be modified as necessary to achieve the RAO for groundwater in the Upper Potomac Aquifer.

Performance Standards for Installation and Operation of Extraction Wells in the Upper Potomac Aquifer

Additional extraction wells installed in the Upper Potomac Aquifer, including the UPCUTZ, will be constructed, modified and repaired in accordance with the substantive requirements of Delaware's regulations governing construction and use of wells (7 DE Admin. Code 7301). Wells and pumps will be installed and repaired by persons licensed by the Water Well Licensing Board pursuant to 7 DE Admin. Code 7302.

Drill cuttings identified as hazardous waste and other generated hazardous waste will be managed in accordance with Delaware's EPA-authorized standards applicable to generators of hazardous waste, including storage and manifesting of hazardous waste (7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsections 262.11-42).

The extraction of ground water from the Upper Potomac Aquifer will continue until MCLs (40 CFR §§ 141.11-.12 and 141.61-.62) and non-zero MCLGs (40 CFR §§141.50-.51) are attained throughout the Area of Attainment and the cumulative excess cancer risk associated with potential residential use of the ground water within the Area of Attainment is reduced to one in ten thousand (1.0×10^{-4}) and the HI is reduced to 1.0.

Once the groundwater cleanup standards have been met throughout the Area of Attainment, groundwater extraction wells will continue to be operated to prevent contaminated groundwater beneath the Waste Management Area from migrating and degrading groundwater quality in the Upper Potomac Aquifer downgradient of the Waste Management Area. Groundwater extraction wells will be operated in the Upper Potomac Aquifer, including the UPCUTZ, until EPA, in consultation with DNREC, determines that operation of the wells is no longer required to ensure

[32] Based on the results of the groundwater flow modeling performed in support of the Feasibility Study, it is anticipated that approximately 222 gpm of groundwater will be extracted from the Upper Potomac Aquifer in order to provide effective migration control.

that groundwater quality in the Upper Potomac Aquifer beyond the Waste Management Area continues to meet the cleanup standards.

EPA's determination regarding the attainment of risk- and health-based groundwater cleanup standards will be based on an assessment of cumulative risks associated with residential use of groundwater. A cumulative excess cancer risk of 1×10^{-4} was selected as the risk-based performance standard for groundwater remediation because there are multiple groundwater contaminants which contribute to carcinogenic risk. As discussed above, groundwater extraction wells will continue to be operated after the risk- and health-based groundwater cleanup standards, MCLs and non-zero MCLGs are met to prevent degradation of water quality downgradient of the Waste Management Area. As discussed in Section 2.12.7 of this ROD Amendment No. 2, treatment at the Llangollen well field shall provide an additional degree of protectiveness.

Groundwater extraction wells will be decommissioned in accordance with State requirements for well sealing (7 DE Admin. Code 7301 Regulations Governing the Construction and Use of Wells, Section 10.0).

2.12.6 Discharge of Groundwater to the Wilmington Wastewater Treatment Plant

Groundwater extracted from the Columbia Aquifer and the Upper Potomac Aquifer will be discharged to the Wilmington Wastewater Treatment Plant.

Performance Standards for Discharge of Groundwater to the Wilmington Wastewater Treatment Plant

Groundwater discharged to the Wilmington Wastewater Treatment Plant will comply with effluent limitations established by New Castle County and the City of Wilmington to meet the requirements of Delaware's National Pollutant Discharge Elimination System Program (7 DE Admin. Code 7201 Regulations Governing the Control of Water Pollution, Section 6.0) and will meet all pretreatment standards established by New Castle County and the City of Wilmington in accordance with the NPDES General Pretreatment Regulations for Existing and New Sources of Pollution (40 CFR Part 403).[33]

2.12.7 Continued Groundwater Extraction and Treatment at Llangollen Well Field

The Selected Remedy includes continued groundwater extraction at Artesian's Llangollen well field with treatment utilizing existing systems for BCEE (granular activated carbon) and 1,4-dioxane (advanced oxidation process) and, if necessary to protect human health, additional treatment systems targeting manganese or other COCs. The continued operation of water supply wells at the Llangollen well field will assist in restoring groundwater to its beneficial use and prevent downgradient migration of contaminants.

[33] The need for pretreatment is not currently anticipated based on the estimated mass loading of BCEE to the POTW resulting from projected groundwater discharges from the Site.

Performance Standards for Groundwater Extraction/Treatment at Llangollen Well Field

If any Site-related COCs are determined to be present in groundwater extracted from a Llangollen well field public water supply well at concentrations determined by EPA to present an excess lifetime cancer risk greater than $1.0 \text{ X } 10^{-4}$, or potential non-cancer adverse health effects (HQ > 1.0 or, where there are multiple COCs with non-cancer endpoints affecting the same target organ, HI > 1.0), treatment will be provided at the well field to reduce the concentrations of those COCs to MCLs or, where MCLs are not available or the presence of multiple COCs would result in unacceptable cumulative risk, to acceptable risk- and health-based levels (i.e., concentrations that would not present an excess cancer risk greater than 2.0×10^{-5} or an HI exceeding 1.0).

Any generated treatment residuals identified as hazardous waste will be managed in accordance with Delaware's EPA-authorized standards applicable to generators of hazardous waste, including storage and manifesting of hazardous waste (7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsections 262.11-42).

2.12.8 Groundwater Monitoring

A groundwater monitoring program will be implemented to evaluate the effectiveness of hydraulic containment and contaminant migration control and progress toward the attainment of the RAO for groundwater in the Upper Potomac Aquifer. The locations, frequency, and duration of groundwater monitoring, and the analytical parameters and methods to be used, will be determined by EPA, in consultation with DNREC.

Performance Standards for Groundwater Monitoring

New monitoring wells will be constructed and repaired in accordance with the substantive requirements of Delaware's regulations governing construction and use of wells (7 DE Admin. Code 7301). Wells will be installed and repaired by persons licensed by the Water Well Licensing Board pursuant to 7 DE Admin. Code 7302.

Drill cuttings identified as hazardous waste and other generated hazardous waste will be managed in accordance with Delaware's EPA-authorized standards applicable to generators of hazardous waste, including storage and manifesting of hazardous waste (7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsections 262.11-42).

Monitoring wells will be abandoned in accordance with State requirements for well sealing (7 DE Admin. Code 7301 Regulations Governing the Construction and Use of Wells, Section 10.0).

2.12.9 Existing Institutional Controls

Institutional controls selected in EPA's 2003 ESD will prevent direct contact with contaminated soil, the installation of drinking water wells on the Site property and other future uses of the Site property which could compromise the effectiveness of the Selected Remedy.

2.12.10 Institutional Controls to Prevent Exposure to Site Contaminants in Indoor Air

Land use limitations will be put in place to prevent potential future exposure to Site contaminants in landfill gas that are capable of migrating into indoor air. The land use limitations will ensure that all new habitable buildings constructed on or adjacent to the Site property in areas potentially impacted by landfill gas (i.e., within several hundred feet of those sections of the Inert Area and the Grantham South Area where landfill gas mitigation measures are not in place) have, at a minimum, a foundation vapor barrier and subsurface piping for a SSDS, and will be subjected to indoor air testing prior to building occupancy. Should indoor air concentrations equal or exceed EPA risk-based criteria, the land use limitations will require activation and operation of a SSDS until such time that EPA, in consultation with DNREC, determines that landfill gas migration no longer poses a vapor intrusion risk. The use limitations will be implemented through enforceable institutional controls such as judicial consent decrees, administrative orders, State regulations, local ordinances or environmental covenants.

Performance Standards

Should indoor air concentrations in habitable buildings constructed adjacent to the Inert Area or the Grantham South Area present an excess lifetime cancer risk greater than 1.0×10^{-5} or a HI greater than 1.0 (based on target organ effects), the installation, activation and operation of a vapor intrusion mitigation system will be required. O&M of the vapor intrusion mitigation system will continue until such time that EPA determines that landfill gas migration no longer poses a vapor intrusion risk.

Summary of the Estimated Remedy Costs

The estimated cost of the Selected Remedy is $46,100,000. Details regarding the estimated costs to construct and implement the Selected Remedy are provided in Appendix E. The information in Appendix E is based on the best available information regarding the anticipated scope of the remedial alternative. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Minor changes may be documented in the form of a memorandum to the Administrative Record file. Changes which are significant, but not fundamental, may be documented in an ESD. Any fundamental changes will be documented in a ROD amendment.

<u>Expected Outcome of the Selected Remedy</u>

This section presents the expected outcomes of the Selected Remedy in terms of resulting land and groundwater uses and risk reduction achieved as a result of the response action.

The Selected Remedy will prevent exposure to contaminated soil and groundwater at the DDA through a combination of engineering and institutional controls. Land use at the DDA will be restricted to long-term waste management and the use of groundwater beneath the Waste Management Area will be prohibited.

The Selected Remedy will prevent exposure to groundwater COCs through groundwater treatment at the Llangollen well field and continued implementation of institutional controls

restricting groundwater use that could result in unacceptable exposure risks or interfere with the effectiveness of the remedial action.

The Selected Remedy will restore groundwater in the Area of Attainment within the Upper Potomac Aquifer which has been impacted by releases from the DS&G Site and the eastern lobe of the Army Creek Landfill.

Through operation of the eLFExS within the slurry-wall system and operation of groundwater extraction wells in the Upper Potomac Aquifer, including the UPCUTZ, it is estimated that the groundwater cleanup standards will be achieved throughout the Area of Attainment within 25 years. Upon attainment of the groundwater cleanup standards, contaminant levels in groundwater within the Upper Potomac Aquifer beyond the boundary of the Waste Management Area will be below MCLs and MCLGs, and use of the groundwater in a residential setting would present an excess lifetime cancer risk that is less than 1.0×10^{-4} and no adverse non-cancer health effects. Once the groundwater cleanup standards are achieved, the need for institutional controls restricting groundwater use can be reevaluated as part of the CERCLA five-year review process.

The Selected Remedy will prevent potential future exposure to Site-related contaminants in indoor air through institutional controls that will require property owners to implement measures to mitigate potential vapor intrusion at new construction adjacent to the Inert Area and the Grantham South Area, without prohibiting future land use.

2.13 STATUTORY DETERMINATION

Under Section 121 of CERCLA (42 U.S.C. § 9621) and the NCP [40 C.F.R. § 300.430(f)(5)(ii)], EPA must select remedies that are protective of human health and the environment, comply with ARARs, are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery to the maximum extent possible. There is also a preference for remedies that use treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the remedy modification meets these statutory requirements.

Protection of Human Health and the Environment

The Selected Remedy will protect human health and the environment using a combination of treatment, engineering controls and institutional controls. The composite barrier landfill cap to be installed at the DDA will minimize infiltration and mitigate the release of contaminants from the vadose zone within the slurry-wall enclosure into the groundwater of the Columbia Aquifer. Operation of the eLFExS will prevent the release of contaminated groundwater from the slurry-wall enclosure into the UPCUTZ and the upper sand unit of the Upper Potomac Aquifer. The operation of groundwater extraction wells in the Upper Potomac Aquifer, including the UPCUTZ, will optimize capture and removal of contaminant mass from the more highly-impacted areas of the Upper Potomac Aquifer in order to meet groundwater cleanup standards throughout the Area of Attainment within a reasonable time frame. Upon meeting the groundwater RAOs, residential use of groundwater within the Upper Potomac Aquifer

downgradient of the Waste Management Area would not present an excess lifetime cancer risk that exceeds 1.0×10^{-4} or adverse non-cancer health effects.

Treatment at the Llangollen well field will reduce the concentrations of Site-specific COCs to acceptable risk- and health-based levels, i.e., concentrations that do not present an excess cancer risk greater than 2.0×10^{-5} or an HI exceeding 1.0.

Institutional controls will require testing of indoor air in any habitable buildings constructed in areas affected by the migration of landfill gas from the Inert Area and the Grantham South Area and, should indoor air concentrations of Site-related contaminants exceed EPA's risk-based criteria, the activation and operation of a SSDS until such time that EPA determines that landfill gas migration no longer poses a vapor intrusion risk.

Short-term risks associated with the implementation of the Selected Remedy are expected to be minimal because of the limited scope of required excavation activities. Groundwater discharged to the POTW will meet effluent limitations established by local authorities to ensure compliance with State regulations governing discharge to surface water. No adverse cross-media impacts are expected during implementation of the Selected Remedy.

Compliance with Applicable or Relevant and Appropriate Requirements

The Selected Remedy will comply with all Federal and State requirements, standards, criteria, and limitations that are applicable or relevant and appropriate, as required by Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), and the NCP, 40 CFR §§ 300.430(f)(5)(ii)(B) and (C), as discussed in Section 2.12 of this Amendment and Appendix D.

Cost-Effectiveness

A cost-effective remedy in the Superfund program is one for which the implementation costs are proportional to the overall effectiveness of the remedy. Overall effectiveness of a remedial alternative is determined by considering how it satisfies the following primary balancing criteria: long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; and short-term effectiveness. The Selected Remedy provides long- and short-term effectiveness and includes treatment to reduce the toxicity of contaminants. EPA has determined that cost of the Selected Remedy is proportional to its overall effectiveness.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be practicably utilized at the Site. Among the alternatives considered in the Feasibility Study that are protective of human health and the environment and ARAR compliant, EPA has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and State and community acceptance.

Bioventing was previously implemented at the DDA to address principal threats and reduce the toxicity and mobility of contaminants. The Selected Remedy addresses lower level threats presented by residual contaminants using engineering controls, including a landfill cap and hydraulic containment, institutional controls and long-term monitoring and maintenance to ensure protection of human health and the environment.

Preference for Treatment as a Principal Element

Previously implemented response actions at the DDA included treatment as a principal element. The Selected Remedy employs treatment of groundwater extracted at the Llangollen well field to reduce the toxicity of contaminants and satisfies the statutory preference for treatment as a principal element.

Five-Year Review Requirements

Because the Selected Remedy will result in hazardous substances, pollutants or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure, five-year reviews will be conducted in accordance with statutory requirements pursuant to Section 121(c) of CERCLA, 42 U.S.C. § 9621(c) and the NCP, 40 CFR § 300.430(f)(4)(ii), to ensure that the remedy continues to provide adequate protection of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

There are no significant changes from the Preferred Alternative presented in the Proposed Plan.

3.0 RESPONSIVENESS SUMMARY

This Responsiveness Summary documents public participation in the remedy selection process for the DS&G Site. It contains a summary of the significant comments EPA received on the Proposed Plan during the public comment period and EPA's responses to those comments. The Proposed Plan was released for public comment on September 7, 2016, and the thirty-day comment period ended on October 7, 2016. On September 21, 2016, EPA held a public meeting at William Penn High School in New Castle, Delaware, to inform local officials, interested citizens and other stakeholders in attendance about EPA's proposed cleanup plan, and to receive comments on, and respond to questions about, the Proposed Plan.

Section 3.1, below, summarizes issues raised by stakeholders, including citizens, the support agency and PRPs. Section 3.1.1 contains a detailed list of comments received from the general public, along with EPA's responses. Section 3.1.2 contains a summary of comments received during the public meeting directed toward Artesian and Artesian's responses. During the public comment period, DNREC requested that EPA include responses to the State's July 28, 2015 comments on the draft Feasibility Study in the Responsiveness Summary. Section 3.1.3 of this Amendment contains a summary of DNREC's comments on the draft Feasibility Study with EPA's responses. Sections 3.1.4 and 3.1.5 contain a summary of comments submitted by the DS&G Remedial Trust and the Government of New Castle County Delaware, and EPA's responses. The written comments received from the DS&G Remedial Trust, Golder Associates and the Government of New Castle County, Delaware are contained in the Administrative Record file.

3.1 STAKEHOLDER ISSUE AND LEAD AGENCY RESPONSES

3.1.1 Comments from the General Public

Comment #1: A local citizen asked during the public meeting if her residence was located in the vicinity of the plume and, if so, whether she should be concerned.

Response: The contaminated groundwater is located beneath and downgradient of the Waste Management Area (within the Area of Attainment shown in Figure 6), and is approximately 70 to 180 feet below the ground surface, with a layer of clay separating the groundwater from the surface. Therefore, because of these conditions, EPA has determined that residences in the vicinity of the Site are not susceptible to migration of vapors from the groundwater contaminant plume into indoor air.

Comment #2: Two local citizens expressed concern during the public meeting that exposure to Site-related contaminants might be responsible for their pets' health concerns or premature deaths.

Response: Potential exposure pathways at the Site include exposure to contaminated soil and groundwater and exposure to Site-related contaminants in indoor air. EPA has evaluated those exposure pathways and determined that they have been eliminated. Specifically, the potential for exposure to contaminated soil and waste at the Site has been eliminated through engineering controls (landfill caps and fences). The potential for exposure to Site-related contaminants in

indoor air exists only at buildings adjacent to the Inert Area and the Grantham South Area, both located within the Waste Management Area, where landfill gas may be migrating in the subsurface. Steps have been, and will continue to be, undertaken to prevent exposure to Site-related contaminants in indoor air as discussed in Section 2 of this Amendment. The potential for exposure to Site-related COCs in tap water has been eliminated by treatment provided by Artesian at the Llangollen well field to address BCEE (since 2000) and 1,4-dioxane (since 2014). Therefore, while EPA evaluated the risks that the Site presents to human health and the environment, and not risks posed to domestic pets, there is no basis to conclude that pets are at risk from exposure to Site-related contaminants.

Comment #3: A local citizen asked during the public meeting what contaminants may be found in vapors on or near the Site.
Response: Methane generated during waste decomposition at the Inert Area and the Grantham South Area is the predominant constituent of the landfill gas. The volume of methane generated has caused landfill gas to migrate laterally into soil beyond the perimeter of those waste disposal areas. Contaminants that may be present in the landfill gas include benzene and 1,2,4-trimethylbenzene. To address concerns about landfill gas migration beyond the perimeter of the landfills, the DS&G Remedial Trust installed a soil vapor extraction system to prevent landfill gas from migrating beyond the boundaries of the waste disposal areas.

Comment #4: A local citizen asked during the public meeting if water runoff onto her property was due to recent construction near Llangollen Boulevard.

Response: Construction activities near Llangollen Boulevard are unrelated to the Site. Therefore, EPA does not have the information to determine whether the runoff was due to the construction.

Comment #5: A number of citizens expressed concern during the public meeting that the time frame for groundwater cleanup is projected to be 25 years.

Response: Due to the nature and extent of contamination and the complexity of the subsurface environment at many Superfund sites, ground water cleanup activities often require an extended amount of time to remediate. EPA will take every opportunity to incorporate new methods and technologies to expedite cleanup activities as they are developed.

Comment #6: A local citizen asked during the public meeting how much additional construction work will be associated with the cleanup activities.

Response: Additional construction activities will include the installation of a 3-acre cap over the DDA and installation of groundwater monitoring and extraction wells and subsurface piping to convey extracted groundwater to a pump station that discharges to the sewer.

Comment #7: A local citizen stated during the public meeting that the water in her home, which is supplied by Artesian, has a gasoline odor and taste.

Response: Based on Artesian's annual water quality report, the water supplied by Artesian meets drinking water standards for all contaminants for which there are MCLs established under

the Safe Drinking Water Act, 42 U.S.C. §§ 300f et seq., and codified at 40 CFR Part 141. Artesian's annual water quality reports for public water system DE0000552 are available online and document that water distributed to local residences and businesses meets federal drinking water and other relevant standards. In addition, please see Artesian's response to this comment which is summarized in Section 3.1.2, below.

Comment #8: A local citizen asked during the public meeting if there is any potential for exposure to Site contaminants at her home on Llangollen Boulevard.

Response: EPA has evaluated exposure pathways at the Site and determined that they have been eliminated. Please see EPA's responses to Comments #1 and 2, above. In addition, water that Artesian supplies to local residential and business customers is not pumped directly from the impacted production wells. Artesian has a treatment system to reduce concentrations of groundwater COCs at the Llangollen well field to acceptable levels. The treated water from the Llangollen well field is combined with water from production wells throughout northern New Castle County and the Susquehanna and Brandywine River basins in the water distribution lines. Based on Artesian's annual water quality report, the water supplied by Artesian meets drinking water standards established under the Safe Drinking Water Act, 42 U.S.C. §§ 300f et seq., and codified at 40 CFR Part 141, otherwise known as MCLs. Please see EPA's response to Comment #7, above.

Comment #9: A local citizen asked during the public meeting if it safe to garden on her property on Llangollen Boulevard.

Response: Yes, it is safe. There is no threat of exposure to Site contamination when gardening or planting in the Llangollen Estates development. Please see EPA's responses to Comments #1 and 2, above.

Comment #10: A local citizen asked during the public meeting if it was reasonable to assume that the groundwater contamination has migrated farther south.

Response: Based upon the existing data, EPA believes that production wells in Artesian's Llangollen well field are capturing the groundwater contaminant plume and have, therefore, stopped it from migrating further south. Additional monitoring wells will be installed to ensure that capture at the Llangollen well field is maintained.

Comment #11: A local citizen asked during the public meeting if shutting down Artesian's wells would be a better solution than EPA's preferred method.

Response: EPA determined that there is no need to shut down the wells at this time. Artesian's Llangollen well field is an important source of drinking water in New Castle County. Testing has shown that the water Artesian distributes throughout northern New Castle County meets federal drinking water standards or acceptable risk-based criteria. When BCEE and 1,4-dioxane were detected in groundwater at the Site, EPA informed Artesian and the State of these findings. Both Artesian and Delaware's Office of Drinking Water have been proactive in shutting down production wells before concentrations reached levels that EPA has determined would not be protective. Treatment systems were then installed before bringing the impacted wells back

online. In addition, please see Artesian's response to this comment is summarized in Section 3.1.2, below.

Comment #12: A local citizen asked during the public meeting if it was possible that EPA would discover additional contaminants in groundwater in the future.

Response: Yes, it is possible that additional contaminants could be discovered. Analytical techniques have improved over the years, and will continue to improve, enabling the identification of additional compounds in environmental samples and providing lower detection limits. The DS&G Remedial Trust has agreed to regularly review and update the analytical program for the DS&G Site to ensure the use of appropriate analytical methods for samples collected at the Site.

Comment #13: A local citizen commented during the public meeting that he does not like the use of the phrase "non-detect" in describing testing results because analytical detection limits may vary.

Response: A representative of Delaware's Office of Drinking Water explained that he uses this phrase because it is more accurate to report a result as "non-detect" than to say that an analyte is not present in a sample or that the concentration is "zero." As analytical methodology improves, contaminants can be detected at lower and lower levels.

Comment #14: A local citizen asked during the public meeting if it is known whether treatment provided at the Wilmington Wastewater Treatment Plant would effectively remove contaminants in groundwater discharged from the Site into the sewer system.

Response: Activated sludge, a component of the treatment train at the Wilmington Wastewater Treatment Plant, has been shown to reduce concentrations of some, but not all, Site-related COCs in wastewater. Based on mass loading projections, EPA, in consultation with New Castle County's Department of Special Services, has determined that the discharge of additional groundwater from the Site to the Wilmington Wastewater Treatment Plant will not affect the ability of the POTW to comply with effluent limits to meet Delaware Water Quality Criteria for the protection of human health and aquatic life.

Comment #15: A local citizen asked during the public meeting if contaminants in the groundwater discharged from the Site could end up in sludge generated at the wastewater treatment plant.

Response: Yes, some of the contaminants remain in the sludge, but at levels that do not pose a risk. Sludge from the wastewater treatment plant is taken to mines in Pennsylvania for use in mine reclamation. In Pennsylvania, the sewage sludge may not be applied to the land if the concentration of any pollutant in the sludge exceeds the limit for the pollutant set forth in Pennsylvania's regulations governing the beneficial use of sewage sludge by land application [25 Pa. Code 271.914(b)(1)].

Comment #16: A local citizen asked during the public meeting how EPA can be sure that there aren't more instances of vapor intrusion.

Response: EPA has assessed the potential for vapor intrusion at buildings located above the groundwater contaminant plume, including buildings close to the landfills. Vapor migration from the contaminated groundwater in the Upper Potomac Aquifer into the indoor air of overlying buildings is unlikely. The groundwater contaminant plume is 75 to 100 feet below the ground surface, and there is a thick clay layer, which serves as a barrier, between the groundwater plume and any buildings above the plume. However, there is a potential for landfill gas to migrate laterally through the soil into buildings near the landfills. The DS&G Remedial Trust has addressed this risk through operation of a sub-slab depressurization system at an office building adjacent to the landfills and the installation and operation of a landfill gas mitigation system. Please see EPA's responses to Comments #1 and 2, above.

Comment #17: A local citizen asked during the public meeting if vapors rising from the landfill could contain constituents in addition to methane.

Response: Yes. Landfill gas may contain constituents that are hazardous to human health, in addition to methane. The landfill gas mitigation system recently installed at the Inert Area and the Grantham South Area will prevent landfill gas from migrating into nearby buildings.

Comment #18: A local citizen expressed concerns during the public meeting that EPA's preferred remedial alternative called for containment rather than removal of contaminants from the Site.

Response: In deciding that the remaining wastes and contaminated soil at the DDA will be managed through containment, EPA evaluated remedial alternatives that include excavation or additional treatment of contaminated soil at the DDA in the Feasibility Study as discussed in Section 2.9 of this ROD Amendment No. 2. EPA determined that because contamination is present in the UPCUTZ, removal of contaminated soil at the DDA would not shorten the groundwater remediation time frame. The contaminated UPCUTZ, located beneath the clay unit underlying the DDA, is a significant secondary source of impacts to groundwater in the Upper Potomac Aquifer. The nature (interbedded silts, sands and clays) and location (40 to 80 feet below grade and beneath 5 to 15 feet of clay) of the UPCUTZ substantially curtail remediation options for this secondary source area. The Selected Remedy includes capping the DDA, which will prevent infiltration into the subsurface at the DDA, and groundwater extraction from the UPCUTZ to remove contaminant mass and control the migration of contaminants. EPA does not believe that removal of contaminated soil from the DDA would address the principal remaining source of groundwater contamination at the Site. Based on its evaluation, EPA determined that the Selected Remedy provides an appropriate balance of trade-offs with respect to the nine evaluation criteria.

Comment #19: A local citizen asked during the public meeting if a health assessment had ever been done for the community in the Llangollen Estates area.

Response: Yes, whenever a site is listed on the NPL, the Agency for Toxic Substances and Disease Registry (ATSDR) is required to perform a health assessment for that site. ATSDR conducted a health assessment for the Site in 1989 which was focused primarily on environmental data, including analytical results for Site soil, groundwater, sediment and surface water samples. Because the available data did not indicate that human exposure to Site

contaminants was occurring at the time of the assessment, the Site was not considered for follow-up health studies. ATSDR's April 1989 Health Assessment for Delaware Sand & Gravel Landfill National Priorities List (NPL) Site is available in the Administrative Record file for the Site.

Comment #20: A local citizen stated during the public meeting that many members of the community have died from cancer.

Response: The background cancer rate in the United States is approximately one in two males and one in three females. This means that roughly forty percent of the population will get cancer at some point in their lives. Therefore, it is not uncommon for communities, small neighborhoods, cul-de-sacs, etc. to see a high incidence of cancer. For a group of cancers to be categorized as a cluster, the same form of cancer would need to be found at rates higher than what is normal for that community. Currently, the Delaware Department of Health and Social Services houses the Surveillance, Epidemiology, and End Results Program which tracks all incidence data for the State. Additionally, there have been studies conducted in the past comparing incidences in the upper and lower counties in the State. To date, EPA is not aware that a door-to-door investigation in the vicinity of the Site has been conducted. Such an investigation is certainly something ATSDR would consider if community interest warrants it.

Comment #21: A local citizen asked during the public meeting if the 1,600 drums that were removed from the Site constituted all of the drums on Site, or if any were not removed.

Response: All visible drums, and drums encountered during excavation activities, have been removed from the Site. Specifically, in 1984, more than 1,600 drums which were located at surface level and easily visible were removed from the Site. After the slurry wall was constructed in 1994, excavation activities were conducted at the DDA, and all of the buried drums, an estimated 13,000, encountered during the excavation work, were removed.

Comment #22: A local citizen asked during the public meeting how much contaminated soil will be removed from the Site.

Response: No additional contaminated soils will be removed from the Site. Waste and contaminated soil at the Inert Area and the Grantham South Area have been capped in place. Another permanent cap is to be installed over the DDA to prevent infiltration of water and mobilization of contamination above the water table.

Comment #23: A local citizen commented during the public meeting that the best solution would be to remove contaminated soil from the Site.

Response: See EPA's response to Comment # 18.

Comment #24: A local citizen asked during the public meeting who will be responsible for paying for cleanup activities.

Response: The DS&G Remedial Trust has paid for cleanup and investigation activities required at the Site under the 1995 Consent Decree. EPA will invite the parties it believes are responsible

for the contamination at the Site to implement the Selected Remedy as described in this ROD Amendment No. 2. In the future, if additional treatment is installed at the Llangollen well field to address Site-specific groundwater COCs identified in ROD Amendment No. 2, EPA will seek to have the parties who are implementing ROD Amendment No. 2 to be financially responsible for such treatment.

Comment #25: A local citizen asked during the public meeting how thick the cap that EPA will ultimately install will be and what it will be made of.

Response: A typical composite barrier cap consists of the following, from the bottom up: a foundation layer, a gas collection layer and two hydraulic barriers, which may include a clay layer and a flexible plastic liner. A drainage layer is installed above the hydraulic barriers to drain water resulting from precipitation to the edges of the cap. Topsoil is placed above the drainage layer to protect the underlying layers of the cap and support a grass cover. The thickness of the cap, which depends upon the materials used in cap construction, will be determined during the design phase. Depending on materials used, it is expected that the cap will be two and a half to five and a half feet thick.

Comment #26: A local citizen asked during the public meeting when the drummed chemical waste that resulted in contamination was originally placed into the ground.

Response: Wastes were disposed of at the Site beginning no later than 1968 and continued until sometime in 1976.

Comment #27: A local citizen asked during the public meeting who was responsible for placing the drums into the ground.

Response: The property owner operated the landfills on the Site, and approximately 30 companies either transported waste to, or arranged to have their waste disposed of at, the Site. The names of the owner and those 30 companies can be found in the Administrative Record as signatories to the 1995 Consent Decree.

Comment #28: A local citizen asked during the public meeting what uses the companies had for the materials that were disposed of at the Site.

Response: The materials that the companies arranged to dispose of at the Site were wastes from the companies' plants and drums of materials for which they no longer had use. Such disposal was a fairly common practice in the 1960s and 1970s prior to the enactment of environmental protection laws.

Comment #29: A local citizen asked during the public meeting what effects these contaminants could have on residents if they were to be exposed to them.

Response: The potential for adverse health effects from exposure to contaminants which are present at the Site (e.g., BCEE, 1,4-dioxane and manganese) would depend on the concentration of the contaminant and the amount of time an individual is exposed to the contaminant. Exposure to low concentrations of Site contaminants in groundwater could occur without

negative effects on human health. Exposure to higher concentrations of Site contaminants over an extended period of time could pose a health risk. BCEE is a probable human carcinogen. Exposure to high levels of BCEE can cause irritation to the skin, eyes, throat, and lungs. 1,4-dioxane is a likely human carcinogen. Exposure to high levels of 1,4-dioxane could affect the liver and kidneys. Manganese is a naturally occurring substance found in many types of rock, soil, groundwater and food. Exposure to high levels of manganese can affect the nervous system, cause changes in behavior and decrease the ability to learn and remember.

Comment #30: A local citizen commented via e-mail that he felt the composite barrier should be extended over to the Llangollen Green area. As a child, he and a friend witnessed tankers dumping their contents in the landfill area abutting Llangollen Green.

Response: EPA requested clarification from the commenter regarding the location of the Llangollen Green area. The commenter identified the Grantham South Area on a map as the area where he had witnessed tankers emptying their contents. EPA completed construction of a multi-layer landfill cap over the Grantham South Area in 1991 to prevent rainwater from entering the landfill and carrying contaminants downward into groundwater. Additional studies will be performed to evaluate whether the Grantham South Area or the nearby Inert Area may be contributing to groundwater contamination as recommended in EPA's 2015 Five-Year Report for the DS&G Landfill, which is available online at https://semspub.epa.gov/work/03/2179999.pdf.

Comment #31: A local citizen asked via e-mail what EPA's mandate is in requiring Artesian to shut down production wells instead of continuing to operate them when known carcinogens are present in the groundwater.

Response: Artesian installed treatment systems in 2000 to remove BCEE and in 2014 to remove 1,4-dioxane. EPA, DNREC and Delaware's Office of Drinking Water have been carefully monitoring conditions at the Llangollen well field and have not found contaminants in drinking water at levels above drinking water standards or acceptable risk-based concentrations. Therefore, because treatment provided at the Llangollen well field has been reliable and effective in protecting human health, the production wells can continue to be used.

Comment #32: A local citizen asked via e-mail what contaminant levels were found in treated drinking water and where the community could access this data.

Response: Artesian's annual water quality reports are available online and the most recent report for the system that includes the Llangollen well field can be found online at http://www.artesianwater.com/WQR/AWC2015.pdf. As indicated in the most recent report, concentrations of BCEE and 1,4-dioxane in the water supply are well below levels of concern. There are no federal drinking water standards for BCEE and 1,4-dioxane. However, Site-specific risk-based groundwater cleanup standards were developed for these chemicals as discussed in Section 2.7.2 of this ROD Amendment No. 2. Groundwater pumped from the Llangollen well field is being treated prior to distribution so that drinking water meets regulatory and risk-based standards.

Comment #33: A local citizen asked via e-mail if there was a possibility that Artesian will reach a diminishing rate of return in operating the Llangollen well field and renege on treatment.

Response: The Selected Remedy requires treatment to address Site-related COCs at the Llangollen well field. EPA will seek to have the PRPs implement the Selected Remedy which includes treatment to address Site-related COCs.

Comment #34: A local citizen asked via e-mail what contaminants citizens might be exposed to in addition to those discussed in the Proposed Plan and why additional contaminant testing is not part of EPA's Proposed Plan.

Response: All known contaminants of potential concern in groundwater are discussed in the Proposed Plan and the Administrative Record file. The DS&G Remedial Trust is implementing a comprehensive groundwater monitoring program at the Site which has been updated with additional target analytes several times in recent years. As part of the groundwater monitoring plan, the DS&G Remedial Trust has agreed to review and update the analytical program for the DS&G Site every two years in order to ensure the use of appropriate analytical methods for Site samples.

Comment #35: A local citizen asked via e-mail if EPA will wait for citizens to become sick with cancer before responding.

Response: No. There are currently no exposures to Site-related contaminants at levels of concern (i.e., levels that present an excess lifetime cancer risk greater than 1×10^{-4} or a non-cancer HI greater than 1.0). Implementation of the Selected Remedy will prevent potential future exposure to Site-related contaminants at levels of concern and restore groundwater in the Upper Potomac Aquifer within a reasonable time frame.

Comment #36: A local citizen asked via e-mail if the events in Flint, Michigan, will be repeated at the DS&G Site.

Response: No. EPA has addressed the release of contaminants from the DS&G and Army Creek Landfill Sites through a number of response actions discussed in Section 2 of this ROD Amendment No. 2 and will continue to address contamination at the Sites in the future to ensure adequate protection of human health and the environment.

3.1.2 Comments Regarding Artesian Water Company's Operations and Testing

A number of citizens during the public meeting had questions and comments directly for the Artesian Water Company. Those questions and comments raised concerns about observed odors and tastes; whether the Llangollen wells should continue to be operated or be shut down; Artesian's construction activities in the community; and Artesian's groundwater monitoring and treatment systems. Artesian's responses to citizens' questions and comments are recorded in the transcript of the public meeting which is available in the Administrative Record file. A short summary of Artesian's responses to these comments can be found below:

Odor and taste - Should a customer have a concern about drinking water taste or odor, the customer may contact Artesian's Water Quality Department and a representative will visit the residence or business and test the water quality. Inquiries may be made by calling (302) 453-6900 or sent via email to custserv@artesianwater.com.

Shutting down production wells - If there is any sign of trouble within the treatment system, Artesian will shut down the well(s) until a solution is found and implemented. It is Artesian's opinion that it can serve the community by continuing to operating the Llangollen well field which is an integral part of the remedy for the DS&G Site.

Local construction projects - Artesian construction crews will be seen in the community from time to time performing maintenance activities.

Testing frequency - Testing schedules can vary from contaminant to contaminant. Citizens are encouraged to contact Artesian and request a copy of the testing schedule for their public water system.

Artesian's monitoring program - Artesian is doing everything within its power to ensure that contaminants detected by the monitoring system are never released into the water distribution system. Citizens interested in the testing and monitoring programs are encouraged to contact Artisan for details.

3.1.3 Written Comments from DNREC

Comment #1: During the development of the Feasibility Study, DNREC made it clear that it was most interested in a permanent solution to remediate the source(s) of impact to groundwater and an efficient solution to clean up the contaminants that have migrated from source areas to the surrounding aquifer. It is not evident that DNREC's desire for permanence and a shorter remediation time frame was seriously considered.

Response: EPA disagrees with DNREC's characterization. EPA's response to Comment #18 in Section 3.1.1, above, addresses this comment.

Comment #2: The time frame for meeting groundwater RAOs is very unclear in the draft Feasibility Study. Based on the cost opinion in the Feasibility Study, a 30-year time frame is assumed. DNREC recalls the DS&G Remedial Trust stating that any pump-and-treat- style remedy would take between 40 and 60 years to achieve cleanup goals

Response: In response to questions raised by DNREC about the expected time frame for achieving groundwater RAOs, the DS&G Remedial Trust estimated groundwater restoration time frames based on particle tracking simulations with the Site-specific groundwater flow model and the application of a modifying factor based on pore volume exchanges. Based on this approach, which is described in Appendix O of the *Final Feasibility Study – Revision 1*, the estimated time frame for achieving groundwater RAOs is 60 years for the current pumping regime, which includes operation of extraction well PW-1 and the LFExS, and 25 years for the Selected Remedy.

Comment #3: DNREC generally accepts the technical merits of the recommended remedy, but does not support the long time frame necessary for achieving RAOs or the permanence of the proposed remedy.

Response: Please see the responses to Comments #1 and 2 in this section.

Comment #4: DNREC is concerned that changes in sea level and regional pumping may result in an elevated regional water table or changes in regional flow directions, either of which could dramatically affect the proposed remedy. Changes in aquifer withdrawal rates and locations, groundwater elevations, horizontal and vertical hydraulic gradients and groundwater flow directions cannot easily be predicted. However, the success of the recommended remedy is reliant upon continuous control over groundwater elevation and migration.
Response: EPA agrees that the success of the Selected Remedy will depend upon regular performance evaluations of the remedial action and system modifications as necessary to achieve RAOs, as well as communication and coordination among water withdrawers (e.g., Artesian), the parties implementing the Selected Remedy and the regulatory agencies. EPA and DNREC will have a significant role in determining the requirements for performance monitoring and evaluations during remedy design and implementation.

Comment #5: Detection of "new" contaminants of concern can easily cause shutdown (temporary or permanent) of area water supply systems.

Response: EPA's responses to Comments #12 and 34 in Section 3.1.1, above, address this comment.

Comment #6: DNREC believes that the recommended remedy will eventually accomplish goals established by EPA as long as regional hydrogeologic conditions remain essentially unchanged and if intensive operation and maintenance activities continue at the Site. However, another containment and migration control strategy for the DDA and surrounding areas (the same basic remedial approach selected in ROD Amendment No. 1) does not seem efficient or permanent.

Response: EPA agrees that a comprehensive and rigorous O&M plan will be crucial to the performance of the Selected Remedy. The DS&G Remedial Trust has demonstrated its willingness and ability to conduct effective O&M with self-initiated improvements to the operation of the LFExS and extraction well PW-1. Regulatory agency oversight is also an important component of successful remediation outcomes.

ROD Amendment No. 1 included *in-situ* treatment of soil (bioventing) to remove contaminant mass at the DDA, in addition to containment measures, but did not achieve remediation objectives due, in part, to gaps in the CSM. Significant changes have been incorporated into the CSM based on the recent supplemental Site characterization activities. The CSM will continue to be updated as information is generated during remedy implementation and performance evaluations. Continual refinement of the CSM will support remedy optimization efforts, identify potential challenges and assist in assessment of performance metrics to help ensure that the remedy is functioning as intended.

3.1.4 Written Comments from the DS&G Remedial Trust and Golder Associates

A. The following are summaries of the DS&G Remedial Trust comments on the Proposed Plan followed by EPA's responses:

Comment #1: The DS&G Remedial Trust supports EPA's decision to recommend Alternative C, as proposed by the Trust in the *Final Feasibility Study – Revision 1*, as the preferred remedial alternative.

Response to Comment: EPA acknowledges the DS&G Remedial Trust's support for the Selected Remedy.

Comment #2: The DS&G Remedial Trust, while willing to perform the Feasibility Study, is unwilling to perform any remedial action ultimately selected by EPA to address the groundwater in the Upper Potomac Aquifer downgradient of the location of well PW-l without the significant involvement of New Castle County.

Response to Comment: Apportioning liability among the PRPs for the various components of the Selected Remedy is not a component of the remedy selection process prescribed by the Superfund law and its implementing regulations.

Comment #3: In the Proposed Plan, EPA discusses extraction well PW-1, but fails to recognize that the installation of well PW-l and another well (NEW-1) by the County in 2004 was needed to complete the network of extraction wells necessary to create and maintain an effective groundwater divide between the DS&G and Army Creek Landfill Superfund sites and Artesian's Llangollen well field.

Response to Comment: The DS&G Trust's discussion, of a historical nature, is not relevant to current Site conditions which will be addressed by the Selected Remedy. However, the comment contains several factual misunderstandings which EPA addresses as follows. The operation of extraction well PW-1 was not required to maintain a groundwater divide between the Superfund sites and the Llangollen well field. Well PW-1 was installed and operated to circumvent the anticipated need for treatment to remove BCEE from the effluent from the Army Creek Landfill groundwater treatment plant.

Comment #4: In the Proposed Plan, EPA asserts that "the suspension of the County's pumping did not result in new releases of contamination from the Army Creek Landfill waste management area" and "that the BCEE groundwater plume originated at the DDA and not the Army Creek Landfill." EPA cites no technical reports or studies to support those assertions and, as far as the DS&G Remedial Trust is aware, no such studies exist.

Response to Comment: EPA concluded in its Third Five-Year Review Report for the Army Creek Landfill, based on groundwater and stream monitoring data generated during the review period, that the suspension of the County's pumping had not resulted in new releases of contamination from the Army Creek Landfill. The Third Five-Year Review Report for the Army Creek Landfill Superfund Site has been included in the Administrative Record file for the DS&G Site. Groundwater monitoring results and BCEE iso-concentration plots in the *Supplemental Site*

Characterization Report – Revision 2, prepared by Golder Associates on behalf of the DS&G Remedial Trust, provide sufficient evidence that the DS&G Site, and not the Army Creek Landfill Site, is the source of BCEE in groundwater.

Comment #5: Although EPA asserts (at pages 14-15 of the Proposed Plan) that New Castle County agreed to operate the groundwater recovery wells in the Upper Potomac Aquifer to attain primary drinking water standards beyond the Army Creek Landfill property boundary (alleging a discrepancy between the groundwater cleanup goals in the 1988 ROD for the DS&G Site and those goals for the Army Creek Landfill Site), EPA actually excused New Castle County from its Consent Decree obligation in 2009. EPA did so, despite exceedances of the drinking water standard for lead in MW-40, because EPA had concluded that certain constituents detected above applicable standards in the Army Creek Landfill boundary wells (used to define the Army Creek Landfill property boundary) had migrated from the DS&G Site, not the Army Creek Landfill. See EPA's Third Five-Year Review Report for the Army Creek Landfill, at pp. 21- 22 (noting repeated exceedances of the current drinking water standard for lead in MW-40; exceedances of the State's interim advisory levels for BCEE in boundary wells BW-1 and BW-2, and dissolved manganese concentrations [wells BW-1 and BW-2] and iron concentrations [well BW-1] exceeding EPA's health-based standards). See also page 15 of the Proposed Plan where EPA states that "MCLs have been attained at the Army Creek Landfill property boundary." That statement is inconsistent with EPA's Third Five-Year Review Report and the express recognition that lead levels in MW-40 exceeded the current drinking water standard for lead.

Response to Comment: EPA did not excuse the County from its obligations under the Army Creek Landfill Consent Decree. Because the groundwater cleanup levels specified in SOW-2[34] of the 1991 Consent Decree had been achieved at the boundary wells, with the exception of the standard for lead at well MW-40, EPA approved New Castle County's request to terminate SOW-2 on May 4, 2009, with the condition that the County perform additional lead monitoring in groundwater in the vicinity of well MW-40. As documented in the Fourth Five-Year Review Report for the Army Creek Landfill Site, lead levels in groundwater samples collected from MW-40 and nearby wells during the 2009 through 2014 review period were consistently below the 15 µg/L drinking water standard. Therefore, the statement in EPA's 2016 Proposed Plan regarding attainment of MCLs at the Army Creek Landfill is correct.

Groundwater extraction from the Army Creek Landfill recovery wells had already been discontinued in 2004, as discussed in Section 2.2 of this Amendment. Following the shutdown of the Army Creek Landfill well field, the BCEE plume in the Upper Potomac Aquifer shifted eastward as illustrated in Figures 5.1D through 5.1H in the *Supplemental Site Characterization Report – Revision 2*. By 2009, it was apparent that the DS&G Site, and not the Army Creek Landfill Site, was the source of BCEE in the Upper Potomac Aquifer. No stakeholder at either Site suggested that resuming pumping from the Army Creek Landfill well field would be an appropriate response to the groundwater plume originating from the DDA. EPA was concerned that doing so would exacerbate releases from the DDA. In 2010, due to the ongoing release of BCEE, benzene and other contaminants from inadequately controlled source areas at the DS&G Site, EPA provided the DS&G Remedial Trust with the opportunity to conduct additional Site characterization activities and a Feasibility Study. The additional Site characterization work

[34] SOW-2 does not specify groundwater cleanup standards for BCEE, iron or manganese.

performed by the DS&G Remedial Trust identified a persistent secondary source of contamination within the UPCUTZ. The Feasibility Study, which evaluated a range of potential response actions to address the DDA source area and the contaminant plume in the Upper Potomac Aquifer originating from the DDA, including the UPCUTZ, was completed in 2016.

EPA's Third Five-Year Review Report for the Army Creek Landfill Site noted that concentrations of manganese and iron at boundary wells BW-1 and/or BW-2 exceeded EPA health-based standards. Due to observed increases in dissolved iron and, particularly, manganese concentrations in portions of the Upper Potomac Aquifer, EPA's Fourth Five-Year Review Report for the Army Creek Landfill Site recommended an evaluation of the sources, fate and transport of these metals in order to assess the potential for impacts to the Llangollen well field. On September 28, 2017 EPA requested that the Army Creek Landfill PRPs perform additional response actions to address dissolved manganese and other COCs in groundwater caused by releases from the Army Creek Landfill Site. EPA's Third and Fourth Five-Year Review Reports for the Army Creek Landfill Superfund Site have been included in the Administrative Record file for ROD Amendment No. 2.

Comment #6: Under Section III.A.20 of the Army Creek Landfill Consent Decree, the Army Creek Landfill Site is defined to include both the landfill property "and the groundwater affected by the release of hazardous substances from the Army Creek Landfill Superfund Site and/or the Delaware Sand & Gravel Landfill Superfund Site."

Response to Comment: EPA does not dispute this statement; however, it is not relevant to EPA's remedy decision.

Comment #7: As EPA expressly recognized in the 2015 Five-Year Review Report (p. 22) for the DS&G Site, "[t]he groundwater remedy for the Army Creek Landfill and DS&G Landfill sites were combined in order to eliminate redundancies and implemented by New Castle County under the 1991 Army Creek Consent Decree."

Response to Comment: EPA agrees with the statement.

Comment #8: In Appendix E to the 1995 DS&G Consent Decree (describing the remedy and performance standards), EPA referenced the recovery of contaminated groundwater by New Castle County's "5 recovery well system (RW-13, Well-31, RW-12, Well-29, Well-28) currently recovering DS&G contamination" as "among the nine wells which currently comprise the Army Creek/Delaware Sand and Gravel recovery well system." EPA explained that "[p]ursuant to the [Army Creek] Consent Decree entered ... on September 12, 1991 the Army Creek Settlors are operating the recovery well system." EPA stated that "[t]he Army Creek Settlors shall continue to operate the recovery well system as required under the Consent Decree for the Army Creek Landfill. Therefore, [DS&G] Settling Defendants will not be required to operate the recovery well system."

Response to Comment: The 1991 Consent Decree requires the Army Creek Settling Defendants to operate the recovery well system until performance standards are met. The performance standards for operation of the groundwater recovery well system are given in SOW-2 of the 1991 Consent Decree. Section 6.2 in SOW-2 states, "If primary drinking water criteria

(as set out at [sic] in Table A overleaf) are met in the boundary wells at that time, the [groundwater recovery well] system may be phased out in the manner described in § 6.3 hereof." Primary drinking water criteria have been achieved at the boundary wells.

Comment #9: Pursuant to the Army Creek Consent Decree, and as recognized in EPA's 2015 Five-Year Review Report for the DS&G Site (p. 25), "[f]rom 1993 to 2004, in accordance with the Consent Decree for the neighboring Army Creek Landfill Site, New Castle County operated a groundwater collection and treatment system in the Upper Potomac Aquifer to prevent contaminants from the Army Creek Landfill and DS&G Sites from migrating to Artesian's Llangollen well field."

Response to Comment: EPA agrees. This excerpt is from the Five-Year Review Report for the DS&G Site. See EPA's reply to Comment #10, directly below, for a further response.

Comment #10: Despite its Consent Decree obligation to do so, New Castle County failed to create and maintain a groundwater divide between both Superfund sites and Artesian's Llangollen well field. As a result, constituents from both sites have migrated to the Llangollen well field and required treatment by Artesian, the costs for which are included in EPA's Preferred Alternative.

Response to Comment: EPA agrees that New Castle County's operation of the Army Creek Landfill groundwater recovery wells failed to create and maintain a groundwater divide between both Superfund sites and the Llangollen well field, but it was not a requirement of the Consent Decree to create and maintain such a divide. Nonetheless, contaminants have migrated to the Llangollen well field and it became necessary for Artesian to install treatment systems to address BCEE and 1,4-dioxane. However, EPA disagrees that the presence of BCEE and/or 1,4-dioxane at the Llangollen well field is attributable, in part, to releases from Army Creek Landfill; available data do not support such a conclusion. Other factors contributing to the unforeseen impacts at the Llangollen well field were deficiencies in the groundwater monitoring programs at both Sites, a flawed CSM and inadequate source control measures at the DDA. It should be noted that SOW-2 (p. 1) specifies that the Army Creek Landfill groundwater recovery well field is designed to "control groundwater that may contain unacceptably high levels (under drinking water standards) of either organic or inorganic compounds." Federal drinking water standards are not available for BCEE and 1,4-dioxane. However, EPA has determined that concentrations of BCEE and 1,4-dioxane in groundwater at the Llangollen well field exceed acceptable risk-based levels. Site-specific PRGs for these and other groundwater COCs were developed in support of the Feasibility Study and the Selected Remedy includes performance standards for these COCs. As stated by the commenter, the Selected Remedy includes treatment to address Site-specific groundwater COCs, including BCEE and 1,4-dioxane, at the Llangollen well field.

Comment #11: As EPA has recognized in its last two Five-Year Review Reports for the DS&G Site, "[u]nder the 1995 Delaware Sand & Gravel Consent Decree, the DS&G Remedial Trust is not required to implement response actions to address contaminants released from the Site into the groundwater of the Upper Potomac Aquifer." Consistent with this assertion, EPA further stated in the 2015 Five-Year Review Report (p. 37) that "[t]he groundwater remedy [was] implemented at the Delaware Sand & Gravel Site pursuant to the Army Creek Landfill Consent Decree."

Response to Comment: EPA agrees with these statements. However, new information and conditions warranted a reassessment of the appropriate remedial approach taken at the DS&G Site.

Comment #12: In conclusion, the Trust supports EPA's recommendation of Alternative C as the preferred remedial alternative. For the reasons set forth above and supported by Golder's letter enclosed herewith, acknowledgment of the legal obligations of the Army Creek Settlors (including but not limited to New Castle County's historic failure to maintain the groundwater divide) and the contribution of the Army Creek Landfill Site to the groundwater impacts in the commingled plume should be incorporated into the Record of Decision.

Response to Comment: Although EPA expected that the Army Creek Landfill recovery wells would capture contaminants from both Sites and prevent contaminants from reaching the public water supply wells, the 1991 Consent Decree does not require New Castle County to maintain a groundwater divide. Section 2.10 of ROD Amendment No. 2 states that the operation of the Army Creek Landfill recovery wells was not effective in preventing the migration of Site-specific COCs to the Llangollen well field.

B. The following are summaries of Golder Associates' comments on the Proposed Plan followed by EPA's responses:

Comment #1: The foundation for any proposed remedy is the CSM. The Proposed Plan does not reference the CSM presented in the *Final Feasibility Study – Revision 1* and instead only references the analytical results and evaluations presented in the *Supplemental Site Characterization Report - Revision 2*.

Response to Comment: EPA agrees and has included a description of the CSM in this ROD Amendment No. 2.

Comment #2: The information included in the Proposed Plan does not provide the public with an understanding of the contribution from the Army Creek Landfill to the constituents in groundwater for which the remedial action will be designed and implemented. Acknowledgement of the Army Creek Landfill's contribution to the groundwater impacts between the two sites should be incorporated into this ROD Amendment No. 2.

Response to Comment: Sections 2.5.3 and 2.5.4 of this Amendment discuss the Army Creek Landfill's contribution to elevated concentrations of contaminants, including 1,2-dichloroethane and dissolved metals (primarily cobalt, iron and manganese), in groundwater within the Upper Potomac Aquifer.

Comment #3: The Proposed Plan does not acknowledge that the Army Creek Landfill represents a source of groundwater impacts to the Area of Attainment that exceed the Site-specific groundwater PRGs. This acknowledgement is significant to the remedy and the ROD because one of the RAOs for groundwater is to meet the groundwater PRGs within the Area of Attainment. Instead, the Proposed Plan indicates as follows:

- "[S]uspension of pumping at the Army Creek Landfill well field did not result in new releases of contamination from the Army Creek Landfill waste management area."
- "MCLs have been attained at the Army Creek Landfill property boundary."

However, based upon review of the current and historical data for the Sites, the suspension of pumping from the Army Creek Landfill groundwater recovery well system in 2004 resulted in increasing concentrations of constituents in groundwater downgradient of the Army Creek Landfill, between the Army Creek Landfill and Artesian's Llangollen well field. Groundwater quality data presented in the *Supplemental Site Characterization Report - Revision 2* support this observation (e.g., Figure 5.5C for 1,2-dichloroethane and Figures 5.8A through 5.8E for manganese).

Furthermore, based on increasing concentrations of the metals downgradient of the two Superfund Sites, EPA recommended in its Fourth Five-Year Review Report for the Army Creek Landfill Superfund Site an evaluation of the sources, fate, and transport of dissolved iron and manganese in the Upper Potomac Aquifer, in order to assess the potential for impacts to Artesian Water Company's Llangollen well field.

In addition, EPA stated in its December 19, 2014 comments on a submission from the DS&G Remedial Trust that the Army Creek Landfill is a source of 1,2-dichloroethane, iron and manganese in groundwater of the Upper Potomac Aquifer and that elevated levels of arsenic and cobalt in groundwater appear to be related to the Army Creek Landfill site.

Acknowledgement of the Army Creek Landfill's contribution to the groundwater impacts between the two sites should be incorporated into EPA's Amendment to the ROD.

Response to Comment: EPA acknowledges, and ROD Amendment No. 2 reflects, that elevated concentrations of dissolved metals, particularly iron, manganese and cobalt, within a portion of the Area of Attainment are due, in part, to redox conditions in the Upper Potomac Aquifer caused by releases from the Army Creek Landfill. Releases from the DS&G Site are also contributing to reducing conditions and elevated levels of redox-sensitive metals in groundwater. The extent to which each Site is contributing to elevated metals concentrations in specific areas of the Upper Potomac Aquifer, including elevated manganese concentrations between the Grantham South Area and monitoring wells BW-1 and MW-26N, has not been established. However, observed increasing manganese concentrations along the central axis of the organic COC plume emanating from the DDA (at monitoring wells UPA-02D, MW-26N and AWC-E2) suggest a correlation between releases from the DS&G Site and elevated dissolved manganese concentrations at these monitoring locations. This ROD Amendment also identifies the Army Creek Landfill as a source of 1,2-dichloroethane in groundwater.

Comment #4: The Proposed Plan states that MCLs have been attained at the Army Creek Landfill property boundary. However, it does not acknowledge that MCLs represent a limited set of drinking water standards, and the Army Creek Landfill monitoring program historically did not include analysis for 1,4-dioxane and cobalt which are COCs in groundwater between the two Superfund sites. These differences underscore the inconsistent cleanup goals and monitoring programs applied by the EPA at these two adjacent Superfund sites. More specifically:

- For the Army Creek Landfill, primary drinking water standards (MCLs) for a limited set of constituents were established as performance goals for groundwater at the four wells identified by EPA as boundary wells. These wells are located between 800 and 1,800 feet downgradient of the landfill boundary, and two of these wells are located within the Area of Attainment for the DS&G Site.
- For the adjacent DS&G Site, based on the EPA's direction, the DS&G Remedial Trust has developed risk-based groundwater PRGs for a broader suite of constituents as performance goals for groundwater in the Upper Potomac Aquifer beyond the Waste Management Area (throughout the Area of Attainment). These goals must be attained at the landfill boundary and in all wells in the Upper Potomac Aquifer within the Area of Attainment, which is also downgradient of the Army Creek Landfill.

The groundwater PRGs for the DS&G Site are generally lower (i.e., more conservative) than MCLs, and there are several constituents with established PRGs at the DS&G Site for which there are no equivalent performance goals for the Army Creek Landfill (e.g., BCEE, 1,4-dioxane, manganese, iron, and cobalt). However, as acknowledged by EPA, the Army Creek Landfill represents a source of many of these constituents to the Upper Potomac Aquifer, and EPA has requested that a plume stability analysis for iron, manganese and cobalt be prepared for the Army Creek Landfill.

The Proposed Plan does not fully evaluate groundwater impacts downgradient of the Army Creek Landfill relative to risk-based standards. EPA's lack of acknowledgement of constituents from the Army Creek Landfill within the Area of Attainment could undermine the long-term achievability of the cleanup goals within the Area of Attainment. A framework for resolving the issue of the area of combined constituent mass (i.e., the area downgradient from both sites where groundwater from both sites is commingled) should be incorporated into EPA's Amendment to the ROD.

Response to Comment: Most of the available evidence points to the DS&G Site as the source of BCEE and 1,4-dioxane impacts in the Upper Potomac Aquifer (see, for example, Figures 5.1A through 5.2E of the *Supplemental Site Characterization Report - Revision 2*). Based on groundwater monitoring results depicted in figure groups 4 and 5 in the *Supplemental Site Characterization Report - Revision 2* and groundwater monitoring reports submitted by New Castle County, EPA considers the Army Creek Landfill to be a source of 1,2-dichloroethane, manganese, iron, arsenic and cobalt in the Upper Potomac Aquifer. EPA acknowledges the discrepancy between the regulatory based groundwater cleanup standards established for the Army Creek Landfill Site in the 1991 Consent Decree and the risk- and health-based groundwater cleanup standards established for the DS&G Site in this ROD Amendment No. 2. EPA has notified the Army Creek Landfill PRPs of the need for additional response actions to evaluate the nature and extent of these impacts and potential remedial alternatives to address groundwater contamination downgradient of the western lobe of the Army Creek Landfill. EPA anticipates modifying the remedy at the Army Creek Landfill Site, including the list of groundwater COCs and groundwater cleanup standards, as necessary to ensure adequate protection of human health and the environment.

As discussed in Section 2.5.3 of this Amendment, elevated concentrations of dissolved metals, particularly iron, manganese, arsenic and cobalt, in groundwater within a portion of the Upper

Potomac Aquifer are due to redox conditions in the aquifer caused by releases from both DS&G and the Army Creek Landfill. The Selected Remedy includes the installation and operation of groundwater recovery wells to optimize the capture and removal of contaminants from the Upper Potomac Aquifer. EPA anticipates that the recovery wells will need to be operated for some time after cleanup standards have been met for the organic groundwater COCs in order to prevent organic contaminant mass beneath the Waste Management Area from migrating downgradient. As the milestone for shutting down the groundwater recovery wells approaches, EPA may consider whether monitored natural attenuation (MNA) would be a viable cleanup approach for any dissolved metals present within the Area of Attainment at concentrations exceeding the cleanup level.

MNA for inorganic contaminants, when appropriately implemented, can help to restore an aquifer to beneficial uses by immobilizing contaminants onto aquifer solids and providing attenuation of contaminants in groundwater. MNA would not be an appropriate response action, however, in cases where the dissolved metals plume is expanding. However, it may be appropriate as a finishing step when it can achieve RAOs within a reasonable time frame, there is documented geochemical evidence of attenuation and the source of contaminants has been identified and addressed.

Comment #5: The Proposed Plan presents the Area of Attainment from the *Final Feasibility Study – Revision 1* without acknowledging that there are conflicting lines of evidence regarding the potential source of impacts in the western portion of the Area of Attainment. Wells BW-1 and BW-2 (two of the four boundary wells used by EPA to assess compliance for the Army Creek Landfill Site) are located downgradient of the eastern lobe of the Army Creek Landfill, are screened in the Upper Potomac Aquifer lower sand and are within the commingled plume that exists within the Area of Attainment.

As presented to and discussed with EPA in January 2015, reverse particle tracking simulations from Tetra Tech's numerical flow model (Tetra Tech, 2015) indicate that the source of constituents, including 1,4-dioxane, in the well BW-2 area is the eastern lobe of the Army Creek Landfill. Further discussion of this point is provided in Section 3.3.4 of the *Final Feasibility Study – Revision 1*. Section 3.3.3 of the *Final Feasibility Study – Revision 1* also identifies the Army Creek Landfill as a source manganese mass in the Area of Attainment. Furthermore, monitoring wells MW-28, MW-29, and MW-31, immediately downgradient of the Army Creek Landfill, consistently have manganese in excess of the PRG for manganese in groundwater at the DS&G Site.

Response to Comment: The Proposed Plan did not identify the Army Creek Landfill as a potential source of 1,4-dioxane in the Upper Potomac Aquifer in the well BW-2 area because the lines of evidence presented to EPA suggesting the Army Creek Landfill as a potential source of impacts at BW-2 have not been adequately developed and, as they stand, are insufficient to name the Army Creek Landfill as a source. As discussed in Appendix N of the *Final Feasibility Study – Revision 1*, and Section 2.12.2 of this Amendment, pre-design investigations will be conducted to address data gaps and areas of uncertainty, including the south and southwest extent of contamination in the UPCUTZ originating from the DDA and the source(s) of groundwater impacts at wells P-6, MW-18, MW-34, BW-2 and MW-26N. If the Army Creek Landfill is

found to be a source of 1,4-dioxane in the Upper Potomac Aquifer, EPA will modify the list of groundwater COCs for that site as appropriate.

Manganese concentrations at monitoring wells MW-28, MW-29, and MW-31, immediately downgradient of the Army Creek Landfill have generally remained between 1 and 1.5 mg/L since shutdown of the Army Creek Landfill recovery wells in 2004. EPA has concerns about the accuracy of the analysis of the "area of combined impacts" presented in Golder Associates' 2014 *Memorandum on Preliminary Cleanup Goals*. That analysis appears to be based on the unsubstantiated premise that elevated manganese concentrations between the eastern lobe of the Army Creek Landfill and monitoring well MW-26N are attributable to releases from the Army Creek Landfill Site rather than from the Grantham South Area or the DDA. An effort should be made to determine if the Army Creek Landfill is contributing to increasing manganese concentrations at and downgradient of monitoring well MW-26N.

Comment #6: The following are examples of constituents at concentrations that exceed MCLs at locations downgradient of the Army Creek Landfill Site:

- 1,2-dichloroethane and tetrachloroethylene (PCE) have been detected at concentrations in groundwater above MCLs at off-property wells P-4 and MW-22N, respectively.
- Lead has been detected above MCLs at well MW-40 which is one of the four wells identified by EPA as the boundary wells for the Army Creek Landfill Site.

In addition, other groundwater constituents (e.g., 1,4-dioxane, BCEE, manganese, iron, and cobalt) for which there are no primary drinking water standards are also present in groundwater downgradient of the Army Creek Landfill Site. For example:

- 1,4-dioxane has been detected above the DS&G Site groundwater PRG of 7.8 µg/L at BW-2 (110 µg/l in April 2016).
- Manganese has been detected above the DS&G Site groundwater PRG of 190 µg/L at most ACL monitoring wells, including April 2016 results from wells BW-2 (1,500 µg/l), MW-28 (958 µg/L) and MW-29 (954 µg/L).
- Cobalt has been detected above the DS&G Site groundwater PRG of 6 µg/L at most Army Creek Landfill monitoring wells, including April 2016 results from wells BW-2 (16.7 µg/l) and MW-28 (38.5 µg/L).

These examples of results from wells MW-28 and MW-29 indicate the Army Creek Landfill Site is contributing groundwater at concentrations above DS&G Site groundwater PRGs to the area of combined constituent mass (including, but not limited to the well BW-2 area) which includes portions of the DS&G Area of Attainment.

Response to Comment: 1,2-dichloroethane concentrations have cycled up and down at well P-4, in tandem with dissolved metals concentrations. Concentrations of 1,2-dichloroethane at well P-4 were below the 5 µg/L MCL from October 2009 through October 2012; from March 2013 through October 2015, concentrations ranged from 19 µg/L to 6.7 µg/L. The dissolved manganese concentration at P-4 rose to 3.2 mg/L in March 2016 and EPA has requested that the Army Creek Landfill PRPs perform additional response actions to address this concern. At well MW-22N, there were two minor exceedances of the 5 µg/L MCL for PCE between April 2006

and October 2015: 5.1 µg/L PCE was detected in the April 2012 groundwater sample and 5.4 µg/L PCE was detected in the October 2014 groundwater sample. The presence of PCE at well MW-22N warrants continued monitoring. Lead concentrations in groundwater samples collected from well MW-40 were consistently below the 0.015 mg/L action level for lead in public water systems from October 2009 through April 2013 when monitoring for lead was discontinued with EPA approval.

Evidence implicating the Army Creek Landfill as a source of 1,4-dioxane at well BW-2 is insufficient; pre-design studies are planned to further evaluate potential sources of 1,4-dioxane at this well. EPA's Fourth Five-Year Review Report for the Army Creek Landfill Superfund Site recognized manganese and other dissolved metals in the Upper Potomac Aquifer associated with the Army Creek Landfill Site and recommended an evaluation of the stability of the metals plume. On September 28, 2017, EPA requested that the Army Creek Landfill PRPs perform additional response actions to address dissolved manganese and other COCs in the groundwater of the Upper Potomac Aquifer caused by releases from the Army Creek Landfill Site. Additional investigation is recommended to evaluate the extent to which the Army Creek Landfill and other potential sources are contributing to increasing manganese concentrations in the area of monitoring well MW-26N; other potential sources of the expanding manganese plume include the Grantham South Area and the DDA.

Comment #7: There are significant differences between the monitoring well networks associated with the Army Creek Landfill Site and the DS&G Site. These differences complicate any comparison of the groundwater conditions downgradient of the sites. As documented in the DS&G Remedial Trust's August 15, 2016 Technical Memorandum, entitled "Response to Manganese Assessment by CDM Smith," it is important to recognize that the DS&G monitoring well network is much more extensive both vertically and horizontally which biases a comparison of the groundwater conditions downgradient of the sites. The following is excerpted from DS&G Remedial Trust's Technical Memorandum:

- Horizontally, both parallel and perpendicular to groundwater flow from the Army Creek Landfill, the Army Creek Landfill monitoring well network is very widely spaced; therefore, the monitoring network inadequately characterizes the groundwater flow direction and leachate plume extent.
- Vertically, there are no monitoring wells screened in the Columbia Aquifer or the UPCUTZ, either within, adjacent to or downgradient of the Army Creek Landfill.
- Most of the existing Upper Potomac Aquifer wells in the Army Creek Landfill monitoring well network have long screen intervals and are screened across both the upper and lower sand of the Upper Potomac Aquifer. There are only two wells screened solely in the Upper Potomac Aquifer upper sand in proximity to the Army Creek Landfill: wells P-4 and RW-10 (a former large diameter extraction well). Some of the highest manganese concentrations measured downgradient of the Army Creek Landfill are from well P-4 (which has a 10- foot well screen), potentially demonstrating the bias in the samples from the wells with long screen intervals.
- In comparison to the monitoring network and available data set for the DS&G Site, there is very little Upper Potomac Aquifer monitoring data associated with the Army Creek Landfill Site. Golder also notes that the Army Creek Landfill Site is much larger in aerial

extent than the DS&G Site, resulting in an even lower density of monitoring for the Army Creek Landfill Site as compared to the DS&G Site.

The differences between the monitoring networks for the Army Creek Landfill and the DS&G Site biases a comparison of the downgradient impacts of the two Superfund sites, especially as it relates to the ability to support EPA's conclusions regarding the Army Creek Landfill's contribution to the groundwater impacts between the two sites.

Response to Comment: EPA agrees that there is a need for additional wells to monitor groundwater downgradient of the Army Creek Landfill Site. However, there are sufficient data to show that the DS&G Site is the source of contamination driving the need for additional response actions within the Area of Attainment.

Comment #8: The CSM upon which the proposed remedial action is based includes contribution of inorganics (manganese, iron and cobalt) as well as organic compounds from the adjacent Army Creek Landfill Site. While Golder indicates in the *Final Feasibility Study – Revision 1* that the source to certain areas downgradient of the eastern lobe of the Army Creek Landfill remains under evaluation, the extraction well network included in the proposed remedial action was developed by the Trust, at the request of EPA, to capture impacts from the DS&G Site as well as the area of combined impacts located between the DS&G Site and the eastern lobe of the Army Creek Landfill. As stated in Section 3.3.4 of the *Final Feasibility Study – Revision 1*, "it is anticipated that the remedy would be the same whether the source [of 1,4-dioxane at well BW-2] was from the DS&G Site or the [Army Creek Landfill Site], since the potential source areas are capped, the impacts are already in the [Upper Potomac Aquifer], and there are limited remedial options for 1,4-dioxane." Acknowledgement that the remedy will capture groundwater impacts from the DS&G Site as well as from the eastern lobe of the Army Creek Landfill Site should be incorporated into EPA's Amendment to the ROD.

Response to Comment: EPA has not determined that the Army Creek Landfill is contributing to increasing manganese concentrations in the well MW-26N area. Additional investigations are to be performed to further define groundwater impacts from the Army Creek Landfill Site and also to develop suitable response actions for groundwater downgradient of the western lobe of Army Creek Landfill Site.

Comment #9: The Proposed Plan includes several statements that seem to indicate that the constituents in groundwater at the DDA and within the Upper Potomac Aquifer are associated with the potential for exposure to contaminants in indoor air. To avoid confusion, it should be acknowledged that the potential for landfill gas migration and vapor intrusion is only a potential issue for indoor air in existing buildings and potential future buildings immediately adjacent to the Inert Area and the Grantham South Area via the Columbia Aquifer.

Response to Comment: EPA has included language in this ROD Amendment No. 2 to clarify that vapor intrusion is a potential issue for indoor air in existing buildings and potential future buildings immediately adjacent to the Inert Area and the Grantham South Area which is associated with the migration of landfill gas in the vadose zone rather than contaminants in groundwater. Please also see EPA's response to Comment #16 in Section 3.1.1, above.

Comment #10: The DS&G Remedial Trust has been performing tiered monitoring of landfill gas at and in the vicinity of the Inert Area and Grantham South Area on a quarterly basis since 1997. As documented in the quarterly monitoring reports, landfill gas concentrations measured in structures adjacent to the landfills have not exceeded one percent of the lower explosive limit.

Response to Comment: EPA acknowledges this statement.

Comment #11: The DS&G Remedial Trust assessed the potential for migration of landfill gas from the Inert Area and the Grantham South Area. Based on this assessment, there is limited landfill gas migration in the immediate vicinity of the Inert Area and Grantham South that has the potential to affect two buildings. To address this issue, the DS&G Remedial Trust is designing and will install a soil vapor extraction system. The potential for landfill gas migration to other buildings is not anticipated.

Response to Comment: Information regarding the DS&G Remedial Trust's installation of a landfill gas mitigation system has been added to Section 2 of this ROD Amendment No. 2.

Comment #12: Golder has provided documents for addition to the Administrative Record.

Response to Comment: EPA has included these documents in the Administrative Record.

3.1.5 Comments Submitted by the DS&G Remedial Trust and the Government of New Castle County, Delaware ("New Castle County") After the Close of the October 7, 2016 Public Comment Period

New Castle County submitted two sets of comments and the DS&G Remedial Trust submitted one set of comments after the Public Comment Period which closed on October 7, 2106. The NCP, 40 C.F.R. 300.825(c), requires EPA to consider comments submitted after the close of the public comment period, only to the extent that such comments contain significant information not contained elsewhere in the Administrative Record file and such comments could not have been submitted during the public comment period and substantially support the need to significantly alter the response action. The NCP also requires that all comments that meet these criteria, and all responses thereto, be placed in the Administrative Record file.

EPA has reviewed the comments submitted by New Castle County and the DS&G Trust after the close of the public comment period and has determined, among other things, that they do not support the need to significantly alter the response action. Accordingly, EPA is not required to respond to the comments or include them in the Administrative Record file for the ROD Amendment No.2. Nevertheless, EPA is hereby, in its discretion, including the comments in the Administrative Record file and providing a short written response by way of feedback.

Response #1: In their respective comments, New Castle County and the DS&G Trust contend that the other is liable under CERCLA to implement some, or all, of ROD Amendment No. 2. The remedy selection process prescribed in CERCLA and the NCP does not require EPA to evaluate the liability of PRPs to implement a remedy, such as the Selected Remedy in this ROD Amendment No. 2. As such, the DS&G Remedial Trust and New Castle County's comments in this regard are irrelevant to the selection of the response action.

Response #2: In its September 17, 2017 comments, New Castle County contends that the long-term cost estimate of Alternative C was significantly understated, and that EPA should therefore reassess the remedial alternatives. Specifically, New Castle County contends that EPA's estimate of the present worth cost of Alternative C is based on a discount rate, which was changed by the Office of Management and Budget after the Proposed Plan was issued. As a result, the $42,300,000 estimate in the Proposed Plan to implement Alternative C using the old discount rate could exceed $60,000,000 using the new discount rate. EPA should therefore consider selecting Alternative B because of uncertainties regarding restoring the groundwater to "beneficial use."

EPA disagrees. Based on *A Guide to Developing and Documenting Cost Estimating During the Feasibility Study* (EPA 540-R-00-002, July 2000), EPA is correctly applying the 7 percent discount rate recited in the Proposed Plan. Accordingly, the present worth cost of Alternative C is $46,100,000 as described in Section 2.9 of this Amendment. Regardless of which discount rate applies, all of the requirements of Alternative C are necessary to restore the groundwater to its "beneficial use" and, therefore, protect human health and the environment.

FIGURES

REFERENCE

1.) BASE MAP TAKEN FROM U.S.G.S. 7.5 MINUTE QUADRANGLE OF WILMINGTON SOUTH, DELAWARE, DATED 1993.

2000 0 2000
SCALE FEET

Source: Supplemental Site Characterization - Revision 2, Golder Associated, Inc., 2016

FILE No.

PROJECT No.

TITLE

SITE LOCATION MAP

DELAWARE SAND AND GRAVEL SUPERFUND SITE

FIGURE 1

Drawing file: 0136052Z006.dwg Dec 09, 2015 – 10:21am

AR319344

Path: V:\001 GIS Projects\GIS DS&G\Reports\2013\SSC Report Figs\FIGURE 1.2.mxd

REFERENCES

Base Imagery taken from United States Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP), 2008.

Spatial Reference:
NAD 1983 HARN StatePlane Delaware FIPS 0700

N

0 350 700 1,400 Feet

1 inch = 700 feet

FIGURE 2

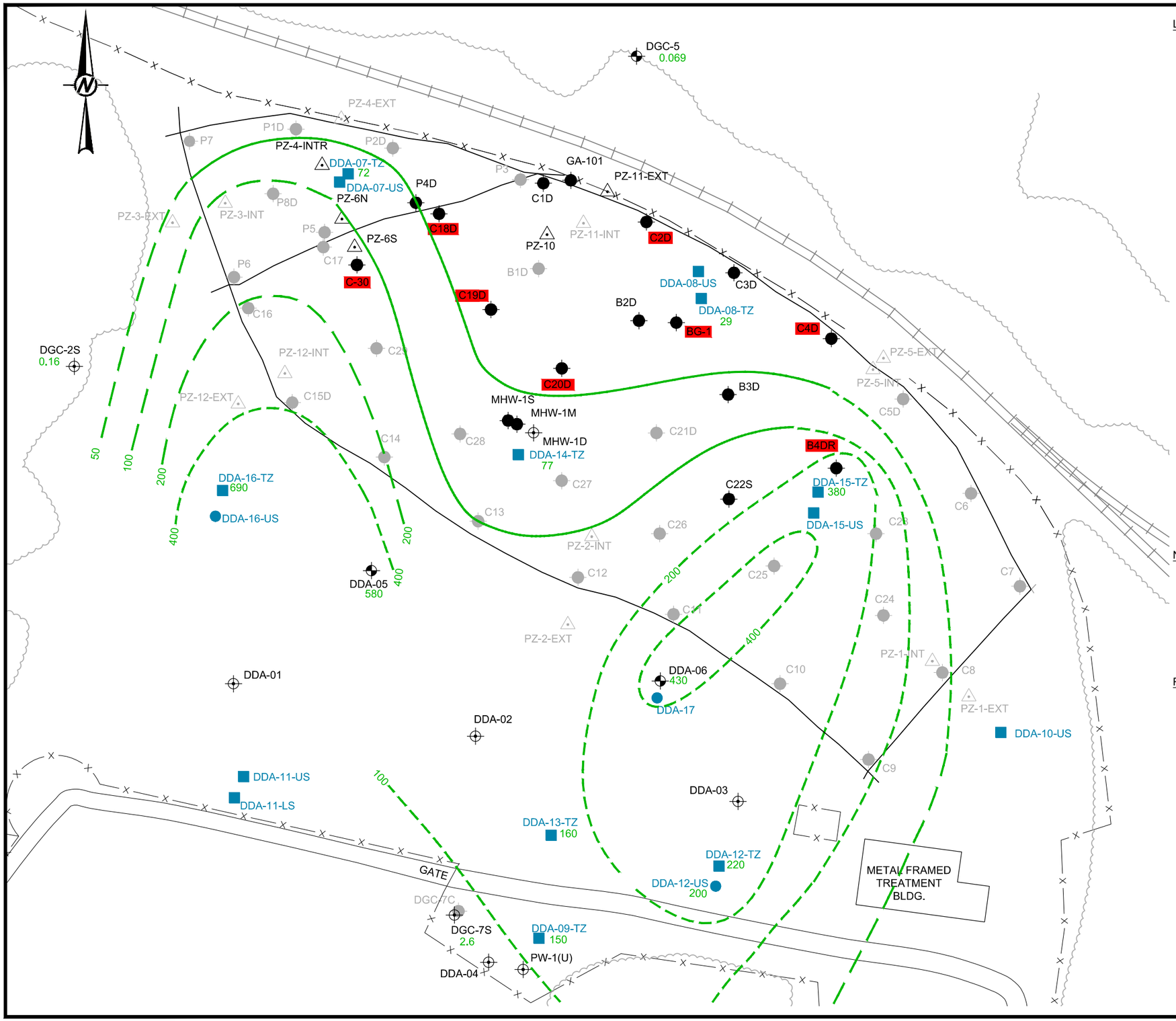
TITLE

GENERAL SITE LAYOUT

PROJECT

Delaware Sand and Gravel Superfund Site New Castle, Delaware

Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016



LEGEND

—X—X—X—X	FENCELINE
	CENTERLINE OF SLURRY WALL AROUND DRUM DISPOSAL AREA
	RAILROAD
C21D	COLUMBIA MONITORING WELLS (NOT INCLUDED IN MONITORING PROGRAM)
C1D	COLUMBIA MONITORING WELLS (INCLUDED IN MONITORING PROGRAM)
C19D	DDA LOW-FLOW EXTRACTION SYSTEM (LFExS) WELL
DGC-2S	MONITORING WELL SCREENED IN UPPER POTOMAC AQUIFER
DDA-05	UPPER POTOMAC CONFINING UNIT TRANSITION ZONE MONITORING WELLS
PZ-5	DDA PIEZOMETERS (NOT INCLUDED IN MONITORING PROGRAM)
PZ-10	DDA PIEZOMETERS (INCLUDED IN MONITORING PROGRAM)
DDA-12-TZ	2012 2" DIAMETER MONITORING WELL LOCATIONS
DDA-12-US	2012 4" DIAMETER MONITORING WELL LOCATIONS
	BCEE ISOCONCENTRATION CONTOURS (ug/l)
	BCEE ISOCONCENTRATION CONTOURS (INFERRED)
22	BCEE CONCENTRATIONS (ug/l) *INDICATES VALUE NOT USED IN CONTOURING

NOTES

1.) LOCATIONS OF WELLS AND BORING ARE BASED ON SURVEY BY TAYLOR WISEMAN & TAYLOR (REVISED 2012)
2.) BASED ON FEBRUARY - APRIL 2013 GROUNDWATER DATA
3.) DASHED LINES REPRESENT INFERRED ISOCONCENTRATIONS CONTOURS
4.) BCEE = BIS(2-CHLOROETHYL)ETHER
5.) ug/l = MICROGRAMS PER LITER

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL U.S.G.S. 7.5 MINUTE QUADRANGLES OF WILMINGTON SOUTH, DELAWARE/NEW JERSEY (DATED 1984), DELAWARE CITY, DELAWARE (DATED 1984), NEWARK EAST, DELAWARE (DATED 1984) AND SAINT GEORGES, DELAWARE (DATED 1984).

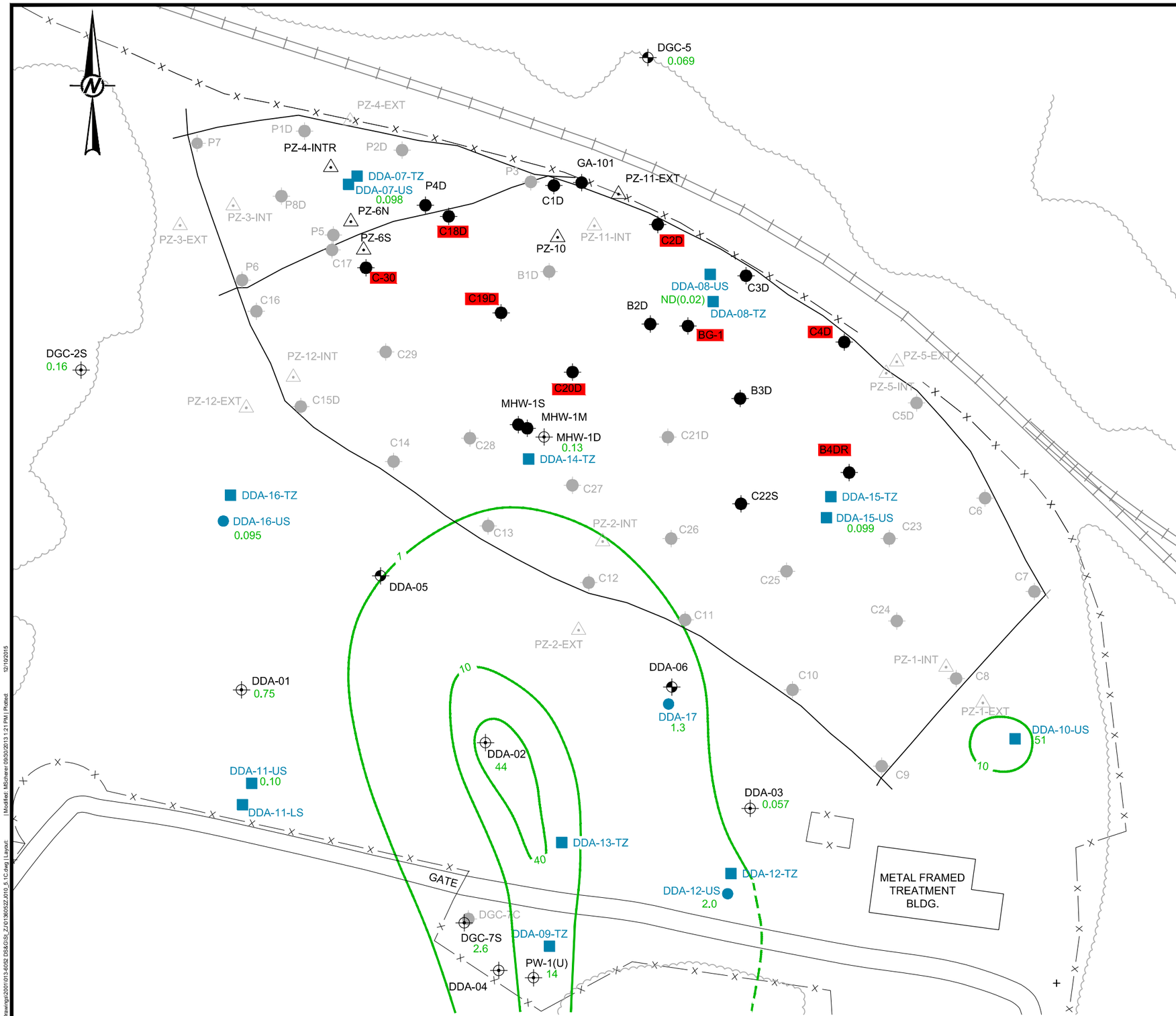
0 30 60 90
SCALE FEET

PROJECT
DELAWARE SAND AND GRAVEL
SUPERFUND SITE
NEW CASTLE, DELAWARE

TITLE
BCEE
DDA TO WELL PW-1(U)
UPCU TRANSITION ZONE
FEBRUARY - APRIL 2013

Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc.

FIGURE 3A



LEGEND

—X—X—X—X	FENCELINE
	CENTERLINE OF SLURRY WALL AROUND DRUM DISPOSAL AREA
	RAILROAD
C21D	COLUMBIA MONITORING WELLS (NOT INCLUDED IN MONITORING PROGRAM)
C1D	COLUMBIA MONITORING WELLS (INCLUDED IN MONITORING PROGRAM)
C19D	DDA LOW-FLOW EXTRACTION SYSTEM (LFExS) WELL
DGC-2S	MONITORING WELL SCREENED IN UPPER POTOMAC AQUIFER
DDA-05	UPPER POTOMAC CONFINING UNIT TRANSITION ZONE MONITORING WELLS
PZ-5	DDA PIEZOMETERS (NOT INCLUDED IN MONITORING PROGRAM)
PZ-10	DDA PIEZOMETERS (INCLUDED IN MONITORING PROGRAM)
DDA-12-TZ	2012 2" DIAMETER MONITORING WELL LOCATIONS
DDA-12-US	2012 4" DIAMETER MONITORING WELL LOCATIONS
	BCEE ISOCONCENTRATION CONTOURS (ug/l)
	BCEE ISOCONCENTRATION CONTOURS (INFERRED)
22	BCEE CONCENTRATIONS (ug/l) *INDICATES VALUE NOT USED IN CONTOURING

NOTES

1.) LOCATIONS OF WELLS AND BORING ARE BASED ON SURVEY BY TAYLOR WISEMAN & TAYLOR (REVISED 2012)
2.) BASED ON FEBRUARY - APRIL 2013 GROUNDWATER DATA
3.) DASHED LINES REPRESENT INFERRED ISOCONCENTRATIONS CONTOURS
4.) BCEE = BIS(2-CHLOROETHYL)ETHER
5.) ug/l = MICROGRAMS PER LITER

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL U.S.G.S. 7.5 MINUTE QUADRANGLES OF WILMINGTON SOUTH, DELAWARE/NEW JERSEY (DATED 1984), DELAWARE CITY, DELAWARE (DATED 1984), NEWARK EAST, DELAWARE (DATED 1984) AND SAINT GEORGES, DELAWARE (DATED 1984).

0 30 60 90
SCALE FEET

PROJECT
DELAWARE SAND AND GRAVEL SUPERFUND SITE
NEW CASTLE, DELAWARE

TITLE
BCEE
DDA TO WELL PW-1(U) - UPA
FEBRUARY - APRIL 2013

Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016

FIGURE 3B

AR319347

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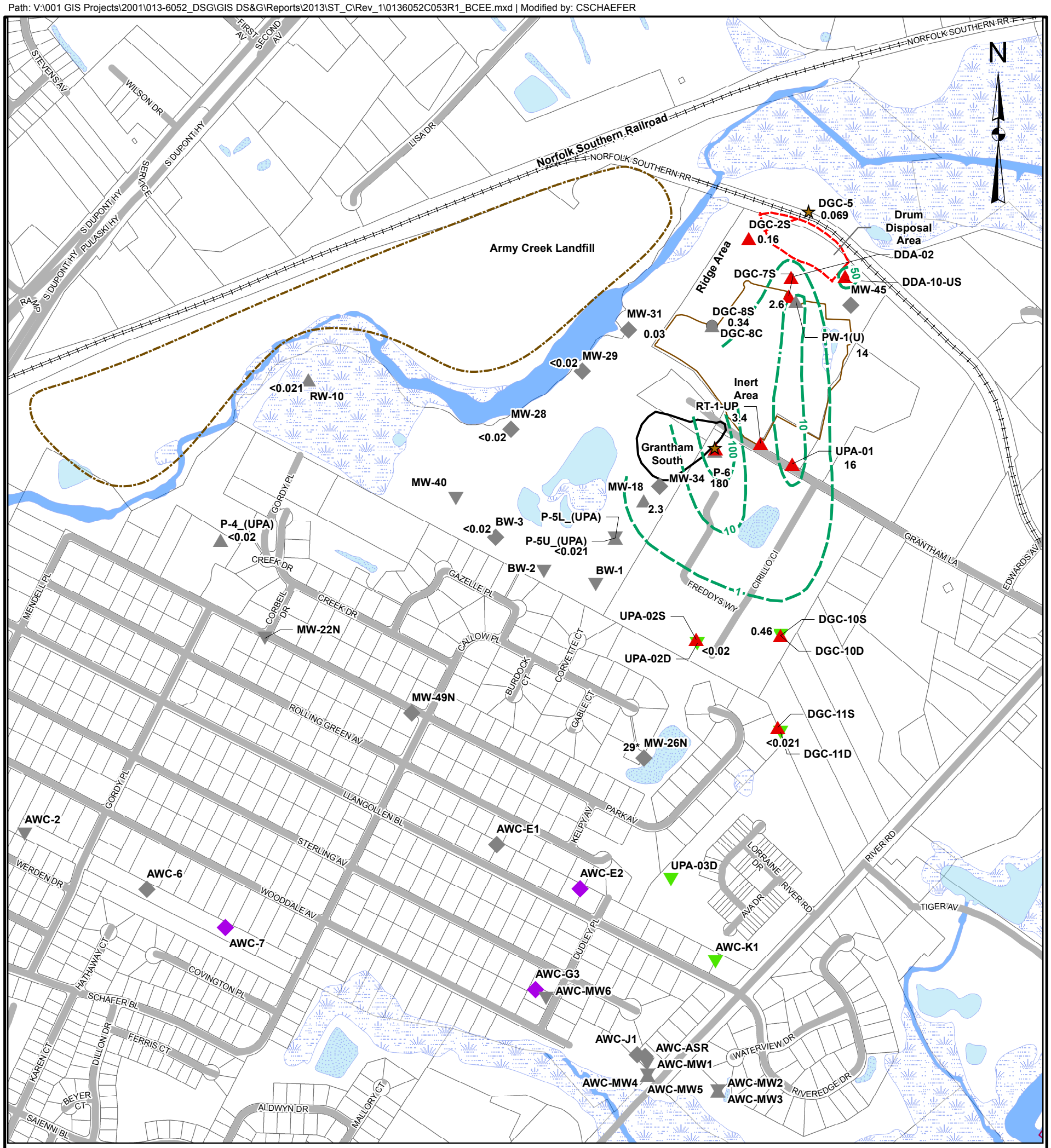

LEGEND

- Well screened in UPCU Transition Zone included in the current monitoring program
- Well screened in UPA Upper Sand included in the current monitoring program
- Well screened in UPA Upper Sand not included in the current monitoring program
- Well screened in UPA Lower Sand included in the current monitoring program
- Well screened in UPA Lower Sand not included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand not included in the current monitoring program
- Well screened in Columbia Aquifer included in the current monitoring program
- Well screened in Columbia Aquifer not included in the current monitoring program
- BCEE Isoconcentration Contour (Inferred)
- 14 - BCEE Concentrations (ug/L)

BCEE = BIS(2-CHLOROETHYL)ETHER
ug/L = Micrograms per Liter
* Indicated data not used for contouring

Notes:
1) Isoconcentration contours are approximate and should not be interpreted as exact indicators of groundwater quality at locations between wells.

2) Contours shown are based on available data interpreted through professional judgment in the context of groundwater flow direction and the conceptual site model for the area at and between the Delaware Sand & Gravel and Army Creek Landfill Superfund Sites.

REFERENCE

Base data from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 01/18/2012.

0 300 600 1,200 Feet

FIGURE 3C

TITLE
BCEE
UPA UPPER SAND
DOWNGRADIENT OF WELL PW-1(U)
MARCH - APRIL 2013

PROJECT
Delaware Sand and Gravel Superfund Site
New Castle, Delaware

Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016

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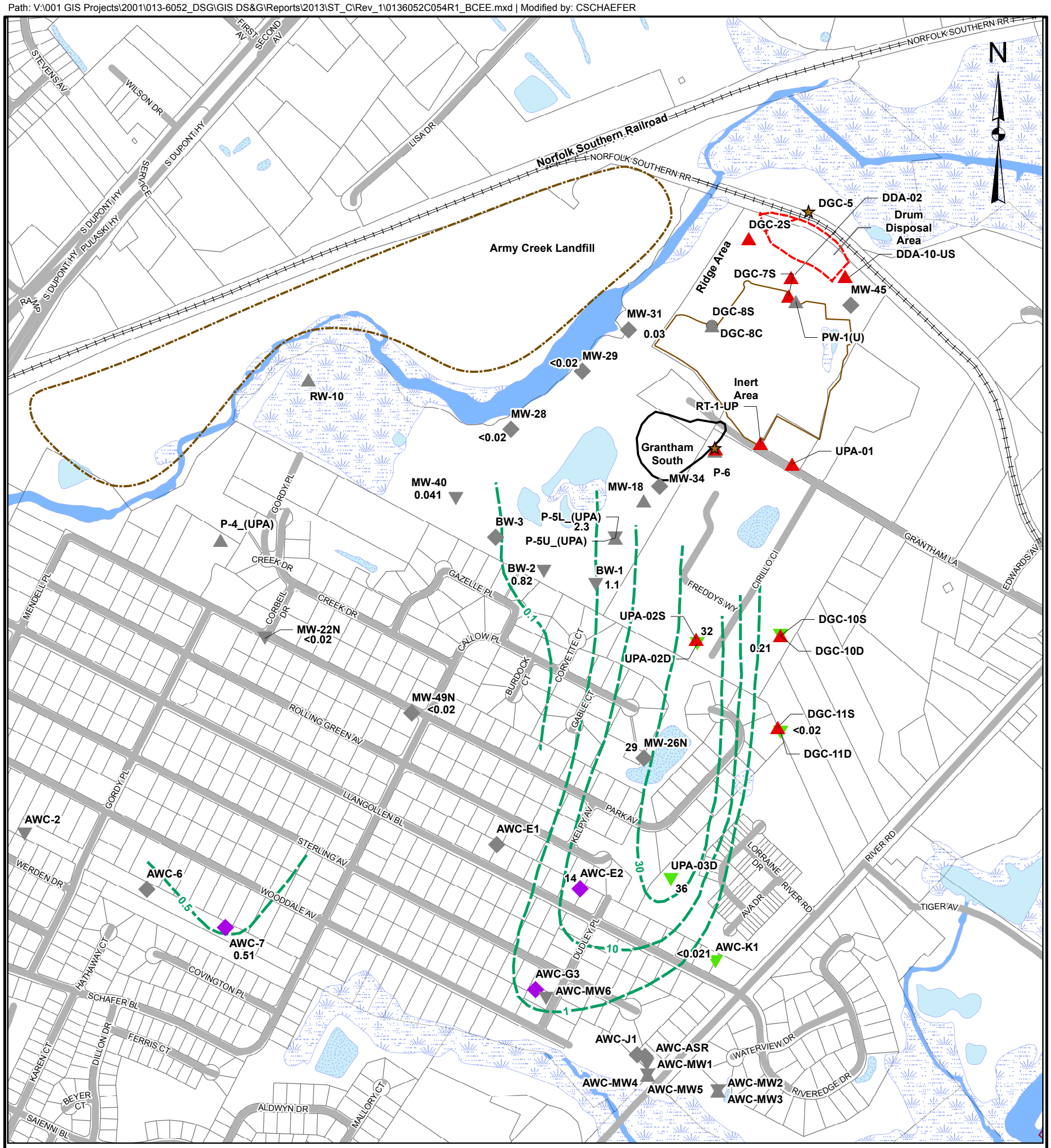


LEGEND

- Well screened in UPCU Transition Zone included in the current monitoring program
- Well screened in UPA Upper Sand included in the current monitoring program
- Well screened in UPA Upper Sand not included in the current monitoring program
- Well screened in UPA Lower Sand included in the current monitoring program
- Well screened in UPA Lower Sand not included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand not included in the current monitoring program
- Well screened in Columbia Aquifer included in the current monitoring program
- Well screened in Columbia Aquifer not included in the current monitoring program
- BCEE Isoconcentration Contour (Inferred)
- 14 - BCEE Concentrations (ug/L)

BCEE = BIS(2-CHLOROETHYL)ETHER
ug/L = Micrograms per Liter

Notes:
1) Isoconcentration contours are approximate and should not be interpreted as exact indicators of groundwater quality at locations between wells.

2) Contours shown are based on available data interpreted through professional judgment in the context of groundwater flow direction and the conceptual site model for the area at and between the Delaware Sand & Gravel and Army Creek Landfill Superfund Sites.

REFERENCE

Base data from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 01/18/2012.

0 300 600 1,200 Feet

FIGURE 3D

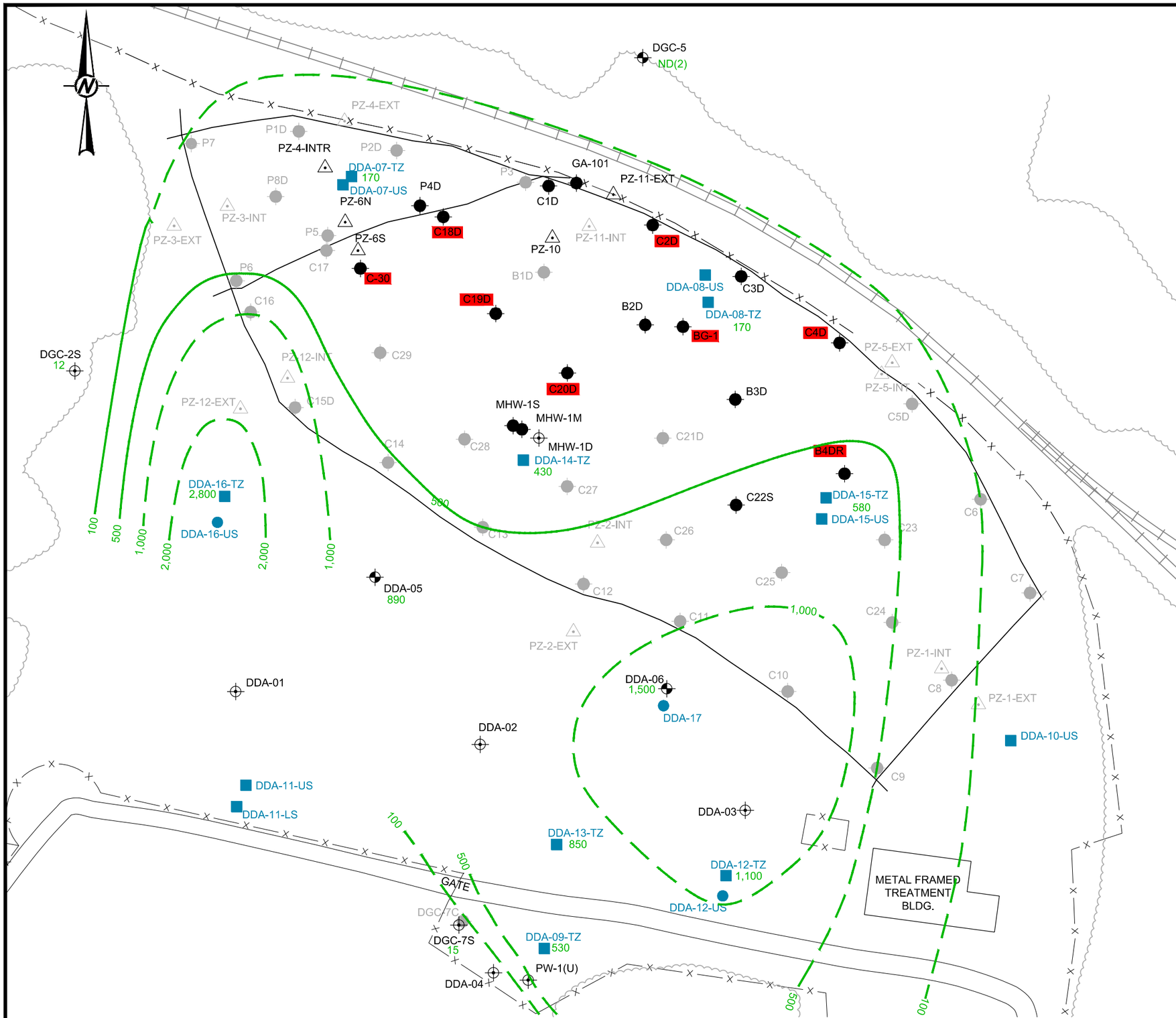
TITLE

BCEE
UPA LOWER SAND
DOWNGRADIENT OF WELL PW-1U
MARCH - APRIL 2013

PROJECT

Delaware Sand and Gravel Superfund Site
New Castle, Delaware

Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016



LEGEND

–X——X——X——X	FENCELINE
	CENTERLINE OF SLURRY WALL AROUND DRUM DISPOSAL AREA
	RAILROAD
C21D	COLUMBIA MONITORING WELLS (NOT INCLUDED IN MONITORING PROGRAM)
C1D	COLUMBIA MONITORING WELLS (INCLUDED IN MONITORING PROGRAM)
C19D	DDA LOW-FLOW EXTRACTION SYSTEM (LFExS) WELL
DGC-2S	MONITORING WELL SCREENED IN UPPER POTOMAC AQUIFER
DDA-05	UPPER POTOMAC CONFINING UNIT TRANSITION ZONE MONITORING WELLS
PZ-5	DDA PIEZOMETERS (NOT INCLUDED IN MONITORING PROGRAM)
PZ-10	DDA PIEZOMETERS (INCLUDED IN MONITORING PROGRAM)
DDA-12-TZ	2012 2" DIAMETER MONITORING WELL LOCATIONS
DDA-12-US	2012 4" DIAMETER MONITORING WELL LOCATIONS
	1,4-DIOXANE ISOCONCENTRATION CONTOURS (ug/l)
	1,4-DIOXANE ISOCONCENTRATION CONTOURS (INFERRED)
22	1,4-DIOXANE CONCENTRATIONS (ug/l) * INDICATES VALUE NOT USED IN CONTOURING

NOTES

1.) LOCATIONS OF WELLS AND BORING ARE BASED ON SURVEY BY TAYLOR WISEMAN & TAYLOR (REVISED 2012)
2.) BASED ON FEBRUARY - APRIL 2013 GROUNDWATER DATA
3.) DASHED LINES REPRESENT INFERRED ISOCONCENTRATIONS CONTOURS
4.) ug/l = MICROGRAMS PER LITER

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL U.S.G.S. 7.5 MINUTE QUADRANGLES OF WILMINGTON SOUTH, DELAWARE/NEW JERSEY (DATED 1984), DELAWARE CITY, DELAWARE (DATED 1984), NEWARK EAST, DELAWARE (DATED 1984) AND SAINT GEORGES, DELAWARE (DATED 1984).

0 30 60 90
SCALE FEET

PROJECT
DELAWARE SAND AND GRAVEL
SUPERFUND SITE
NEW CASTLE, DELAWARE

TITLE
1,4-DIOXANE
DDA TO WELL PW-1(U)
UPCU TRANSITION ZONE
FEBRUARY - APRIL 2013

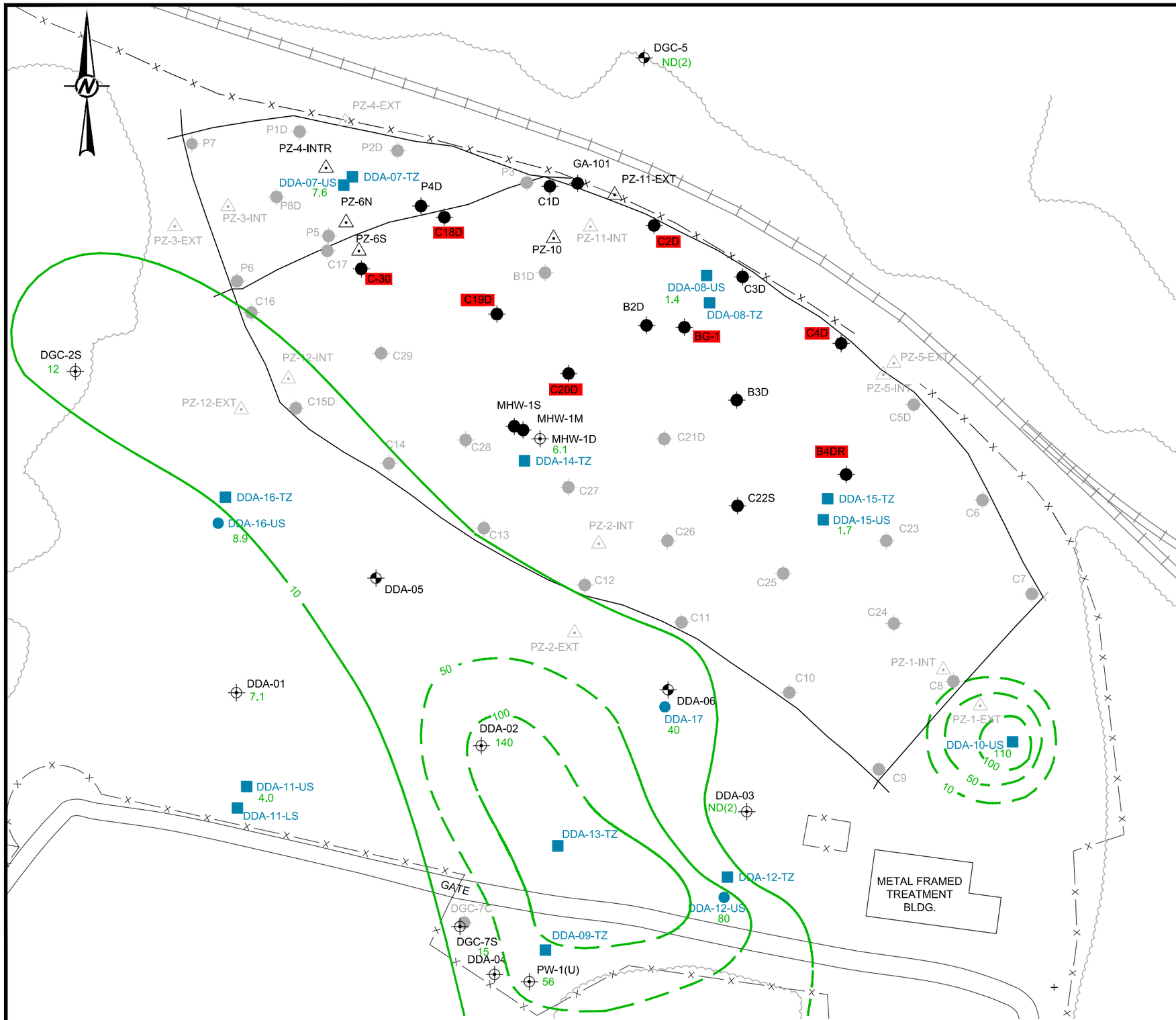
Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016

PROJECT No.		
DESIGN		
CADD		
CHECK		
REVIEW		

SCALE AS SHOWN

FIGURE 4A

AR319350



LEGEND

–X——X——X——X	FENCELINE
———	CENTERLINE OF SLURRY WALL AROUND DRUM DISPOSAL AREA
++++++	RAILROAD
C21D	COLUMBIA MONITORING WELLS (NOT INCLUDED IN MONITORING PROGRAM)
C1D	COLUMBIA MONITORING WELLS (INCLUDED IN MONITORING PROGRAM)
C19D	DDA LOW-FLOW EXTRACTION SYSTEM (LFExS) WELL
DGC-2S	MONITORING WELL SCREENED IN UPPER POTOMAC AQUIFER
DDA-05	UPPER POTOMAC CONFINING UNIT TRANSITION ZONE MONITORING WELLS
PZ-5	DDA PIEZOMETERS (NOT INCLUDED IN MONITORING PROGRAM)
PZ-10	DDA PIEZOMETERS (INCLUDED IN MONITORING PROGRAM)
DDA-12-TZ	2012 2" DIAMETER MONITORING WELL LOCATIONS
DDA-12-US	2012 4" DIAMETER MONITORING WELL LOCATIONS
———	1,4-DIOXANE ISOCONCENTRATION CONTOURS (ug/l)
- - - -	1,4-DIOXANE ISOCONCENTRATION CONTOURS (INFERRED)
22	1,4-DIOXANE CONCENTRATIONS (ug/l) * INDICATES VALUE NOT USED IN CONTOURING

NOTES

1.) LOCATIONS OF WELLS AND BORING ARE BASED ON SURVEY BY TAYLOR WISEMAN & TAYLOR (REVISED 2012)
2.) BASED ON FEBRUARY - APRIL 2013 GROUNDWATER DATA
3.) DASHED LINES REPRESENT INFERRED ISOCONCENTRATIONS CONTOURS
4.) ug/l = MICROGRAMS PER LITER

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL U.S.G.S. 7.5 MINUTE QUADRANGLES OF WILMINGTON SOUTH, DELAWARE/NEW JERSEY (DATED 1984), DELAWARE CITY, DELAWARE (DATED 1984), NEWARK EAST, DELAWARE (DATED 1984) AND SAINT GEORGES, DELAWARE (DATED 1984).

0 30 60 90
SCALE FEET

PROJECT
DELAWARE SAND AND GRAVEL
SUPERFUND SITE
NEW CASTLE, DELAWARE

TITLE
1,4-DIOXANE
DDA TO WELL PW-1(U) - UPA
FEBRUARY - APRIL 2013

Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016

PROJECT No.			FILE No.
DESIGN			SCALE AS SHOWN
CADD			**FIGURE 4B**
CHECK			
REVIEW			

AR319351

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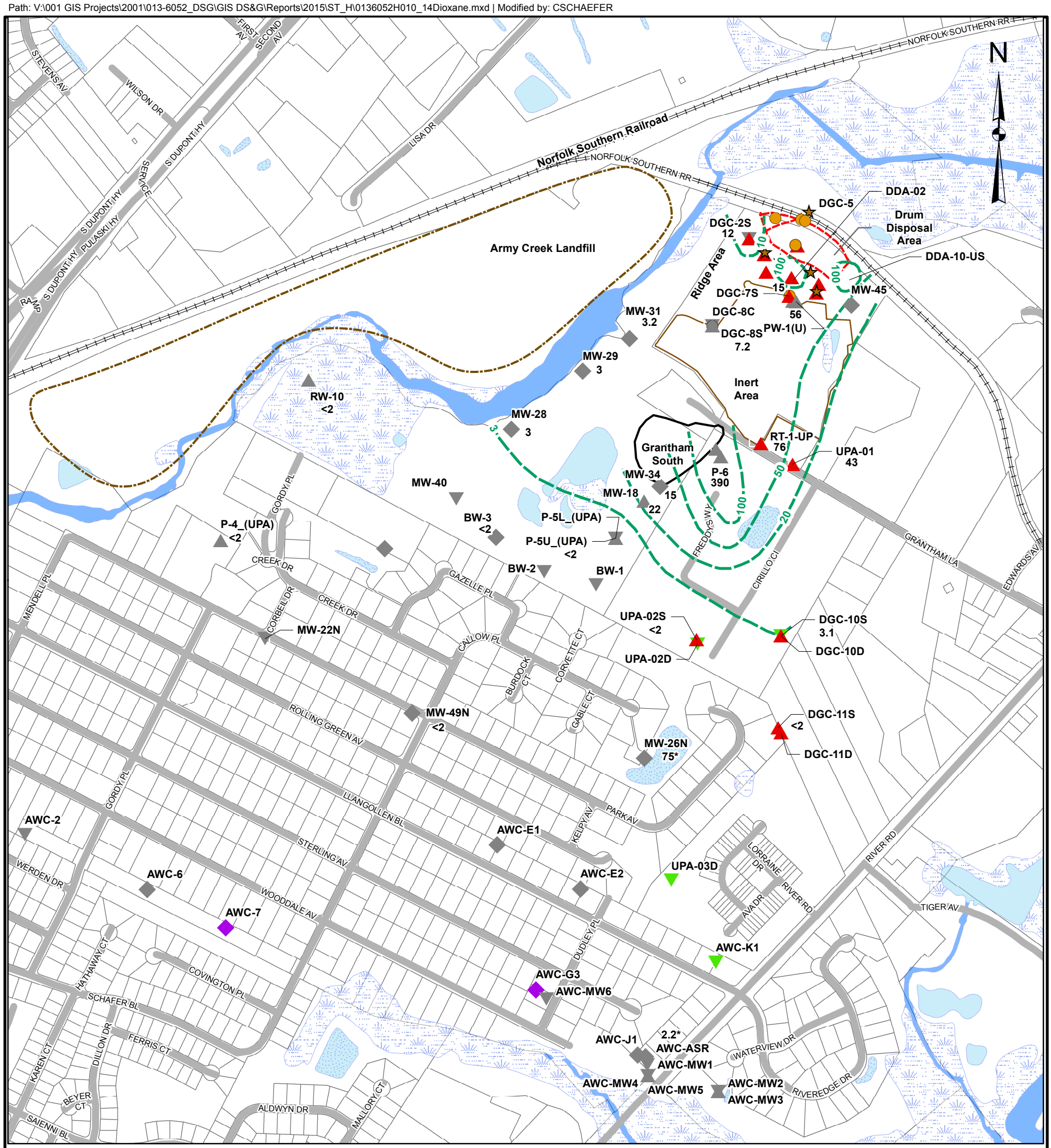

LEGEND

- Well screened in UPCU Transition Zone included in the current monitoring program
- Well screened in UPA Upper Sand included in the current monitoring program
- Well screened in UPA Upper Sand not included in the current monitoring program
- Well screened in UPA Lower Sand included in the current monitoring program
- Well screened in UPA Lower Sand not included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand not included in the current monitoring program
- Well screened in Columbia Aquifer included in the current monitoring program
- Well screened in Columbia Aquifer not included in the current monitoring program
- 1,4-Dioxane Isoconcentration Contour (Inferred)
- 14 - 1,4-Dioxane Concentrations (ug/L)
- * Indicated data not used for contouring

Notes:
1) Isoconcentration contours are approximate and should not be interpreted as exact indicators of groundwater quality at locations between wells.

2) Contours shown are based on available data interpreted through professional judgment in the context of groundwater flow direction and the conceptual site model for the area at and between the Delaware Sand & Gravel and Army Creek Landfill Superfund Sites.

REFERENCE

Base data from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 01/18/2012.

0 300 600 1,200 Feet

FIGURE 4C

TITLE

1,4-DIOXANE
UPA UPPER SAND
DOWNGRADIENT OF WELL PW-1(U)
MARCH - APRIL 2013

PROJECT

Delaware Sand and Gravel Superfund Site
New Castle, Delaware

Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016

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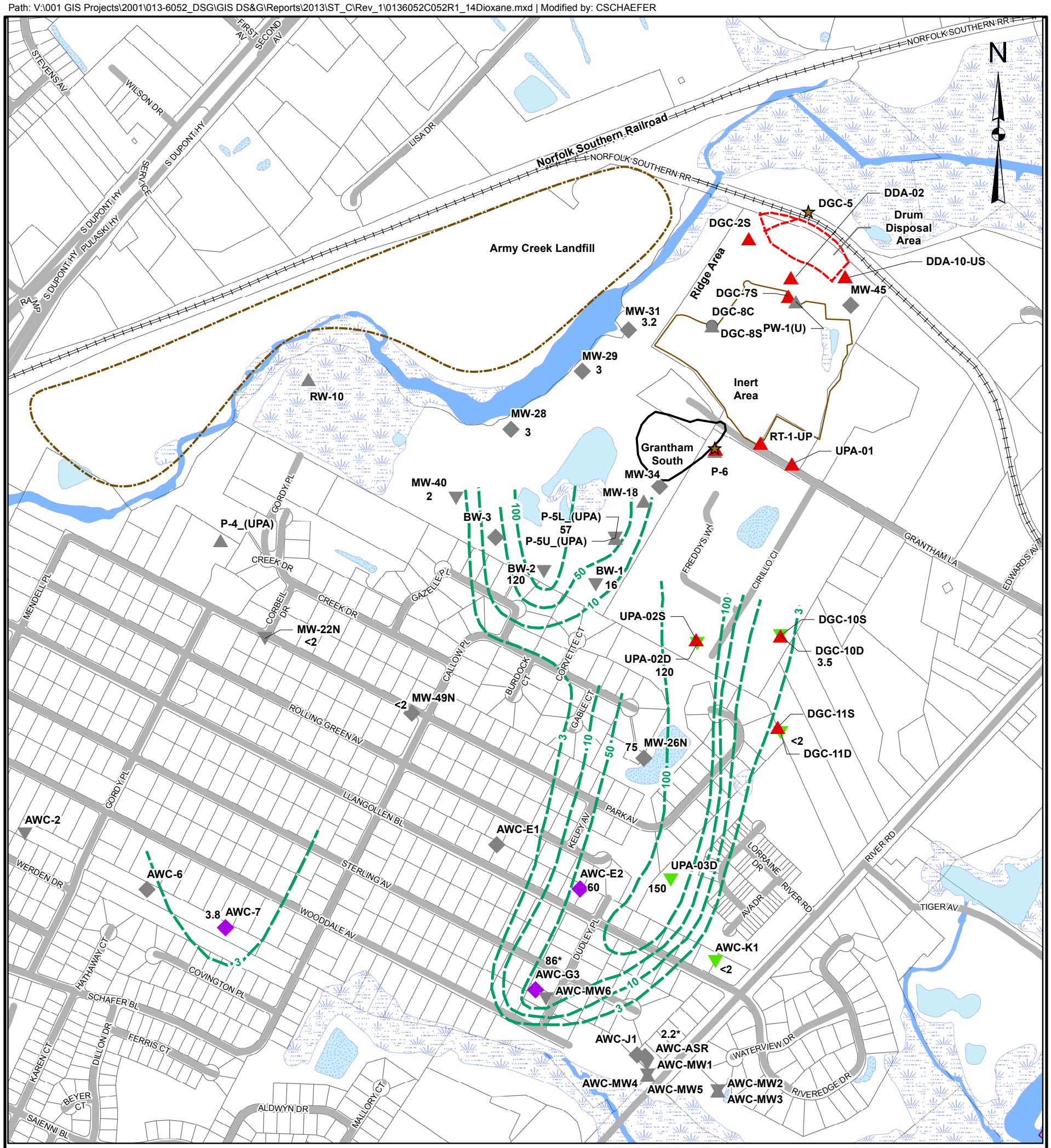


LEGEND

- Well screened in UPCU Transition Zone included in the current monitoring program
- Well screened in UPA Upper Sand included in the current monitoring program
- Well screened in UPA Upper Sand not included in the current monitoring program
- Well screened in UPA Lower Sand included in the current monitoring program
- Well screened in UPA Lower Sand not included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand not included in the current monitoring program
- Well screened in Columbia Aquifer included in the current monitoring program
- Well screened in Columbia Aquifer not included in the current monitoring program
- 1,4-Dioxane Isoconcentration Contour (Inferred)
- **14** - 1,4-Dioxane Concentrations (ug/L)

* Indicated data provided by Artesian Water Company
ug/L = Micrograms per Liter

Notes:
1) Isoconcentration contours are approximate and should not be interpreted as exact indicators of groundwater quality at locations between wells.

2) Contours shown are based on available data interpreted through professional judgment in the context of groundwater flow direction and the conceptual site model for the area at and between the Delaware Sand & Gravel and Army Creek Landfill Superfund Sites.

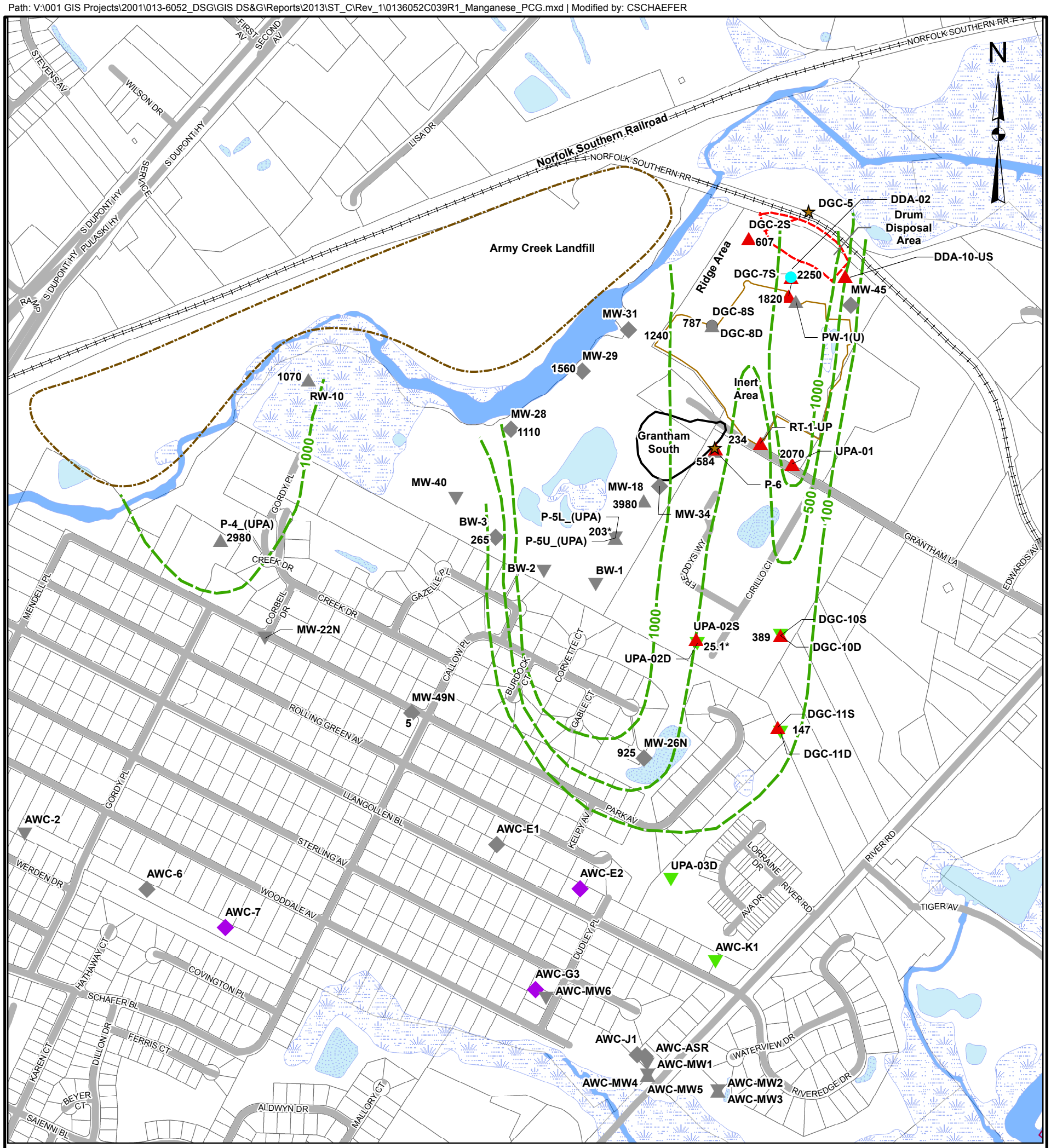
REFERENCE

Base data from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 01/18/2012.

0 300 600 1,200 Feet

FIGURE 4D	REVIEW	CHECK	GIS	DESIGN	SCALE: AS SHOWN	FILE No.	TITLE	PROJECT	
							1,4-DIOXANE UPA LOWER SAND DOWNGRADIENT OF WELL PW-1(U) MARCH - APRIL 2013	**Delaware Sand and Gravel Superfund Site New Castle, Delaware**	Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016

Path: V:\001 GIS Projects\2001\013-6052_DSG\GIS DS&G\Reports\2013\ST_C\Rev_1\0136052C039R1_Manganese_PCG.mxd | Modified by: CSCHAEFER



LEGEND

- Well screened in UPCU Transition Zone included in the current monitoring program
- Well screened in UPA Upper Sand included in the current monitoring program
- Well screened in UPA Upper Sand not included in the current monitoring program
- Well screened in UPA Lower Sand included in the current monitoring program
- Well screened in UPA Lower Sand not included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand not included in the current monitoring program
- Well screened in Columbia Aquifer included in the current monitoring program
- Well screened in Columbia Aquifer not included in the current monitoring program
- Dissolved Manganese Isoconcentration Contour (Inferred)
- <15 Dissolved Manganese Concentration (ug/L)

* Indicates datapoint not used in contouring
ug/L = Micrograms per Liter

Notes:
1) Isoconcentration contours are approximate and should not be interpreted as exact indicators of groundwater quality at locations between wells.

2) Contours shown are based on available data interpreted through professional judgment in the context of groundwater flow direction and the conceptual site model for the area at and between the Delaware Sand & Gravel and Army Creek Landfill Superfund Sites.

REFERENCE

Base data from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 01/18/2012.

FIGURE 5A

REVIEW | CHECK | GIS | DESIGN | REV. | SCALE: | FILE No.

TITLE

MANGANESE (DISSOLVED)
UPA UPPER SAND
DOWNGRADIENT OF WELL PW-1(U)
MARCH - APRIL 2013

PROJECT

Delaware Sand and Gravel Superfund Site
New Castle, Delaware

Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016

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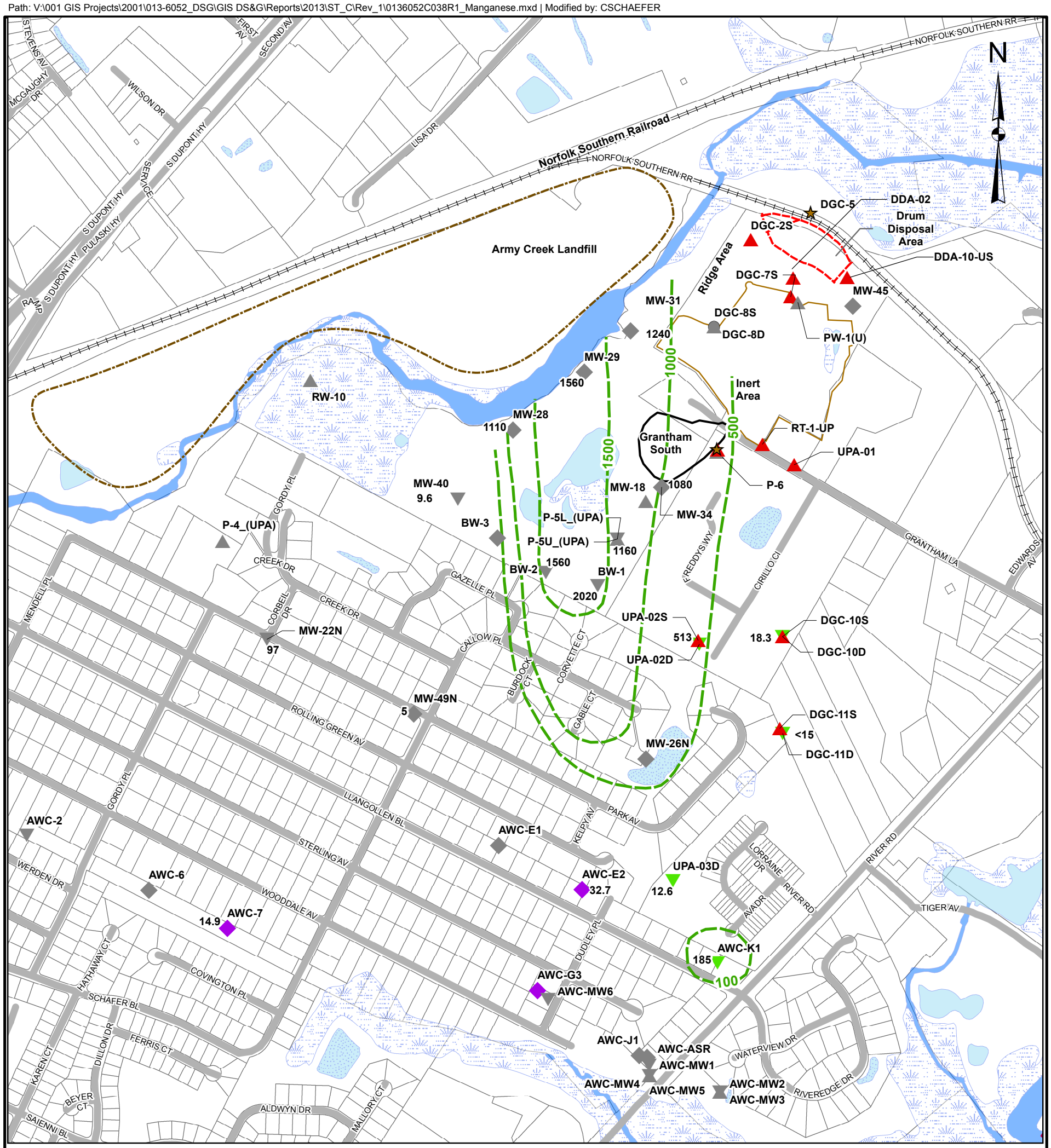

LEGEND

- Well screened in UPCU Transition Zone included in the current monitoring program
- Well screened in UPA Upper Sand included in the current monitoring program
- Well screened in UPA Upper Sand not included in the current monitoring program
- Well screened in UPA Lower Sand included in the current monitoring program
- Well screened in UPA Lower Sand not included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand included in the current monitoring program
- Well screened across UPA Upper Sand and Lower Sand not included in the current monitoring program
- Well screened in Columbia Aquifer included in the current monitoring program
- Well screened in Columbia Aquifer not included in the current monitoring program
- Dissolved Manganese Isoconcentration Contour (Inferred)
- <15 Dissolved Manganese Concentration (ug/L)

* Indicates datapoint not used in contouring
ug/L = Micrograms per Liter

Notes:
1) Isoconcentration contours are approximate and should not be interpreted as exact indicators of groundwater quality at locations between wells.

2) Contours shown are based on available data interpreted through professional judgment in the context of groundwater flow direction and the conceptual site model for the area at and between the Delaware Sand & Gravel and Army Creek Landfill Superfund Sites.

REFERENCE

Base data from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 01/18/2012.

0 300 600 1,200 Feet

FIGURE 5B

REVIEW | CHECK | GIS | DESIGN | REV. | SCALE: | FILE No.

TITLE
MANGANESE (DISSOLVED)
UPA LOWER SAND
DOWNGRADIENT OF WELL PW-1(U)
MARCH - APRIL 2013

PROJECT
Delaware Sand and Gravel Superfund Site
New Castle, Delaware

Source:
Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016

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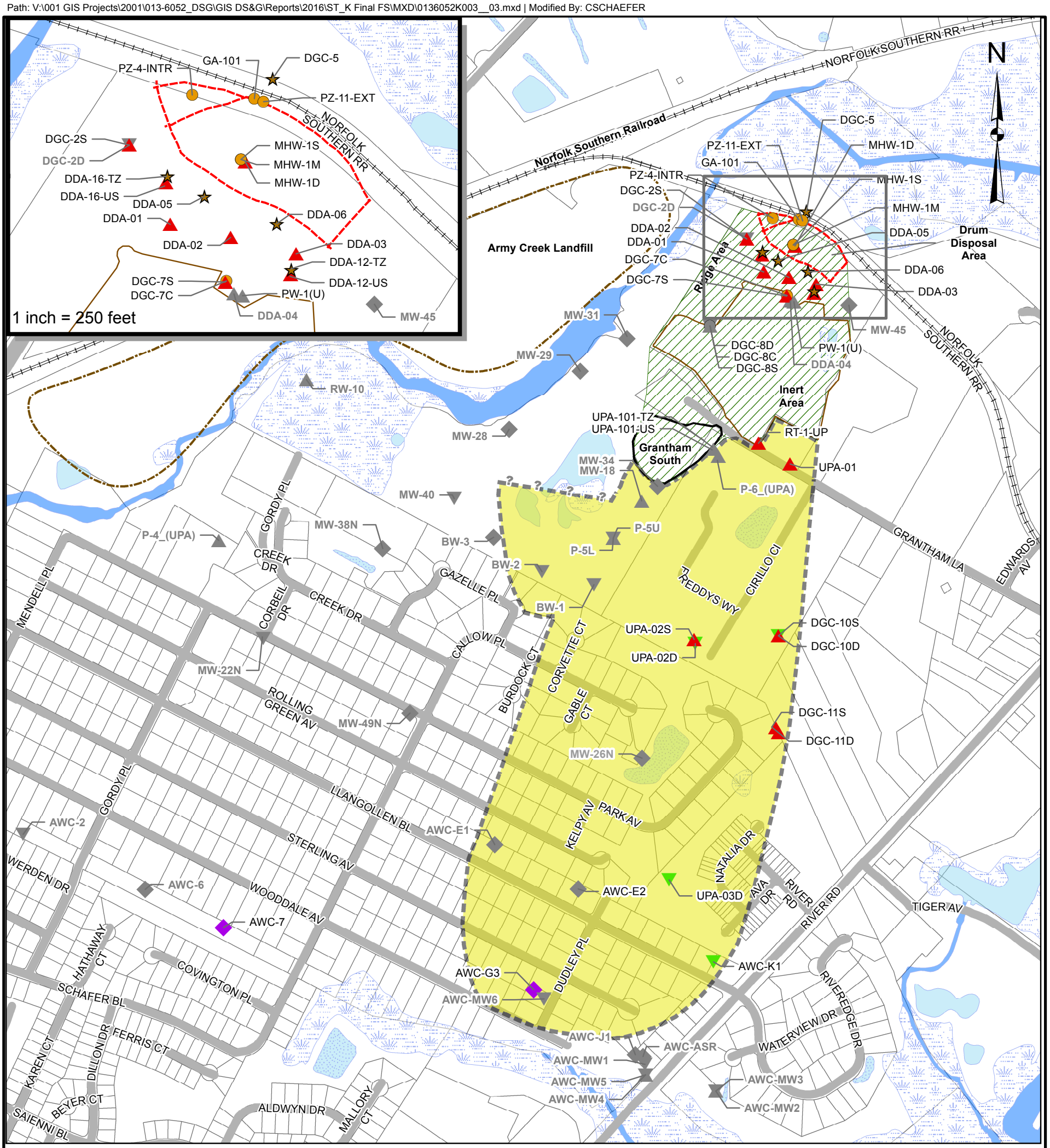


LEGEND

- Well screened in UPCU Transition Zone included in DS&G's approved 2011 monitoring program
- Well screened in UPA Upper Sand included in DS&G's approved 2011 monitoring program
- Well screened in UPA Upper Sand not included in DS&G's approved 2011 monitoring program
- Well screened in UPA Lower Sand included in DS&G's approved 2011 monitoring program
- Well screened in UPA Lower Sand not included in DS&G's approved 2011 monitoring program
- Well screened across UPA Upper Sand and Lower Sand included in DS&G's approved 2011 monitoring program
- Well screened across UPA Upper Sand and Lower Sand not included in DS&G's approved 2011 monitoring program
- Well screened in Columbia Aquifer included in DS&G's approved 2011 monitoring program
- Well screened in Columbia Aquifer not included in DS&G's approved 2011 monitoring program
- Area of Attainment
- Waste Management Area

REFERENCE

Base data from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 01/18/2012.

0 300 600 1,200 Feet

1 inch = 600 feet

FIGURE 6

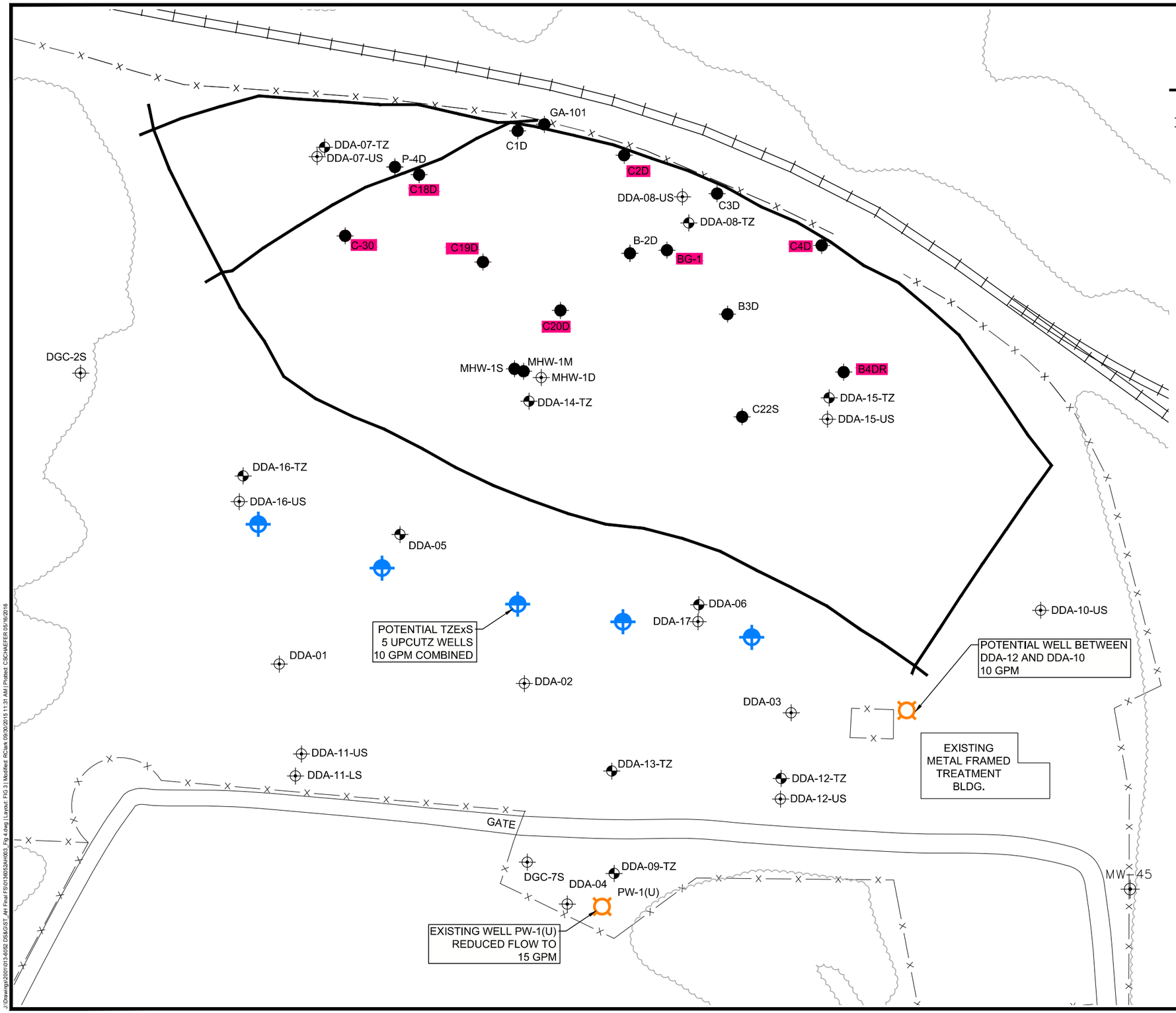
REVIEW | CHECK | GIS | DESIGN | REV. | SCALE: | FILE No.

TITLE

WASTE MANAGEMENT AREA AND AREA OF ATTAINMENT

PROJECT

Delaware Sand and Gravel Superfund Site New Castle, Delaware



LEGEND

X——X——X——X	FENCELINE
▬▬▬	CENTERLINE OF SLURRY WALL AROUND DRUM DISPOSAL AREA
═══	RAILROAD
C19D	DDA LOW-FLOW EXTRACTION SYSTEM (LFExS) WELL
DGC-2S	MONITORING WELL SCREENED IN UPPER POTOMAC AQUIFER
DDA-05	UPPER POTOMAC CONFINING UNIT TRANSITION ZONE (UPCUTZ) MONITORING WELLS
	POTENTIAL UPCUTZ EXTRACTION WELLS
	POTENTIAL UPA EXTRACTION WELLS

NOTES

1. LOCATIONS OF WELLS AND BORINGS ARE APPROXIMATE

REFERENCE

1. BASE MAP TAKEN FROM DIGITAL U.S.G.S. 7.5 MINUTE QUADRANGLES OF WILMINGTON SOUTH, DELAWARE/NEW JERSEY (DATED 1984), DELAWARE CITY, DELAWARE (DATED 1984), NEWARK EAST, DELAWARE (DATED 1984) AND SAINT GEORGES, DELAWARE (DATED 1984).

0 30 60
FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

PROJECT
DELAWARE SAND AND GRAVEL
SUPERFUND SITE
NEW CASTLE, DELAWARE

TITLE
POTENTIAL EXTRACTION WELL LOCATIONS IN THE UPCUTZ AND UPA UPPER SAND UPGRADIENT OF WELL PW-1(U)

Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc.

PROJECT No.		
DESIGN		
CADD		
CHECK		
REVIEW		

FIGURE 7

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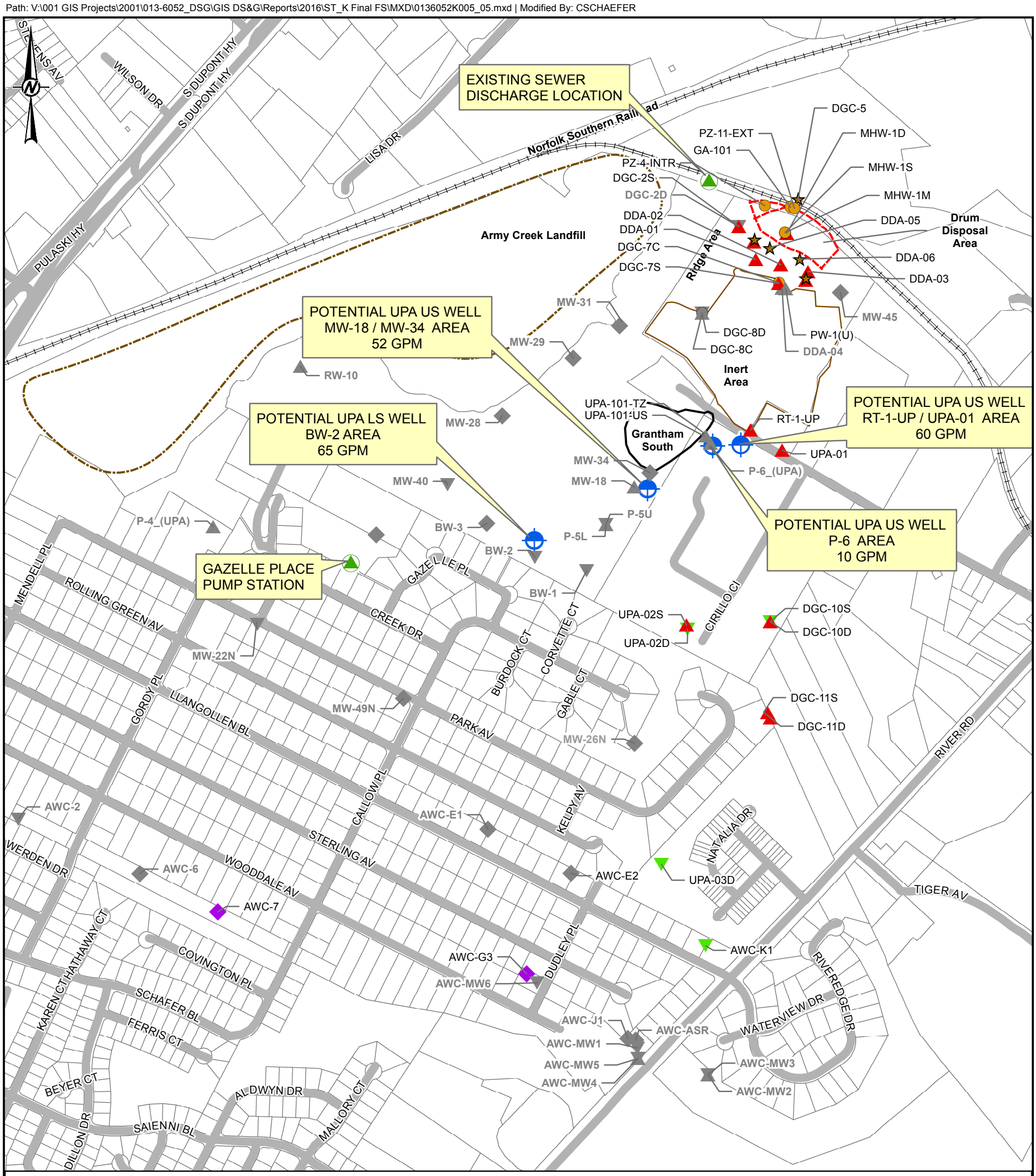


LEGEND

- Well screened in UPCU Transition Zone included in DS&G's approved 2011 monitoring program
- Well screened in UPA Upper Sand included in DS&G's approved 2011 monitoring program
- Well screened in UPA Upper Sand not included in DS&G's approved 2011 monitoring program
- Well screened in UPA Lower Sand included in DS&G's approved 2011 monitoring program
- Well screened in UPA Lower Sand not included in DS&G's approved 2011 monitoring program
- Well screened across UPA Upper Sand and Lower Sand included in DS&G's approved 2011 monitoring program
- Well screened across UPA Upper Sand and Lower Sand not included in DS&G's approved 2011 monitoring program
- Well screened in Columbia Aquifer included in DS&G's approved 2011 monitoring program
- Well screened in Columbia Aquifer not included in DS&G's approved 2011 monitoring program
- Potential Off-Site Extraction Well
- Pump Station / Discharge Location

REFERENCE

Base data from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 01/18/2012.

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B

FIGURE 8

REVIEW	
CHECK	
GIS	
DESIGN	
REV.	
SCALE:	
FILE No.	

TITLE

POTENTIAL EXTRACTION WELL LOCATIONS IN THE UPA DOWNGRADIENT OF WELL PW-1(U)

PROJECT

Delaware Sand and Gravel Superfund Site New Castle, Delaware

Source: Supplemental Site Characterization - Revision 2, Golder Associates, Inc., 2016

APPENDIX A

Risk and PRG Tables for Groundwater

Table 1. Occurrence, Distribution, and Selection of Chemicals of Potential Concern in the Upper Potomac Aquifer

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Method Detection Limits		Concentration Used for Screening (2)	Background Value (3)	2017 Screening Toxicity Value (µg/L) (N/C) (4,5)		Potential ARAR Value µg/L	Potential ARAR/TBC Source (6)	COPC Flag (Y/N)	Rationale for Selection or Deletion (7)
UPA (including UPCUTZ) - Plume Core	75-34-3	1,1-Dichloroethane	0.21	J	2.6	J	µg/L	DDA-05	30 / 55	0.13	1.3	2.6	NA	2.8	c	NA	NA	N	BSL
	120-82-1	1,2,4-Trichlorobenzene	0.35	J	0.86	J	µg/L	DDA-05	5 / 55	0.26	1.3	0.86	NA	0.40	n	70	MCL	Y	ASL
	95-63-6	1,2,4-Trimethylbenzene	0.16	J	420	--	µg/L	DDA-05	14 / 55	0.13	1.3	420	NA	5.6	n	NA	NA	Y	ASL
	95-50-1	1,2-Dichlorobenzene	2.8	--	21	--	µg/L	DDA-06	10 / 55	2.5	13	21	NA	30	n	600	MCL	N	BSL
	107-06-2	1,2-Dichloroethane	0.19	J	4.4	--	µg/L	UPA-03D	16 / 55	0.19	1.9	4.4	NA	0.17	c**	5.0	MCL	Y	ASL
	108-67-8	1,3,5-Trimethylbenzene	0.47	--	110	--	µg/L	DDA-05	13 / 55	0.15	1.5	110	NA	6.0	n	NA	NA	Y	ASL
	106-46-7	1,4-Dichlorobenzene	2.6	J	2.6	J	µg/L	DDA-06	1 / 55	2.5	13	2.6	NA	0.48	c	75	MCL	Y	ASL
	123-91-1	1,4-Dioxane	0.39	J	2,300	--	µg/L	DDA-06	43 / 55	0.31	360	2,300	NA	0.46	c*	3.5	HA	Y	ASL
	105-67-9	2,4-Dimethylphenol	4.4	J	30	J	µg/L	DDA-05	10 / 55	3.4	18	30	NA	36	n	NA	NA	N	BSL
	95-48-7	2-Methylphenol	6.9	J	6.9	J	µg/L	P-6_UPA	1 / 55	1.8	9.3	6.9	NA	93	n	NA	NA	N	BSL
	67-64-1	Acetone	8.3	--	37	--	µg/L	UPA-01	5 / 55	2.7	27	37	NA	1,400	n	NA	NA	N	BSL
	7429-90-5	Aluminum	46	J	4,680	--	µg/L	UPA-01	27 / 30	33	33	4,680	NA	2,000	n	200	sMCL	Y	ASL
	7664-41-7	Ammonia	22	J	6,700	--	µg/L	DDA-05	22 / 30	13	800	6,700	NA	NA	NA	30,000	HA	N	BSL
	7440-38-2	Arsenic	2.1	J	8.7	--	µg/L	P-6_UPA	18 / 30	1.8	1.8	8.7	NA	0.052	c*	10	MCL	Y	ASL
	7440-39-3	Barium	36	--	457	--	µg/L	DDA-06	30 / 30	3.8	3.8	457	NA	380	n	2,000	MCL	Y	ASL
	71-43-2	Benzene	0.29	J	1,400	--	µg/L	DDA-05	40 / 55	0.080	0.80	1,400	NA	0.46	c**	5.0	MCL	Y	ASL
	56-55-3	Benzo[a]anthracene	0.043	J	0.048	J	µg/L	UPA-01	2 / 55	0.035	0.039	0.048	NA	0.030	c	NA	NA	Y	ASL
	205-99-2	Benzo[b]fluoranthene	0.038	J	0.050	--	µg/L	UPA-01	3 / 55	0.030	0.033	0.050	NA	0.25	c	NA	NA	N	BSL
	111-44-4	Bis(2-chloroethyl) Ether	0.033	--	690	--	µg/L	DDA-06	50 / 55	0.018	1.4	690	NA	0.014	c	NA	NA	Y	ASL
	117-81-7	Bis(2-ethylhexyl) Phthalate	3.4	B	5.5	B	µg/L	P-6_UPA	4 / 55	2.0	10	5.5	NA	5.6	c**	6.0	MCL	N	BSL
	80-05-7	Bisphenol A	8.8	--	150	--	µg/L	P-6_UPA	4 / 10	0.0	0.0	150	NA	77	n	NA	NA	Y	ASL
	75-27-4	Bromodichloromethane	0.59	--	1.1	--	µg/L	UPA-01	2 / 55	0.12	1.2	1.1	NA	0.13	c	80	MCL	Y	ASL
	85-68-7	Butylbenzyl Phthalate	9.2	J	9.2	J	µg/L	DDA-06	1 / 55	2.5	13	9.2	NA	16	c*	7,000	HA	N	BSL
	105-60-2	Caprolactum	8.1	J	77	--	µg/L	DDA-06	2 / 55	2.5	13	77	NA	990	n	NA	NA	N	BSL
	75-15-0	Carbon Disulfide	0.13	--	1.3	--	µg/L	UPA-02D	5 / 55	0.13	1.3	1.3	NA	81	n	NA	NA	N	BSL
	16887-00-6	Chloride	2,200	--	121,000	--	µg/L	P-6_UPA	10 / 10	200	200	121,000	NA	NA	NA	250,000	sMCL	N	NUT
	108-90-7	Chlorobenzene	0.56	J	53	--	µg/L	DDA-05	40 / 55	0.11	1.1	53	NA	7.8	n	100	MCL	Y	ASL
	75-00-3	Chloroethane	0.39	--	7.3	--	µg/L	P-6_UPA	6 / 55	0.17	1.7	7.3	NA	2,100	n	NA	NA	N	BSL
	67-66-3	Chloroform	5.3	--	7.7	--	µg/L	UPA-01	2 / 55	0.080	0.80	7.7	NA	0.22	c*	80	MCL	Y	ASL
	74-87-3	Chloromethane	0.11	--	0.11	--	µg/L	MW-26N	1 / 55	0.10	1.0	0.11	NA	19	n	0.40	HA	N	BSL
	7440-47-3	Chromium[8]	4.9	J	27	--	µg/L	UPA-03D	12 / 30	4.0	4.0	27	NA	2,200	n[8]	100	MCL	N	BSL
	156-59-2	cis-1,2-Dichloroethene	0.18	J	1.3	--	µg/L	UPA-03D	15 / 55	0.18	1.8	1.3	NA	3.6	n	70	MCL	N	BSL
	7440-48-4	Cobalt	3.9	J	15	--	µg/L	P-6_UPA	18 / 30	3.9	3.9	15	NA	0.60	n	NA	NA	Y	ASL
	7440-50-8	Copper	4.3	J	13	--	µg/L	DGC-10D	8 / 30	3.8	3.8	13	NA	80	n	1,300	MCL	N	BSL
	110-82-7	Cyclohexane	0.20	--	21	--	µg/L	P-6_UPA	8 / 30	0.16	1.6	21	NA	1,300	n	NA	NA	N	BSL
	124-48-1	Dibromochloromethane	0.25	--	0.38	J	µg/L	UPA-01	2 / 55	0.20	2.0	0.38	NA	0.87	c	80	MCL	N	BSL
	60-29-7	Diethyl Ether	0.35	J	32	--	µg/L	P-6_UPA	38 / 55	0.080	0.80	32	NA	390	n	NA	NA	N	BSL
	84-66-2	Diethyl Phthalate	5.0	--	26	J	µg/L	DDA-05	5 / 55	2.9	15	26	NA	1,500	n	NA	NA	N	BSL
	101-84-8	Diphenyl Ether	1.8	J	15	J	µg/L	DDA-05	9 / 30	1.7	8.7	15	NA	NA	NA	NA	NA	Y	NSV
	74-84-0	Ethane	0.0067	J	550	--	µg/L	P-6_UPA	28 / 28	0.0010	0.0070	550	NA	NA	NA	NA	NA	Y	NSV
	74-85-1	Ethene	0.011	--	11	--	µg/L	DDA-06	27 / 28	0.0050	0.0060	11	NA	NA	NA	NA	NA	Y	NSV
	100-41-4	Ethylbenzene	0.11	J	530	--	µg/L	P-6_UPA	22 / 55	0.10	1.0	530	NA	1.5	c*	700	MCL	Y	ASL
	118-74-1	Hexachlorobenzene	0.030	--	0.035	--	µg/L	UPA-01	2 / 55	0.017	0.019	0.035	NA	0.0098	c	1.0	MCL	Y	ASL
	7439-89-6	Iron (total)	180	--	51,500	--	µg/L	DDA-05	28 / 30	129	129	51,500	NA	1,400	n	300	sMCL	Y	ASL
	7439-89-6	Iron (dissolved)	83	J	53,900	--	µg/L	DDA-05	42 / 50	74	81	53,900	NA	1,400	n	300	sMCL	Y	ASL
	98-82-8	Isopropylbenzene	0.56	J	36	--	µg/L	DDA-05	24 / 55	0.080	0.80	36	NA	45	n	4,000	HA	N	BSL
	7439-92-1	Lead	1.2	J	3.0	--	µg/L	DDA-06	7 / 30	1.2	1.2	3.0	NA	NA	NA	15	MCL	N	BSL
	7439-95-4	Magnesium	3,020	--	31,600	--	µg/L	DDA-06	30 / 30	188	188	31,600	NA	NA	NA	NA	NA	N	NUT
	7439-96-5	Manganese (total)	14	--	2,610	--	µg/L	UPA-01	30 / 30	7.7	7.7	2,610	NA	43	n	50	sMCL	Y	ASL
	7439-96-5	Manganese (dissolved)	8.2	J	2,420	--	µg/L	UPA-01	49 / 50	4.3	4.7	2,420	NA	43	n	50	sMCL	Y	ASL
	7439-97-6	Mercury	0.21	--	0.21	--	µg/L	MW-26N	1 / 30	0.16	0.16	0.21	NA	0.063	n	2.0	MCL	Y	ASL
	74-82-8	Methane	0.50	--	26,000	--	µg/L	P-6_UPA	28 / 28	0.015	0.018	26,000	NA	NA	NA	NA	NA	Y	NSV
	108-87-2	Methyl Cyclohexane	0.56	--	29	--	µg/L	P-6_UPA	15 / 55	0.14	1.4	29	NA	1,300	n	NA	NA	N	BSL
	1634-04-4	Methyl tert-Butyl Ether	0.20	J	9.0	--	µg/L	MW-26N	32 / 55	0.14	1.4	9.0	NA	14	c*	20	HA	N	BSL
	75-09-2	Methylene Chloride	0.30	--	0.30	--	µg/L	UPA-01	1 / 55	0.18	1.8	0.30	NA	11	n	5.0	MCL	N	BSL
	121-69-7	N,N-Dimethylaniline	0.91	--	200	--	µg/L	P-6_UPA	10 / 55	0.21	1.1	200	NA	2.5	c*	NA	NA	Y	ASL
	91-20-3	Naphthalene	3.0	J	8.4	J	µg/L	P-6_UPA	9 / 55	2.7	14	8.4	NA	0.17	c**	100	HA	Y	ASL
	7440-02-0	Nickel	5.0	--	25	--	µg/L	P-6_UPA	26 / 30	4.1	4.1	25	NA	39	n	100	HA	N	BSL
	14797-55-8	Nitrate as N	6.8	--	2,000	--	µg/L	DGC-10D	12 / 30	6.2	43	2,000	NA	3,200	n	10,000	MCL	N	BSL
	14797-65-0	Nitrite as N	35	J	710	--	µg/L	DDA-06	6 / 30	24	24	710	NA	200	n	1,000	MCL	Y	ASL
	98-95-3	Nitrobenzene	28	--	56	--	µg/L	P-6_UPA	2 / 55	0.30	1.5	56	NA	0.14	c**	NA	NA	Y	ASL
	103-65-1	n-Propylbenzene	1.1	--	88	--	µg/L	DDA-05	10 / 30	0.10	1.0	88	NA	66	n	NA	NA	Y	ASL
	108-95-2	Phenol	1.2	J	16	J	µg/L	DDA-05	3 / 55	0.81	4.2	16	NA	580	n	2,000	HA	N	BSL
	7440-09-7	Potassium	980	--	11,800	--	µg/L	DDA-06	30 / 30	190	190	11,800	NA	NA	NA	NA	NA	N	NUT
	7440-23-5	Sodium	4,930	--	88,600	--	µg/L	P-6_UPA	30 / 30	190	190	88,600	NA	NA	NA	20,000	HA	N	NUT
	14808-79-8	Sulfate	810	J	19,200	--	µg/L	DGC-10S	28 / 30	210	210	19,200	NA	NA	NA	250,000	sMCL	N	BSL
	18496-25-8	Sulfide	820	J	820	J	µg/L	DGC-10D	3 / 30	630	880	820	NA	NA	NA	NA	NA	Y	NSV
	127-18-4	Tetrachloroethene	0.11	--	0.33	J	µg/L	MW-26N	9 / 55	0.10	1.0	0.33	NA	4.1	n	5.0	MCL	N	BSL
	109-99-9	Tetrahydrofuran	2.0	--	380	J	µg/L	DDA-05	33 / 55	0.37	3.7	380	NA	340	n	NA	NA	Y	ASL
	108-88-3	Toluene	0.33	--	190	--	µg/L	P-6_UPA	15 / 55	0.15	1.5	190	NA	110	n	1,000	MCL	Y	ASL
	156-60-5	trans-1,2-Dichloroethene	0.26	--	0.26	--	µg/L	P-6_UPA	1 / 55	0.13	1.3	0.26	NA	36	n	100	MCL	N	BSL
	79-01-6	Trichloroethene	0.11	J	1.0	--	µg/L	DGC-10S	23 / 55	0.090	0.90	1.0	NA	0.28	n	5.0	MCL	Y	ASL
	7440-62-2	Vanadium	5.0	--	16	--	µg/L	UPA-01	4 / 30	3.8	3.8	16	NA	8.6	n	NA	NA	Y	ASL
	1330-20-7	Xylenes, Total	0.50	--	2,100	--	µg/L	P-6_UPA	14 / 55	0.13	3.6	2,100	NA	19	n	10,000	MCL	Y	ASL
	7440-66-6	Zinc	16	J	73	--	µg/L	DDA-06	9 / 30	15	15	73	NA	600	n	5,000	sMCL	N	BSL

Footnote Instructions:

(1) J = Analyte Present. Reported value may not be accurate or precise.
B = The analyte is present in the associated laboratory and/or field blanks, as well as in the sample.
(2) Maximum detected concentration used for screening
(3) No background value available
(4) All compounds are screened against the Environmental Protection Agency's (EPA) Residential Tap Water Screening Levels dated June 2017 (cancer benchmark value = 1E-06; HQ =0.1)
(5) When no screening levels are available, surrogate screening levels are used as follows:
Manganese = Manganese (Non-dietary)
Mercury = Mercuric Chloride (and other Mercury salts)
Methyl Cyclohexane = Cyclohexane
Vanadium =Vanadium and compounds
(6) Secondary MCLs and health advisories are utilized for screening purposes only and were not utilized if an RSL value was available
(7) Rationale Codes
Selection Reason: Above Screening Level (ASL)
No Screening Value Available (NSV)
Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
(8) Per the Revised Addendum, chromium in groundwater at the Site has been demonstrated to be trivalent and as such, the data are screened against the RSL for chromium III (soluble salts).

Definitions:
NA = Not Applicable
COPC = Chemical of Potential Concern
ARAR = Applicable or Relevant and Appropriate Requirement
n = Noncarcinogen
c = Carcinogen
Y = Yes
N = No
MCL = EPA Federal Maximum Contaminant Level
sMCL = EPA Secondary Maximum Contaminant Level
** = noncancer screening level using HQ of 0.1 is used because it is more conservative than the 1.0E-06 cancer screening level
* = where: non-cancer screening levels is less than 100 times the cancer screening level
µg/L = micrograms per liter
mg/L = milligrams per liter
UPA = Upper Potomac Aquifer
UPCUTZ = Upper Potomac Confining Unit Transition Zone
HA = EPA 2012 Edition of the Drinking Water Standards and Health Advisories

Revised By: GJG
Checked by: JC

Table 2. Exposure Point Concentration Summary for the Upper Potomac Aquifer

CAS	Chemical of Potential Concern[1]	Units	Arithmetic Mean	95% Upper Confidence Limit[2]	Maximum Detected Concentration[3]		Exposure Point Concentration			
							Value	Units	Statistic[4]	Rationale[5]
120-82-1	1,2,4-Trichlorobenzene	µg/L	0.22	0.32	0.86	J	0.32	µg/L	95% KM (t) UCL	b
95-63-6	1,2,4-Trimethylbenzene	µg/L	49	75	420	--	75	µg/L	95% KM (t) UCL	b
107-06-2	1,2-Dichloroethane	µg/L	0.48	0.65	4.4	--	0.65	µg/L	95% Adjusted Gamma KM-UCL	c
108-67-8	1,3,5-Trimethylbenzene	µg/L	12	18	110	--	18	µg/L	95% KM (t) UCL	b
106-46-7	1,4-Dichlorobenzene[7]	µg/L	1.8	2.2	2.6	J	2.2	µg/L	95% Modified-t UCL	a,g
123-91-1	1,4-Dioxane	µg/L	395	754	2,300	--	754	µg/L	95% KM (Chebyshev) UCL	c
7429-90-5	Aluminum	µg/L	517	1,593	4,680	--	1,593	µg/L	97.5% KM (Chebyshev) UCL	d
7440-38-2	Arsenic	µg/L	2.8	3.8	8.7	--	3.8	µg/L	95% KM (Percentile Bootstrap) UCL	b
7440-39-3	Barium	µg/L	132	221	457	--	221	µg/L	95% Chebyshev (Mean, Sd) UCL	a
71-43-2	Benzene	µg/L	174	670	1,400	--	670	µg/L	99% KM (Chebyshev) UCL	a
56-55-3	Benzo[a]anthracene	µg/L	0.019	0.036	0.048	J	0.036	µg/L	95% KM (t) UCL	a
111-44-4	Bis(2-chloroethyl) Ether	µg/L	112	210	690	--	210	µg/L	95% KM (Chebyshev) UCL	c
80-05-7	Bisphenol A	µg/L	26	58	150	--	58	µg/L	95% KM (t) UCL	b
75-27-4	Bromodichloromethane	µg/L	0.16	0.20	1.1	--	0.20	µg/L	95% KM (t) UCL	a
108-90-7	Chlorobenzene	µg/L	11	17	53	--	17	µg/L	95% GROS Approximate Gamma UCL	c
67-66-3	Chloroform	µg/L	0.32	0.70	7.7	--	0.70	µg/L	95% KM (t) UCL	a
7440-48-4	Cobalt	µg/L	6.2	8.1	15	--	8.1	µg/L	95% KM (t) UCL	b
101-84-8	Diphenyl Ether	µg/L	2.3	3.6	15	J	3.6	µg/L	95% KM (Percentile Bootstrap) UCL	b
74-84-0	Ethane	µg/L	68	341	550	--	341	µg/L	95% Hall's Bootstrap UCL	a
74-85-1	Ethene	µg/L	1.2	6.4	11	--	6.4	µg/L	99% KM (Chebyshev) UCL	a
100-41-4	Ethylbenzene	µg/L	73	288	530	--	288	µg/L	99% KM (Chebyshev) UCL	a
118-74-1	Hexachlorobenzene	µg/L	NC	NC	0.035	--	0.035	µg/L	Maximum Detected Concentration	--
7439-89-6	Iron (total)	µg/L	11,992	23,587	51,500	--	23,587	µg/L	95% KM (Chebyshev) UCL	c
7439-89-6	Iron (dissolved)	µg/L	9,438	18,026	53,900	--	18,026	µg/L	95% KM (Chebyshev) UCL	c
7439-96-5	Manganese (total)	µg/L	585	868	2,610	--	868	µg/L	95% Adjusted Gamma UCL	c
7439-96-5	Manganese (dissolved)	µg/L	597	976	2,420	--	976	µg/L	95% KM (Chebyshev) UCL	c
7439-97-6	Mercury[7]	µg/L	0.087	0.099	0.21	--	0.099	µg/L	95% Modified-t UCL	a,g
74-82-8	Methane	µg/L	3,226	7,149	26,000	--	7,149	µg/L	95% Adjusted Gamma UCL	c
121-69-7	N,N-Dimethylaniline	µg/L	16	27	200	--	27	µg/L	95% KM (t) UCL	b
91-20-3	Naphthalene	µg/L	2.5	3.4	8.4	J	3.4	µg/L	95% KM (% Bootstrap) UCL	d
14797-65-0	Nitrite as N	µg/L	48	134	710	--	134	µg/L	95% Adjusted Gamma KM-UCL	c
98-95-3	Nitrobenzene	µg/L	1.7	4.4	56	--	4.4	µg/L	95% KM (t) UCL	a
103-65-1	n-Propylbenzene	µg/L	6.3	20	88	--	20	µg/L	95% Adjusted Gamma KM-UCL	c
18496-25-8	Sulfide	µg/L	0.46	NA	820	J	820	µg/L	Maximum Detected Concentration	e
109-99-9	Tetrahydrofuran	µg/L	45	128	380	J	128	µg/L	97.5% KM (Chebyshev) UCL	a
108-88-3	Toluene	µg/L	6.6	25	190	--	25	µg/L	95% KM (Chebyshev) UCL	d
79-01-6	Trichloroethene	µg/L	0.23	0.27	1.0	--	0.27	µg/L	95% Approximate Gamma KM-UCL	c
7440-62-2	Vanadium	µg/L	3.0	5.4	16	--	5.4	µg/L	95% KM (t) UCL	b
1330-20-7	Xylenes, Total	µg/L	216	342	2,100	--	342	µg/L	95% KM (Percentile Bootstrap) UCL	b

Footnote Instructions:

(1) Compounds on this table exceed either their respective risk-based screening level residential tap water (cancer benchmark value of 1.0E-06; HQ=0.10) or ARAR or lack an applicable screening value

(2) 95% UCL value is calculated using ProUCL software, Version 5.0. See Attachment B for full ProUCL results table

(3) Maximum Detected Concentrations represent the maximum concentration detected in the primary samples used in the analysis

Revised By: GJG

Checked by: JC

(4) Statistics:

95% Approximate Gamma KM-UCL = approximate gamma UCL using Kaplan-Meier Estimates

95% Adjusted Gamma UCL = adjusted gamma UCL

95% Chebyshev (Mean, Sd) UCL = 95% Chebyshev UCL of mean and standard deviation

95% GROS Adjusted Gamma UCL = adjusted gamma UCL using gamma regression in order statistics

95% GROS Approximate Gamma UCL = approximate gamma UCL using gamma regression in order statistics

95% KM (Chebyshev) UCL = 95% UCL based upon Kaplan-Meier Estimates using the Chebyshev Inequality

95% KM (Percentile Bootstrap) UCL = 95% UCL based upon Kaplan-Meier Estimates using the Percentile Bootstrap Method.

95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates using Student's t-Distribution Critical Value

97.5% KM (Chebyshev) UCL = 97.5% UCL based upon Kaplan-Meier Estimates using the Chebyshev Inequality

99% KM (Chebyshev) UCL = 99% UCL based upon Kaplan-Meier Estimates using the Chebyshev Inequality

(5) EPC Selection Rationale:

a. Data does not follow a discernible distribution. ProUCL recommended values is used as the EPC value

b. Data are normally distributed. ProUCL recommended UCL value is used as the EPC value

c. Data are gamma distributed. ProUCL recommended UCL value is used as the EPC value

d. Data are lognormally distributed. ProUCL recommended UCL value is used as the EPC value

e. ProUCL could not calculate a UCL value. The maximum detected concentration is used

f. Maximum detected concentration was utilized as calculated UCL was greater than the maximum detection

g. Because there was only one detected result for that analyte, the 95UCL was run treating all non-detects as detects using 1/2 the detection limit

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

(7) For mercury and 1,4-dichlorobenzene, only one detected result was reported. Therefore, ProUCL was run w/o non-detects assuming half of the MDL for non-detects

Table 3. Carcinogenic Risk Calculations for the Upper Potomac Aquifer

CAS Number	Chemical of Potential Concern	Exposure Point Concentration (µg/L)	EPA Carcinogenic Residential Tap Water RSLs (µg/L)[1]	Cancer Risk[2]
120-82-1	1,2,4-Trichlorobenzene	0.32	1.2	2.6E-07
95-63-6	1,2,4-Trimethylbenzene	75	NV	NC
107-06-2	1,2-Dichloroethane	0.65	0.17	3.8E-06
108-67-8	1,3,5-Trimethylbenzene	18	NV	NC
106-46-7	1,4-Dichlorobenzene	2.2	0.48	4.6E-06
123-91-1	1,4-Dioxane	754	0.46	1.6E-03
7429-90-5	Aluminum	1,593	NV	NC
7440-38-2	Arsenic	3.8	0.052	7.3E-05
7440-39-3	Barium	221	NV	NC
71-43-2	Benzene	670	0.46	1.5E-03
56-55-3	Benzo[a]anthracene	0.036	0.030	1.2E-06
111-44-4	Bis(2-chloroethyl) Ether	210	0.014	1.5E-02
80-05-7	Bisphenol A	58	NV	NC
75-27-4	Bromodichloromethane	0.20	0.13	1.5E-06
108-90-7	Chlorobenzene	17	NV	NC
67-66-3	Chloroform	0.70	0.22	3.2E-06
7440-48-4	Cobalt	8.1	NV	NC
101-84-8	Diphenyl Ether	3.6	NV	NC
74-84-0	Ethane	341	NV	NC
74-85-1	Ethene	6.4	NV	NC
100-41-4	Ethylbenzene	288	1.5	1.9E-04
118-74-1	Hexachlorobenzene	0.035	0.0098	3.6E-06
7439-89-6	Iron	23,587	NV	NC
7439-96-5	Manganese	868	NV	NC
7439-97-6	Mercury	0.099	NV	NC
74-82-8	Methane	7,149	NV	NC
121-69-7	N,N-Dimethylaniline	27	2.5	1.1E-05
91-20-3	Naphthalene	3.4	0.17	2.0E-05
14797-65-0	Nitrite as N	134	NV	NC
98-95-3	Nitrobenzene	4.4	0.14	3.2E-05
103-65-1	n-Propylbenzene	20	NV	NC
18496-25-8	Sulfide	820	NV	NC
109-99-9	Tetrahydrofuran	128	NV	NC
108-88-3	Toluene	25	NV	NC
79-01-6	Trichloroethene	0.27	0.49	5.5E-07
7440-62-2	Vanadium	5.4	NV	NC
1330-20-7	Xylenes, Total	342	NV	NC
			Cumulative Carcinogenic Risk	**1.8E-02**

Notes:

(1) Screening criteria taken from the EPA Regional Screening Level Tables - Tap Water Screening Levels, Last updated June 2017

(2) Cancer risk is calculated using the following equations: (Exposure Point Concentration (EPC) x 1.0E-06)/RSL

(3) Iron and manganese are based on total value in accordance with Risk Assessment Guidance for Superfund (RAGS) Part A Guidance

(4) NC = Not calculated due to lack of screening value

(5) NV = No appropriate screening value

(6) RSL = EPA Regional Screening Level

Revised By: GJG

Checked by: JC

Table 4. Non-Carcinogenic Hazard Quotient Calculation for the Upper Potomac Aquifer

CAS	Chemical of Potential Concern	Exposure Point Concentration (µg/L)	Ingestion Non-Cancer RSL (THQ = 1.0)[1]	Dermal Non-Cancer RSL (THQ = 1.0)[1]	Inhalation Non-Cancer (THQ = 1.0)[1]	Non-Cancer Hazard Quotient (Ingestion/Dermal)[2]	Target Organ (Ingestion/Dermal)[3]	Reference[3]	Non-Cancer Hazard Quotient (Inhalation)[4]	Target Organ (Inhalation)[3]	Reference[3]
120-82-1	1,2,4-Trichlorobenzene	0.32	200	160	4.2	0.0036	Endocrine (adrenal)	IRIS	0.075	Urinary	PPRTV
95-63-6	1,2,4-Trimethylbenzene	75	200	200	130	0.75	Nervous	IRIS	0.58	Nervous	IRIS
107-06-2	1,2-Dichloroethane	0.65	120	2,800	15	0.0057	Kidney	PPRTV Appendix	0.043	Nervous	PPRTV
108-67-8	1,3,5-Trimethylbenzene	18	200	280	130	0.15	Nervous	IRIS	0.14	Nervous	IRIS
106-46-7	1,4-Dichlorobenzene	2.2	1,400	2,200	1,700	0.0026	Liver	ATSDR	0.0013	Liver	IRIS
123-91-1	1,4-Dioxane	754	600	190,000	63	1.3	Liver/Urinary	IRIS	12	Nervous/Respiratory	IRIS
7429-90-5	Aluminum	1,593	20,000	4,600,000	NV	0.08	Nervous	PPRTV	NC	NA	NA
7440-38-2	Arsenic	3.8	6.0	1,400	NV	0.64	Cardiovascular/Dermal	IRIS	NC	NA	NA
7440-39-3	Barium	221	4,000	64,000	NV	0.059	Urinary	IRIS	NC	NA	NA
71-43-2	Benzene	670	80	600	63	9.5	Immune	IRIS	11	Immune	IRIS
56-55-3	Benzo[a]anthracene	0.036	NV	NV	NV	NC	NA	NA	NC	NA	NA
111-44-4	Bis(2-chloroethyl) Ether	210	NV	NV	NV	NC	NA	NA	NC	NA	NA
80-05-7	Bisphenol A	58	1,000	3,200	NV	0.076	Body Weight	IRIS	NC	NA	NA
75-27-4	Bromodichloromethane	0.20	400	6,500	NV	0.00053	Urinary	IRIS	NC	NA	NA
108-90-7	Chlorobenzene	17	400	1,300	100	0.054	Liver	IRIS	0.17	Kidney	PPRTV
67-66-3	Chloroform	0.70	200	2,500	200	0.0038	Liver	IRIS	0.0035	Liver	ATSDR
7440-48-4	Cobalt	8.1	6.0	3,400	NV	1.3	Thyroid	PPRTV	NC	NA	NA
101-84-8	Diphenyl Ether	3.6	NV	NV	NV	NC	NA	NA	NC	NA	NA
74-84-0	Ethane	341	NV	NV	NV	NC	NA	NA	NC	NA	NA
74-85-1	Ethene	6.4	NV	NV	NV	NC	NA	NA	NC	NA	NA
100-41-4	Ethylbenzene	288	2,000	3,800	2,100	0.22	Liver/Urinary	IRIS	0.14	Developmental	IRIS
118-74-1	Hexachlorobenzene	0.035	16	NV	NV	0.0022	Liver	IRIS	NC	NA	NA
7439-89-6	Iron[5]	23,587	14,000	3,200,000	NV	1.7	GI Tract	PPRTV	NC	NA	NA
7439-96-5	Manganese[5,6]	868	480	4,400	NV	2.0	Nervous	IRIS	NC	NA	NA
7439-97-6	Mercury[7]	0.099	6.0	96	NV	0.017	Immune	IRIS	NC	NA	NA
74-82-8	Methane	7,149	NV	NV	NV	NC	NA	NA	NC	NA	NA
121-69-7	N,N-Dimethylaniline	27	40	310	NV	0.75	Spleen	IRIS	NC	NA	NA
91-20-3	Naphthalene	3.4	400	700	6.3	0.013	Body Weight	IRIS	0.53	Nervous/Respiratory	IRIS
14797-65-0	Nitrite as N	134	2,000	460,000	NV	0.067	Blood	IRIS	NC	NA	NA
98-95-3	Nitrobenzene	4.4	40	620	19	0.12	Blood	IRIS	0.23	Nervous/Respiratory	IRIS
103-65-1	n-Propylbenzene	20	2,000	1,800	2,100	0.021	Liver/Urinary	PPRTV Appendix	0.0095	Developmental	PPRTV Appendix
18496-25-8	Sulfide	820	NV	NV	NV	NC	NA	NA	NC	NA	NA
109-99-9	Tetrahydrofuran	128	18,000	1,700,000	4,200	0.0072	Developmental	IRIS	0.030	Liver/Nervous	IRIS
108-88-3	Toluene	25	1,600	5,300	10,000	0.020	Urinary	IRIS	0.0025	Nervous	IRIS
79-01-6	Trichloroethene	0.27	10	69	4.2	0.031	Cardiovascular/Immune/ Developmental	IRIS	0.065	Cardiovascular/Immune/ Developmental	IRIS
7440-62-2	Vanadium[8]	5.4	100	600	NV	0.063	Dermal (hair)[9]	IRIS	NC	Respiratory	ATSDR
1330-20-7	Xylenes, Total	342	4,000	7,500	210	0.13	Body Weight	IRIS	1.6	Nervous	IRIS
					Ingestion/Dermal Hazard Index	**19**		**Inhalation Hazard Index**	**26**	**Cumulative Hazard Index**	**45**

Notes:

(1) Screening Criteria taken from the U.S.EPA Regional Screening Level Tables - Tap Water Screening Levels, Last updated June 2017

(2) Ingestion Dermal Hazard Quotient is calculated using the following equation: (EPC x THQ)/(ingestion RSL) + (EPC x THQ)/(Dermal RSL)

(3) Target organs and references are taken from the U.S.EPA Regional Screening Level Tables - Screening Level Calculation Tool. Last updated June 2017

(4) Inhalation Hazard Quotient is calculated using the following equation: (EPC x THQ)/(inhalation RSL)

(5) Iron and manganese are based on total value in accordance with RAGS A Guidance

(6) Screening value for manganese is taken from "Manganese - Non-dietary"

(7) Screening values for mercury are taken from "mercuric chloride"

(8) Screening values for vanadium are taken from "vanadium and compounds"

ATSDR = Agency for Toxic Substances and Disease Registry

GI = Gastrointestinal

IRIS = Integrated Risk Information System value

NA = Not applicable

NC = Not calculated due to lack of screening value

NOAEL = No observable adverse effect level

NV = No appropriate screening value

PPRTV = EPA Provisional peer-reviewed value

PPRTV Appendix = EPA Provisional peer-reviewed value Appendix

RSL = EPA Regional Screening Level

Revised By: GJG

Checked by: JC

Table 5. Target Organ Specific Non-Cancer Hazard Index Calculation for the Upper Potomac Aquifer

CAS	Chemical of Potential Concern	Exposure Point Concentration (µg/L)	Non-Cancer Hazard Quotient (Ingestion/Dermal)[1]	Non-Cancer Hazard (Inhalation)[1]	Non-Cancer Hazard Quotient (Ingestion/Dermal/Inhalation)[2]	Is target organ HI greater than 1.0 and the COPC-Specific HQ Greater than 0.1?
Blood						
14797-65-0	Nitrite as N	134	0.067	NC	0.067	No
98-95-3	Nitrobenzene	4.4	0.12	NC	0.12	No
				Target Organ-Specific HI	**0.19**	
Body Weight						
80-05-7	Bisphenol A	58	0.076	NC	0.076	No
91-20-3	Naphthalene	3.4	0.013	NC	0.013	No
1330-20-7	Xylenes, Total	342	0.13	NC	0.13	No
				Target Organ-Specific HI	**0.22**	
Cardiovascular						
7440-38-2	Arsenic	3.8	0.64	NC	0.64	No
79-01-6	Trichloroethene	0.27	0.031	0.065	0.096	No
				Target Organ-Specific HI	**0.73**	
Developmental						
100-41-4	Ethylbenzene	288	NC	0.14	0.14	No
103-65-1	n-Propylbenzene	20	NC	0.0095	0.0095	No
109-99-9	Tetrahydrofuran	128	0.0072	NC	0.0072	No
79-01-6	Trichloroethene	0.27	0.031	0.065	0.096	No
				Target Organ-Specific HI	**0.25**	
Endocrine (adrenal)						
120-82-1	1,2,4-Trichlorobenzene	0.32	0.0036	NC	0.0036	No
				Target Organ-Specific HI	**0.0036**	
GI Tract						
7439-89-6	Iron	23,587	1.7	NC	1.7	Yes
				Target Organ-Specific HI	**1.7**	
Hair						
7440-62-2	Vanadium	5.4	0.063	NC	0.063	No
				Target Organ-Specific HI	**0.063**	
Immune						
71-43-2	Benzene	670	9.5	11	20	Yes
7439-97-6	Mercury	0.099	0.017	NC	0.017	No
79-01-6	Trichloroethene	0.27	0.031	0.065	0.096	No
				Target Organ-Specific HI	**20**	
Kidney						
107-06-2	1,2-Dichloroethane	0.65	0.0057	NC	0.0057	No
108-90-7	Chlorobenzene	17	NC	0.17	0.17	No
				Target Organ-Specific HI	**0.17**	
Liver						
106-46-7	1,4-Dichlorobenzene	2.2	0.0026	0.0013	0.0039	No
123-91-1	1,4-Dioxane	754	1.3	NC	1.3	Yes
108-90-7	Chlorobenzene	17	0.054	NC	0.054	No
67-66-3	Chloroform	0.70	0.0038	0.0035	0.0073	No
100-41-4	Ethylbenzene	288	0.22	NC	0.22	Yes
118-74-1	Hexachlorobenzene	0.035	0.0022	NC	0.0022	No
103-65-1	n-Propylbenzene	20	0.021	NC	0.021	No
109-99-9	Tetrahydrofuran	128	NC	0.030	0.030	No
				Target Organ-Specific HI	**1.6**	
Nervous						
107-06-2	1,2-Dichloroethane	0.65	NC	0.043	0.043	No
95-63-6	1,2,4-Trimethylbenzene	75	0.75	0.58	1.3	Yes
108-67-8	1,3,5-Trimethylbenzene	18	0.15	0.14	0.29	Yes
123-91-1	1,4-Dioxane	754	NC	12	12	Yes
7429-90-5	Aluminum	1,593	0.08	NC	0.08	No
7439-96-5	Manganese	868	2.0	NC	2.0	Yes
91-20-3	Naphthalene	3.4	NC	0.53	0.53	Yes
98-95-3	Nitrobenzene	4.4	NC	0.23	0.23	Yes
109-99-9	Tetrahydrofuran	128	NC	0.030	0.030	No
108-88-3	Toluene	25	NC	0.0025	0.0025	No
1330-20-7	Xylenes, Total	342	NC	1.6	1.6	Yes
				Target Organ-Specific HI	**18**	
Respiratory						
123-91-1	1,4-Dioxane	754	NC	12	12	Yes
91-20-3	Naphthalene	3.4	NC	0.53	0.53	Yes
98-95-3	Nitrobenzene	4.4	NC	0.23	0.23	Yes
				Target Organ-Specific HI	**13**	
Skin						
7440-38-2	Arsenic	3.8	0.64	NC	0.64	No
				NC - Not Calculated	**0.64**	
Spleen						
121-69-7	N,N-Dimethylaniline	27	0.75	NC	0.75	No
				Target Organ-Specific HI	**0.75**	
Thyroid						
7440-48-4	Cobalt	8.1	1.3	NC	1.3	Yes
				Target Organ-Specific HI	**1.3**	
Urinary						
120-82-1	1,2,4-Trichlorobenzene	0.32	NC	0.075	0.075	No
123-91-1	1,4-Dioxane	754	1.3	NC	1.3	Yes
7440-39-3	Barium	221	0.059	NC	0.059	No
75-27-4	Bromodichloromethane	0.20	0.00053	NC	0.00053	No
100-41-4	Ethylbenzene	288	0.22	NC	0.22	Yes
103-65-1	n-Propylbenzene	20	0.021	NC	0.021	No
108-88-3	Toluene	25	0.020	NC	0.020	No
				Target Organ-Specific HI	**1.7**	

Notes:

(1) As provided on Table 4

(2) Sum of the ingestion, dermal, and inhalation HQs

(3) NC = Not Calculated

Revised By: GJG

Checked by: JC

Table 6. Selection of Chemicals of Concern for the Upper Potomac Aquifer

CAS	Chemical of Potential Concern	Exposure Point Concentration (µg/L)	Carcinogenic Risk	Target Organ Specific Non-Carcinogenic Hazard Quotient[1]	Does the COPC meet the conditions to be considered a COC?[2]	Notes
120-82-1	1,2,4-Trichlorobenzene	0.32	2.6E-07	0.075	N	Does not meet COC Selection Criteria
95-63-6	1,2,4-Trimethylbenzene	75	NC	1.3	Y	Exceeds an HQ of 0.1 for a target organ HI greater than 1.0
107-06-2	1,2-Dichloroethane	0.65	3.8E-06	0.043	Y	Exceeds 1.0E-06 Cancer Risk
108-67-8	1,3,5-Trimethylbenzene	18	NC	0.29	Y	Exceeds an HQ of 0.1 for a target organ HI greater than 1.0
106-46-7	1,4-Dichlorobenzene	2.2	4.6E-06	0.0039	Y	Exceeds 1.0E-06 Cancer Risk
123-91-1	1,4-Dioxane	754	1.6E-03	12	Y	Exceeds 1.0E-06 Cancer Risk/Exceeds an HQ of 0.1 for a target organ HI greater than 1.0
7429-90-5	Aluminum	1,593	NC	0.080	N	Does not meet COC Selection Criteria
7440-38-2	Arsenic	3.8	7.3E-05	0.64	Y	Exceeds 1.0E-06 Cancer Risk
7440-39-3	Barium	221	NC	0.059	N	Does not meet COC Selection Criteria
71-43-2	Benzene	670	1.5E-03	20	Y	Exceeds 1.0E-06 Cancer Risk/Exceeds an HQ of 0.1 for a target organ HI greater than 1.0
56-55-3	Benzo[a]anthracene	0.036	1.2E-06	NC	N	EPC based on anomalous detections/Low frequency of detection/Not detected prior to or since 2012
111-44-4	Bis(2-chloroethyl) Ether	210	1.5E-02	NC	Y	Exceeds 1.0E-06 Cancer Risk
80-05-7	Bisphenol A	58	NC	0.076	N	Does not meet COC Selection Criteria
75-27-4	Bromodichloromethane	0.20	1.5E-06	0.00053	N	EPC based on anomalous detections/Low frequency of detection/Not site related
108-90-7	Chlorobenzene	17	NC	0.17	N	Does not meet COC Selection Criteria
67-66-3	Chloroform	0.70	3.2E-06	0.0073	Y	Exceeds 1.0E-06 Cancer Risk
7440-48-4	Cobalt	8.1	NC	1.3	Y	Exceeds an HQ of 0.1 for a target organ HI greater than 1.0
101-84-8	Diphenyl Ether	3.6	NC	NC	N	Does not meet COC Selection Criteria
74-84-0	Ethane	341	NC	NC	N	Does not meet COC Selection Criteria
74-85-1	Ethene	6.4	NC	NC	N	Does not meet COC Selection Criteria
100-41-4	Ethylbenzene	288	1.9E-04	0.22	Y	Exceeds 1.0E-06 Cancer Risk/Exceeds an HQ of 0.1 for a target organ HI greater than 1.0
118-74-1	Hexachlorobenzene	0.035	3.6E-06	0.0022	N	EPC lower than MCL/Low frequency of detection
7439-89-6	Iron	23,587	NC	1.7	Y	Exceeds an HQ of 0.1 for a target organ HI greater than 1.0
7439-96-5	Manganese	868	NC	2.0	Y	Exceeds an HQ of 0.1 for a target organ HI greater than 1.0
7439-97-6	Mercury	0.099	NC	0.017	N	Does not meet COC Selection Criteria
74-82-8	Methane	7,149	NC	NC	N	Does not meet COC Selection Criteria
121-69-7	N,N-Dimethylaniline	27	1.1E-05	0.75	Y	Exceeds 1.0E-06 Cancer Risk
91-20-3	Naphthalene	3.4	2.0E-05	0.53	Y	Exceeds 1.0E-06 Cancer Risk/Exceeds an HQ of 0.1 for a target organ HI greater than 1.0
14797-65-0	Nitrite as N	134	NC	0.067	N	Does not meet COC Selection Criteria
98-95-3	Nitrobenzene	4.4	3.2E-05	0.23	N	EPC based on anomalous detections/Low frequency of detection/Not detected since 2012
103-65-1	n-Propylbenzene	20	NC	0.021	N	Does not meet COC Selection Criteria
18496-25-8	Sulfide	820	NC	NC	N	Does not meet COC Selection Criteria
109-99-9	Tetrahydrofuran	128	NC	0.030	N	Does not meet COC Selection Criteria
108-88-3	Toluene	25	NC	0.020	N	Does not meet COC Selection Criteria
79-01-6	Trichloroethene	0.27	5.5E-07	0.096	N	Does not meet COC Selection Criteria
7440-62-2	Vanadium	5.4	NC	0.063	N	Does not meet COC Selection Criteria
1330-20-7	Xylenes, Total	342	NC	1.6	Y	Exceeds an HQ of 0.1 for a target organ HI greater than 1.0

Notes:

(1) For non-carcinogenic, maximum HQs are presented for only those COPCs that contribute to a target organ HI of 1.0 or greater

(2) COCs are defined as those COPCs that meet any of the following criteria

- COPCs with an associated cancer risk greater than 1.0E-06 if the cumulative cancer risk is greater than 1.0E-04
- COPCs with an associated HQ of 0.1 or greater for a target organ with an HI of 1.0 or greater

(3) COC = Chemical of Concern

(4) HI = Hazard Index

(5) HQ = Hazard Quotient

(6) NA = Not applicable

(7) NC = Not calculated

Revised By: GJG

Checked by: JC

Table 7. Summary of Preliminary Remediation Goals for the Upper Potomac Aquifer

CAS	Chemical of Concern[1]	Exposure Point Concentration (µg/L)	Applicable or Relevant and Appropriate Requirement		Carcinogenic Preliminary Remediation Goals (µg/L)				Non-Carcinogenic Preliminary Remediation Goals (µg/L)					Selected PRG (µg/L)[3]	Notes[4]	Cancer Risk Associated with the Selected PRG	Hazard Quotient Associated with the Selected PRG
			Value (µg/L)	Source	Cancer Risk	PRG (Target Risk of 1.0E-06)	PRG (Target Risk of 1.0E-05)	PRG (Target Risk of 1.0E-04)	Target Organ-Specific Non-Cancer Hazard	PRG (THQ of 0.1)	Site-Specific THQ[2]	Target Organ	Site-Specific Non-Cancer PRG				
95-63-6	1,2,4-Trimethylbenzene	75	NA	NA	NC	NA	NA	NA	1.3	5.7	0.10	Nervous	5.7	**5.7**	COC-specific Non-Carcinogenic PRG	--	0.1
107-06-2	1,2-Dichloroethane	0.65	5.0	MCL	3.8E-06	0.17	1.7	17	NC	NV	NA	NA	NA	**NA**	PRG was not developed	4E-06	--
108-67-8	1,3,5-Trimethylbenzene	18	NA	NA	NC	NA	NA	NA	0.29	6.1	0.10	Nervous	6.1	**6.1**	COC-specific Non-Carcinogenic PRG	--	0.1
106-46-7	1,4-Dichlorobenzene	2.2	75	MCL	4.6E-06	0.48	4.8	48	NC	NV	NA	NA	NA	**NA**	PRG was not developed	5E-06	0.004
123-91-1	1,4-Dioxane	754	NA	NA	1.6E-03	0.46	4.6	46	1.3	60	1.0	Liver/Urinary	598	**4.6**	Carcinogenic PRG with a Target Risk of 1.0E-05	1E-05	0.008
123-91-1	1,4-Dioxane (inhalation)	754	NA	NA	1.6E-03	0.46	4.6	46	12	6.3	1.0	Nervous/Respiratory	63	**4.6**	Carcinogenic PRG with a Target Risk of 1.0E-05	see above	0.07
7440-38-2	Arsenic	3.8	10	MCL	7.3E-05	0.052	0.52	5.2	NC	NV	NA	NA	NA	**0.52**	Carcinogenic PRG with a Target Risk of 1.0E-05	1E-05	--
71-43-2	Benzene	670	5.0	MCL	1.5E-03	0.46	4.6	46	20	3.3	1.0	Immune	33	**4.6**	Carcinogenic PRG with a Target Risk of 1.0E-05	1E-05	0.1
111-44-4	Bis(2-chloroethyl) Ether	210	NA	NA	1.5E-02	0.014	0.14	1.4	NC	NV	NA	NA	NA	**0.14**	Carcinogenic PRG with a Target Risk of 1.0E-05	1E-05	--
67-66-3	Chloroform	0.70	80	MCL	3.2E-06	0.22	2.2	22	NC	NV	NA	NA	NA	**NA**	PRG was not developed	3E-06	0.007
7440-48-4	Cobalt	8.1	NA	NA	NC	NA	NA	NA	1.3	0.60	1.0	Thyroid	6.0	**6.0**	COC-specific Non-Carcinogenic PRG	--	1
100-41-4	Ethylbenzene	288	700	MCL	1.9E-04	1.5	15	150	0.22	131	1.0	Liver/Urinary	1,310	**15**	Carcinogenic PRG with a Target Risk of 1.0E-05	1E-05	0.01
118-74-1	Hexachlorobenzene	0.035	1	MCL	3.6E-06	0.0098	0.098	0.98	NC	NV	NV	NA	NA	**NA**	PRG was not developed	4E-06	0.002
7439-89-6	Iron	23,587	NA	NA	NC	NA	NA	NA	1.7	1,394	1.0	GI Tract	13,939	**13,939**	COC-specific Non-Carcinogenic PRG	--	1
7439-96-5	Manganese	868	NA	NA	NC	NA	NA	NA	2.0	43	0.6	Nervous	260	**260**	COC-specific Non-Carcinogenic PRG	--	0.6
121-69-7	N,N-Dimethylaniline	27	NA	NA	1.1E-05	2.5	25	250	NC	NV	NA	NA	NA	**25**	Carcinogenic PRG with a Target Risk of 1.0E-05	1E-05	--
91-20-3	Naphthalene (Inhalation)	3.4	NA	NA	2.0E-05	0.17	1.7	17	0.53	0.63	0.10	Nervous/Respiratory	0.63	**0.63**	COC-specific Non-Carcinogenic PRG	--	0.1
1330-20-7	Xylenes, Total (Inhalation)	342	10,000	MCL	NC	NA	NA	NA	1.6	21	0.10	Nervous	21	**21**	COC-specific Non-Carcinogenic PRG	--	0.1

Risk	Hazard Index
8E-05	**3.2**

Target Organ Specific HI	
Immune	0.1
GI Tract	1
Liver	0.03
Nervous	1
Thyroid	1
Urinary	0.02

Notes:

(1) For those COCs with different target organ effects between the ingestion/dermal and inhalation pathways, the COC was listed twice so that each pathway could be evaluated separately for non-carcinogenic. Carcinogens were only evaluated once.

(2) Site-Specific Target Hazard Quotients were selected for only those COCs that contribute to a target organ-specific HI of greater than 1.0

(3) PRGs were selected using the following criterion - The lower values of the non-carcinogenic PRG (COC-specific THQ) and the carcinogenic PRG (Target Risk of 1.0E-05) or the MCL, such that the cumulative risk from COCs at the PRG does not exceed a risk of 1.0E-04 or target organ specific HQ of 1.0.

(4) PRGs were not developed because the associated cancer risk for that COC was less than 1.0E-05, or the non-cancer HQ was less than 0.1 for a target organ with an HI greater than 1.0, or was associated with a target organ HI that was less than 1.0

(5) HI = Hazard Index

(6) MCL = Maximum Contaminant Limit

(7) NA = Not applicable

(8) NC = Not calculated

(9) NOAEL = No observable adverse effect level

(10) NV = No value

(11) PRG = Preliminary Remediation Goal

(12) THQ = Target hazard quotient

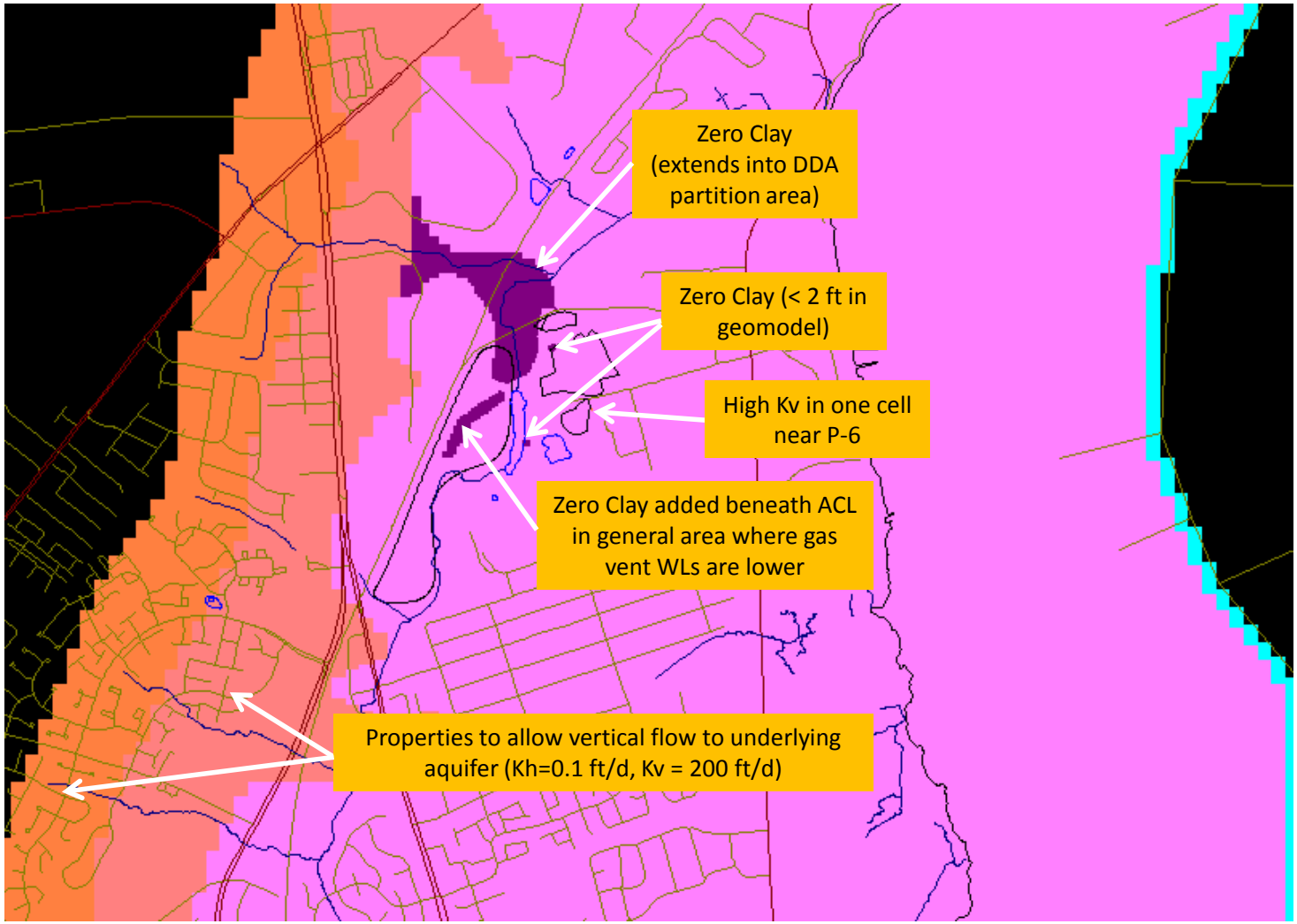
Revised By: GJG

Checked by: JC

APPENDIX B

Depiction of Zero-Clay Areas

K Zones – Layer 2



APPENDIX C

Potential Exposure Pathways

Table 2
Potential Exposure Pathways
Delaware Sand and Gravel Superfund Site
New Castle, Delaware

Source Area Timeframe	Medium	Exposure Medium	Exposure Points	Receptor Population	Receptor Age	Exposure Route	Rationale for Selection or Exclusion of Exposure Pathway
Drum Disposal Area (DDA)/ Future	Groundwater	Groundwater	Groundwater (Columbia and Upper Potomac Aquifers)	Construction/Excavation Worker	Adult	Ingestion	Potential impacts to groundwater. If excavation breaches impacted groundwater, exposure may occur.
						Dermal Contact	
	Subsurface Soil	Subsurface Soil	Subsurface Soil	Construction/Excavation Worker	Adult	Ingestion	Source material in subsurface soil. If excavation occurs to depth of impacts, exposure may occur.
						Dermal Contact	
						Inhalation (particulates)	
	Shallow Groundwater/Soil Vapor	Air	Trench Air	Construction/Excavation Worker	Adult	Inhalation (VOCs)	VOCs in groundwater may accumulate in trench air during excavation activities.
	Groundwater	Tap water	Water Supply Well	Residential	Adult	Ingestion	Known impacts to groundwater and location of residential structure between the Inert Area and Grantham South.
						Dermal Contact	
						Inhalation (VOCs)	
				Residential	Child	Ingestion	Known impacts to groundwater and location of residential structure between the Inert Area and Grantham South.
						Dermal Contact	
				Industrial/Commercial Worker	Adult	Ingestion	Known impacts to groundwater and location of a commercial building immediately south of the Inert Area. There is a treatment system building near the DDA over groundwater contamination.
						Dermal Contact	
	Soil Vapor	Indoor Air	Indoor Air	Residential	Adult	Inhalation (VOCs)	Known impacts of VOCs in groundwater.
				Residential	Child	Inhalation (VOCs)	
				Industrial/Commercial Worker	Adult	Inhalation (VOCs)	
Grantham South and Inert Area/ Present and Future	Shallow Groundwater/Soil Vapor	Indoor Air	Groundwater (Columbia Aquifer)	Residential	Adult	Inhalation (VOCs)	Potential impacts of VOCs in groundwater.
				Residential	Child	Inhalation (VOCs)	
				Industrial/Commercial Worker	Adult	Inhalation (VOCs)	
	Shallow Groundwater/Soil Vapor	Air	Trench Air	Construction/Excavation Worker	Adult	Inhalation (VOCs)	VOCs in groundwater may accumulate in trench air during excavation activities.
	Groundwater	Groundwater	Groundwater (Columbia Aquifer)	Construction/Excavation Worker	Adult	Ingestion	Potential impacts to groundwater. If excavation breaches impacted groundwater, exposure may occur.
						Dermal Contact	
	Groundwater	Tap water	Water Supply Well	Residential	Adult	Ingestion	Known impacts to groundwater and location of residential structure between the Inert Area and Grantham South.
						Dermal Contact	
						Inhalation (VOCs)	
				Residential	Child	Ingestion	Known impacts to groundwater and location of residential structure between the Inert Area and Grantham South.
						Dermal Contact	
				Industrial/Commercial Worker	Adult	Ingestion	Known impacts to groundwater and location of a commercial building immediately south of the Inert Area. There is a treatment system building near the DDA over groundwater contamination.
						Dermal Contact	
	Landfill Gas	Indoor Air	Landfill Gas	Residential	Adult	Inhalation (VOCs)	Potential impacts of VOCs in migration of landfill gas, explosion hazard.
						Explosion Hazard	
				Residential	Child	Inhalation (VOCs)	
						Explosion Hazard	
				Industrial/Commercial Worker	Adult	Inhalation (VOCs)	
						Explosion Hazard	

Notes:

Prepared by: GJG

VOCs = volatile organic compounds

Checked by: TAM

APPENDIX D

ARARs Table

Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered Materials (TBCs)
Delaware Sand and Gravel Superfund Site
New Castle, Delaware

Requirement	Legal Citation	Classification	Summary of Requirement	Applicability to Selected Remedy
Safe Drinking Water Act Maximum Contaminant Level Goals (MCLGs)	42 U.S.C. § 300f et seq. 40 CFR §§ 141.50-.51	Relevant and Appropriate	MCLGs are non-enforceable health goals for public drinking water supply systems which have at least 15 service connections or are used by at least 25 persons. The National Contingency Plan (NCP) requires that remedial actions taken to protect groundwater that is a current or potential source of drinking water must meet non-zero MCLGs for each constituent of concern for which they exist, where they are relevant and appropriate.	The Upper Potomac Aquifer is used as a source of drinking water. Therefore, MCLGs are relevant and appropriate requirements for those Site-related contaminants for which there are non-zero MCLGs.
		Applicable		Artesian Water Company extracts groundwater from the Upper Potomac Aquifer and distributes the water to the public as drinking water (after treatment). Therefore, MCLGs are applicable requirements at Artesian's Llangollen well field for those Site-related contaminants for which there are non-zero MCLGs.
Safe Drinking Water Act Maximum Contaminant levels (MCLs)	42 U.S.C. § 300f et seq. 40 CFR §§ 141.11-.12 and 141.61-.62	Relevant and Appropriate	MCLs are enforceable standards for public drinking water supply systems which have at least 15 service connections or are used by at least 25 persons. The NCP requires that remedial actions taken to protect groundwater that is a current or potential source of drinking water must meet the MCL for each constituent of concern if the MCLG is set at a level of zero and MCLs are relevant and appropriate under the circumstances of the site.	The Upper Potomac Aquifer is used as a source of drinking water. Therefore, MCLs are relevant and appropriate requirements for those Site-related contaminants for which there are no non-zero MCLGs and there are effective MCLs.
		Applicable		Artesian Water Company extracts groundwater from the Upper Potomac Aquifer and distributes the water to the public as drinking water (after treatment). Therefore, MCLs are applicable requirements at Artesian's Llangollen well field for those Site-related contaminants for which there are no non-zero MCLGs and there are effective MCLs.
Delaware Maximum Contaminant Levels (MCLs)	16 DE Admin. Code 4462 Public Drinking Water Systems, Appendix A to Section 6.0 – Regulated Contaminants	Relevant and Appropriate	Delaware's MCLs are enforceable standards for all public water systems in the State of Delaware.	CERCLA §121 requires on-site remedial actions to attain promulgated state ARARs that are more stringent than federal ARARS. Delaware's drinking water standards for tetrachloroethylene (PCE), trichloroethylene (TCE), vinyl chloride and methyl tert-butyl ether (MTBE) are more stringent than federal drinking water standards. Therefore, they are relevant and appropriate requirements for restoration of the Upper Potomac Aquifer.
		Applicable		CERCLA §121 requires on-site remedial actions to attain promulgated state ARARs that are more stringent than federal ARARS. Delaware's drinking water standards for PCE, TCE, vinyl chloride and MTBE are more stringent than federal drinking water standards. Therefore, they are applicable requirements at Artesian's Llangollen well field.
Drinking Water Standards and Health Advisories, 2012 Edition, EPA Office of Drinking Water	EPA 822-S-12-001	To be Considered	The Health Advisories in this document serve as the informal technical guidance for unregulated drinking water contaminants to assist federal, state and local officials and managers of public or community water systems in protecting public health, as needed. The health advisories are non-enforceable guidelines for public water supply systems.	The Upper Potomac Aquifer is used as a source of drinking water. Therefore, the drinking water advisories are to be considered in implementing response actions at the Site. Furthermore, Artesian Water Company extracts groundwater from the Upper Potomac Aquifer and distributes the water to the public as drinking water (after treatment). Therefore, the drinking water advisories are to be considered with respect to treatment requirements at Artesian's Llangollen well field.
EPA Regional Screening Level (RSL) Tables	No legal citation. Source: https://www.epa.gov/risk/regional-screening-levels-rsls	To Be Considered	Risk-based screening levels are derived from equations combining exposure assumptions with chemical-specific toxicity values.	The May 2014 RSLs for tap water were used to develop the PRGs for the Upper Potomac Aquifer groundwater. Tap water RSLs are to be considered because the Upper Potomac Aquifer is used as a source of drinking water. However, these standards may be more stringent than applicable state standards and are not considered cleanup standards by EPA. RSLs are also to be considered when assessing risk associated with potential vapor intrusion at habitable structures adjacent to the landfilled areas.
Surface Water Quality Standards	7 DE Admin. Code 7401 Surface Water Quality Standards	Applicable	It is DNREC's policy to maintain within its jurisdiction surface waters of the State of satisfactory quality consistent with public health and public recreation purposes, the propagation and protection of fish and aquatic life, and other beneficial uses of the water.	Army Creek is a surface water of the State of Delaware. Pursuant to 7 DE Admin. Code 7401 Section 3.0, its designated uses are primary and secondary contact recreation, and the propagation and protection of fish, aquatic life and wildlife. Therefore, all criteria for protection of these beneficial uses of surface water must be met by any point source discharges during construction of the Selected Remedy, e.g., as a result of dewatering activities during pipeline construction.
Delaware Wetlands Regulations	7 DE Admin. Code 7502 Wetlands Regulations	Applicable	Regulations to preserve and protect productive public and private wetlands and to prevent their despoliation and destruction consistent with the historic right of private ownership of lands.	This requirement is applicable to the extent that the pipeline from the groundwater extraction wells extends through areas of wetlands. Actions would be needed to address and avoid the potential long and short term adverse effects to wetlands.
Coastal Zone Management Act of 1972; Reauthorization Amendments of 1990; last amended February 1, 2010	16 U.S.C. § 1456(c)	Applicable	Federal activities affecting the coastal zone must be conducted in a manner consistent with approved state coastal management programs.	The Site is located within Delaware's coastal zone. The Selected Remedy will be implemented in a manner that is consistent, to the maximum extent practicable, with the substantive requirements of Delaware's Coastal Management Program.
Delaware Coastal Zone Act; Regulations Governing Delaware's Coastal Zone	7 Delaware Code, Chapter 70; Regulations of May 11, 1999, amended on October 1, 2001.	Applicable	These regulations specify the permitting requirements for existing non-conforming uses already in the coastal zone and for new manufacturing uses proposing to locate within Delaware's coastal zone.	The Site is located within Delaware's coastal zone. Therefore, the substantive requirements of the regulations apply to the Selected Remedy.
Delaware Coastal Management Program Federal Consistency Policies and Procedures	7 DE Admin. Code 108 § 2.0	Applicable	The Federal Coastal Zone Management Act of 1972, as amended, provides that each federal agency conducting or supporting activities affecting any land or water use or natural resource of the coastal zone must do so in a manner which is, to the maximum extent practicable, consistent with each state's coastal zone management program.	The Site is located within Delaware's coastal zone. Therefore, remedial activities are required to be consistent, to the maximum extent practicable, with Delaware's Coastal Management Program. EPA must provide the Delaware Coastal Management Program with its consistency determination at the earliest practicable time.

Requirement	Legal Citation	Classification	Summary of Requirement	Applicability to Selected Remedy
Endangered Species Act	16 U.S.C §§ 1533 and 1536	Relevant and Appropriate	Requires federal agencies to ensure that any action authorized by an agency is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat.	A review of threatened or endangered species will be performed during the remedial design phase to determine if any threatened or endangered species are present at or in the vicinity of the Site. If so, the Selected Remedy will need to implemented in a manner which is not likely to jeopardize those threatened or endangered species.
Clean Water Act: National Pollutant Discharge Elimination System (NPDES)	33 U.S.C. § 1342 et seq.	Applicable	Substantive and enforceable standards for all on-site point source discharges to waters of the United States. Best management practices must be used and appropriate monitoring performed to ensure that storm water runoff does not cause an exceedance of water quality standards in a receiving surface water body.	Discharge limits shall be met by any point source discharge during construction activities, including clearing, grading, and excavating, that will disturb between one and five acres of land. A storm water management plan, subject to EPA approval, is required for this project.
Purpose and scope	40 CFR 122.1(b)(1)			
Storm water discharges	40 CFR 122.26(b)(15)			
New sources and new dischargers	40 CFR 122.29			
Establishing limitations, standards, and other permit conditions	40 CFR 122.44			
Calculating NPDES permit conditions	40 CFR 122.45			
The National Pollutant Discharge Elimination System (NPDES) Program I	7 DE Admin. Code 7201 Surface Water Discharge Section: Regulations Governing the Control of Water Pollution, Section 6.0	Applicable	These regulations seek to prevent, manage and/or control the pollution from activities that affect or have the reasonable potential to affect the quality of surface water and groundwater.	These standards are applicable to discharge to surface water from dewatering activities during pipeline construction activities.
Sediment and Storm Water Regulations	7 DE Admin. Code 5101 §§ 1.3 and 1.4	Applicable	Establishes management programs for construction projects that disturb more than 5,000 square feet of land.	Substantive requirements of the general storm water permit program for storm water discharges associated with construction activities will be met if remedial action construction activities at the Site, including installation of conveyance piping, will disturb more than 5,000 square feet of land. No permit will be required.
Particulate Emissions from Construction and Materials Handling	7 DE Admin. Code 1106 Particulate Emissions from Construction and Materials Handling, Sections 3.0, 4.0 and 6.0	Applicable	No person shall cause or allow land clearing, land grading, excavation, or the use of non-paved roads on private property unless methods, such as the application of water, are employed to control dust emission, when such activities could emit dust in quantities sufficient to cause air pollution.	Grading, land clearing, excavation, material movement and material storage shall be conducted in a manner which adequately controls particulate emissions.
General Pretreatment Regulations for Existing and New Sources of Pollution	40 CFR 403.5 and .6	Applicable	Establishes responsibilities of federal, state, and local government, industry and the public to implement National Pretreatment Standards to control pollutants which pass through or interfere with treatment processes in POTWs or which may contaminate sewage sludge.	Groundwater discharged to the Wilmington Wastewater Treatment Plant will comply with effluent limitations established by New Castle County and the City of Wilmington to meet the substantive requirements of Delaware's NPDES Program and will meet any pretreatment standards established by New Castle County and the City of Wilmington in accordance with the NPDES General Pretreatment Regulations for Existing and New Sources of Pollution.
Delaware River Basin Commission Basin (DRBC) Administrative Manual - Rules of Practice and Procedure	18 CFR 401.32 and .35(a)(2)	Applicable	No project having a substantial effect on the water resources of the Basin shall be undertaken without the approval of the DRBC.	The project entails groundwater withdrawals exceeding 100,000 gpd and, pursuant to 18 CFR 401.35(a)(2), is not excepted from review under Section 3.8 of the Delaware River Basin Compact. However, extracted groundwater will be discharged to the Wilmington Wastewater Treatment Plant and will remain in the Basin. Therefore, the withdrawal will be a Category F withdrawal, pursuant to Appendix A of the Administrative Agreement between DRBC and DNREC, and the project will be reviewed by DNREC, only, without DRBC comment, pursuant to Section IV.C.4 of the Administrative Agreement.
Office of Solid Waste and Emergency Response (OSWER) Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air	OSWER Publication 9200.2-154, June 2015	To Be Considered	This document describes EPA's recommended framework for assessing vapor intrusion by collecting and evaluating multiple lines of evidence to support risk management decisions. It also provides technical recommendations for monitoring and terminating building mitigation systems.	These recommendations are to be considered when assessing and mitigating vapor intrusion at habitable structures adjacent to the landfilled areas.
EPA-Authorized Delaware Regulations Governing Hazardous Waste	7 DE Admin. Code 1302 Regulations Governing Hazardous Waste	See below.	See below.	See below.
Requirements for Landfill Caps	7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsections 264.303(a), 264.310(a) and (b)(1) and (5)	Applicable	Requirements for monitoring and inspection during installation of landfill cover systems and for closure and post-closure care of hazardous waste landfills.	Closure and post-closure care of the DDA will comply with these requirements.
Identification and Listing of Hazardous Waste	7 DE Admin. Code 1302, Regulations Governing Hazardous Waste, subsections 261.20-.24 and 261.30-.34	Applicable	Identifies solid wastes which are subject to regulation as hazardous wastes.	These regulations establish the criteria for identifying waste generated during the remedial action which must be managed as hazardous waste.

Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered Materials (TBCs)
Delaware Sand and Gravel Superfund Site
New Castle, Delaware

Requirement	Legal Citation	Classification	Summary of Requirement	Applicability to Selected Remedy
Standards Applicable to Generators of Hazardous Waste	7 DE Admin. Code 1302 Regulations Governing Hazardous Waste, subsections 262.11-.42	Applicable	Establishes standards for generators of hazardous waste, including waste determination, manifests, and pre-transport requirements.	Wastes generated by the remedial action (e.g., drill cuttings) and treatment residuals at Artesian Water Company 's Llangollen well field treatment plant will be handled in accordance with these requirement.
Standards for Owners and Operators of Hazardous Waste Treatment Storage and Disposal Facilities: Use and Management of Containers	7 DE Admin. Coder 1302, Standards for Owners and Operators of Hazardous Waste Treatment Storage and Disposal Facilities, subsections 264.171-.175	Relevant and Appropriate	Requirements for storage of hazardous waste in storage containers.	Hazardous waste generated during on-site remediation or treatment shall be managed, while on-site, in accordance with these requirements.
Delaware Regulations Governing Construction and Use of Water Wells	7 DE Admin. Code 7301 §§ 4.0-9.0	Applicable	Minimum requirements are prescribed governing the location, design, installation, use, disinfection, modification, repair, and abandonment of all wells and associated pumping equipment as well as certain requirements for the protection of potable water supply wells.	Applies to substantive requirements for well construction activities (from the initial penetration or excavation of the ground through development, equipment installation, disinfection and abandonment) during implementation of the Selected Remedy.
Delaware Regulations Governing the Allocation of Water	7 DE Admin. Coder 7303 §§ 1.0 and 3.0	Applicable	Substantive requirements of water allocation permits are to be met for all water withdrawals greater than 50,000 gallons in any 24-hour period except in cases of emergency withdrawal.	Substantive requirements apply to the installation, modification and repair of groundwater monitoring and recovery wells
Implementation Policy for Groundwater Management Zone/Groundwater Exclusion Zone, Memorandum of Agreement	No legal citation. October 5, 2012	To Be Considered	This Memorandum of Agreement between DNREC's Division of Waste and Hazardous Substances and Division of Water establishes the authorities of each to create groundwater institutional controls (Groundwater Management Zones or Groundwater Exclusion Zones).	To be considered for institutional controls to be implemented at the Site.

APPENDIX E

Selected Remedy Cost Summary

Selected Remedy Cost Summary

Delaware Sand & Gravel Superfund Site
New Castle, Delaware

REMEDIAL ALTERNATIVE COMPONENTS	Enhanced LFExS with Continued Discharge to POTW	Installation of Extraction Wells for Migration Control*	Direct Discharge of Extracted Groundwater to POTW*	Enhanced (RCRA Subtitle C or equivalent) Cap System		AWC Treatment - AOP and GAC	Total Alternative C Cost (Rounded)	AWC Treatment - Manganese[(a)] (not included in Alternative C costs)
Capital								
Construction Phase								
Subtotal	$384,248	$789,578	$515,100	$2,120,425		-	-	
Contingency %	20%	25%	25%	25%		-	-	
Contingency	$76,850	$197,395	$128,775	$530,106		-	-	
Construction Phase Total	$461,098	$986,973	$643,875	$2,650,532		-	-	
Design								
Subtotal	$353,000	$1,714,000	$2,135,954	$255,000		-	-	
Contingency %	10%	15%	10%	6%		-	-	
Contingency	$35,300	$257,100	$213,595	$15,300		-	-	
Design Total	$388,300	$1,971,100	$2,349,549	$270,300		-	-	
Construction Oversight								
Subtotal	$43,825	$75,550	$72,722	$757,600		-	-	
Contingency %	15%	15%	15%	20%		-	-	
Contingency	$6,574	$11,333	$10,908	$151,520		-	-	
Construction Oversight Total	$50,399	$86,883	$83,630	$909,120		-	-	
System Start-up								
Subtotal	$19,000	$19,000	$19,000	-		-	-	
Contingency %	-	-	-	-		-	-	
Contingency	-	-	-	-		-	-	
System Start-up Total	$19,000	$19,000	$19,000	-		-	-	
Capital Total (Rounded)	**$919,000**	**$3,064,000**	**$3,096,000**	**$3,830,000**	b	**$3,800,000**	**$14,700,000**	**$1,477,000**
Annual Operation, Maintenance, Monitoring (OM&M)								
Subtotal	$337,688	$536,964	$783,522	$18,500		-	-	
Contingency %	20%	15%	10%	15%		-	-	
Contingency	$67,538	$80,545	$78,352	$2,775		-	-	
Annual OM&M Total (Rounded)	$405,000	$618,000	$862,000	$21,000	c	$300,000	-	$197,000
NPV OM&M (30 year, 7% Discount)	**$5,052,000**	**$7,709,000**	**$10,753,000**	**$262,000**		**$3,742,000**	**$27,475,000**	**$2,457,000**
Total Alternative C Cost (Rounded)	**$5,970,000**	**$10,800,000**	**$13,800,000**	**$4,090,000**		**$7,540,000**	**$42,175,000**	**$3,934,000**

Notes:

1) POTW = Publicly-Owned Treatment Works
2) LFExS = Low-Flow Extraction System
3) AWC = Artesian Water Company
4) AOP = Advanced Oxidation Process
5) GAC = Granular-Activated Carbon
6) * indicates well BW-2 area is included in these estimates; however, it is recognized that the source to the well BW-2 area is still under investigation.
7) NPV = Net Present Value calculated based on 7% discount factor per USEPA guidance (USACE and USEPA, 2000)
8) Detailed cost backup is provided in Appendix C of the Detailed Analysis of Alternatives (DAA; Golder, 2015), with the exception of manganese treatment at AWC's Llangollen wellfield and changes documented in Appendix L of the Final FS Rev 1 (Golder, 2016)** as follows:
   a) Capital and annual O&M costs for manganese treatment at AWC's Llangollen wellfield are based on the following assumptions: 1) treatment of extracted water from well G3R only at a rate 850 gallons per minute; 2) manganese influent concentrations of 2 parts per million (ppm); and 3) use of greensand filtration technology for treatment to below secondary drinking water standards of 0.05 ppm for manganese.
   b) Capital costs for the Enhanced Cap System were increased by $25,000 between the DAA and Final FS Rev 1 to include installation of five (5) soil moisture probes prior to cap installation.
   c) Annual OM&M costs for the Enhanced Cap System were increased by $12,000 to include quarterly monitoring and reporting of soil moisture probe data.

   **Costs for operation of the sub-slab depressurization system at the office building and attached garage on Grantham Lane are excluded from this table and the cost estimate in ROD Amendment No. 2, although these costs are included in Appendix L of the Final FS Rev 1.

FIFTH FIVE-YEAR REVIEW REPORT FOR ARMY CREEK LANDFILL SUPERFUND SITE NEW CASTLE COUNTY, DELAWARE

SEPTEMBER 2019

Prepared by

U.S. Environmental Protection Agency
Region 3
Philadelphia, Pennsylvania

September 5, 2019

Paul Leonard, Acting Division Director
Superfund and Emergency Management Division
U.S. EPA, Region 3

Date

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LIST OF ABBREVIATIONS AND ACRONYMS

ACL	Army Creek Landfill
ARAR	Applicable or Relevant and Appropriate Requirement
AWC	Artesian Water Company
BCEE	Bis(2-chloroethyl)ether
BTAG	Biological Technical Assistance Group
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
DAWM	Division of Air and Waste Management
DCA	Dichloroethane
DNREC	Department of Natural Resources and Environmental Control
DS&G	Delaware Sand & Gravel Landfill
DWR	Division of Water Resources
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FYR	Five-Year Review
GMZ	Groundwater Management Zone
HI	Hazard Index
IC	Institutional Control
µg/L	Micrograms per Liter
mg/L	Milligrams per Liter
NCP	National Contingency Plan
ng/L	Nanograms per Liter
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
ppt	Parts per Trillion
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
ROD	Record of Decision
RPM	Remedial Project Manager
RSL	Regional Screening Level
SVOC	Semivolatile Organic Compound
UPCU	Upper Potomac Confining Unit
USACE	United States Army Corps of Engineers
UU/UE	Unlimited Use and Unrestricted Exposure
VOC	Volatile Organic Compound

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings and conclusions of reviews are documented in FYR Reports such as this one. In addition, FYR Reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fifth FYR for the Army Creek Landfill Superfund site (ACL Site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the ACL Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The ACL Site consists of two operable units (OUs), both of which are addressed in this FYR. OU1 addresses source control (including the installation of a multi-layered landfill cap and the operation of a recovery well network downgradient from the ACL Site to prevent contaminated groundwater from migrating to potable water supply wells), and OU2 addresses treating recovery well discharge to Army Creek.

EPA remedial project manager (RPM) Debra Rossi led the FYR. Participants included EPA community involvement coordinators Megan Keegan and Andrew Wynne, EPA hydrogeologist Kathy Davies, EPA toxicologist Linda Watson, EPA Biological Technical Assistance Group (BTAG) representative Matthew Taynor, Christina Wirtz and Paul Will from the Delaware Department of Natural Resources and Environmental Control (DNREC), and Amanda Goyne and Kelly MacDonald from EPA FYR support contractor Skeo. The review began on September 27, 2018.

Site Background

The 50-acre ACL Site is located in New Castle, Delaware just east of the U.S. Route 13 railroad overpass and west of Delaware Route 9 (Figure 1). The landfill is bordered immediately to the northwest by railroad tracks and to the southeast by Army Creek/Pond, which is a tributary of the Delaware River. Another Superfund site, Delaware Sand & Gravel Landfill (DS&G), is located immediately east of the ACL Site on the opposite side of Army Creek. In addition to the landfill itself, the ACL Site includes areas to the south and east where groundwater has become contaminated due to releases of hazardous substances from the landfill.

The Site is an abandoned sand and gravel quarry operated by New Castle County (the County) from 1960 through 1968 for the disposal of two million cubic yards of municipal and industrial waste. Uncontrolled landfill leachate led to groundwater contamination. The ACL Site property is currently used as wildlife habitat, with a mix of annual and perennial grasses and wildflowers planted to promote this use. Prominent visible features on the property include a security fence along the landfill perimeter, landfill gas vents, a drainage ditch and sedimentation basins, groundwater monitoring and recovery wells, and a groundwater treatment plant, which is no longer in use. Land use surrounding the ACL Site is residential and commercial.

The Columbia Aquifer is the uppermost aquifer beneath the landfill. Beneath that is the Upper Potomac Aquifer, which underlies the two Superfund sites and is a primary source of water for the local water utility, Artesian Water Company (AWC). The Columbia Aquifer is separated from the Upper Potomac Aquifer by the Upper Potomac Confining Unit (UPCU), a regional competent clay unit. Areas where the UPCU has been eroded away and replaced by sands, gravels and cobbles have been identified at and near the ACL Site where paleochannels exist. These “zero-clay” areas represent potential pathways for leachate migration from the landfill into the Upper

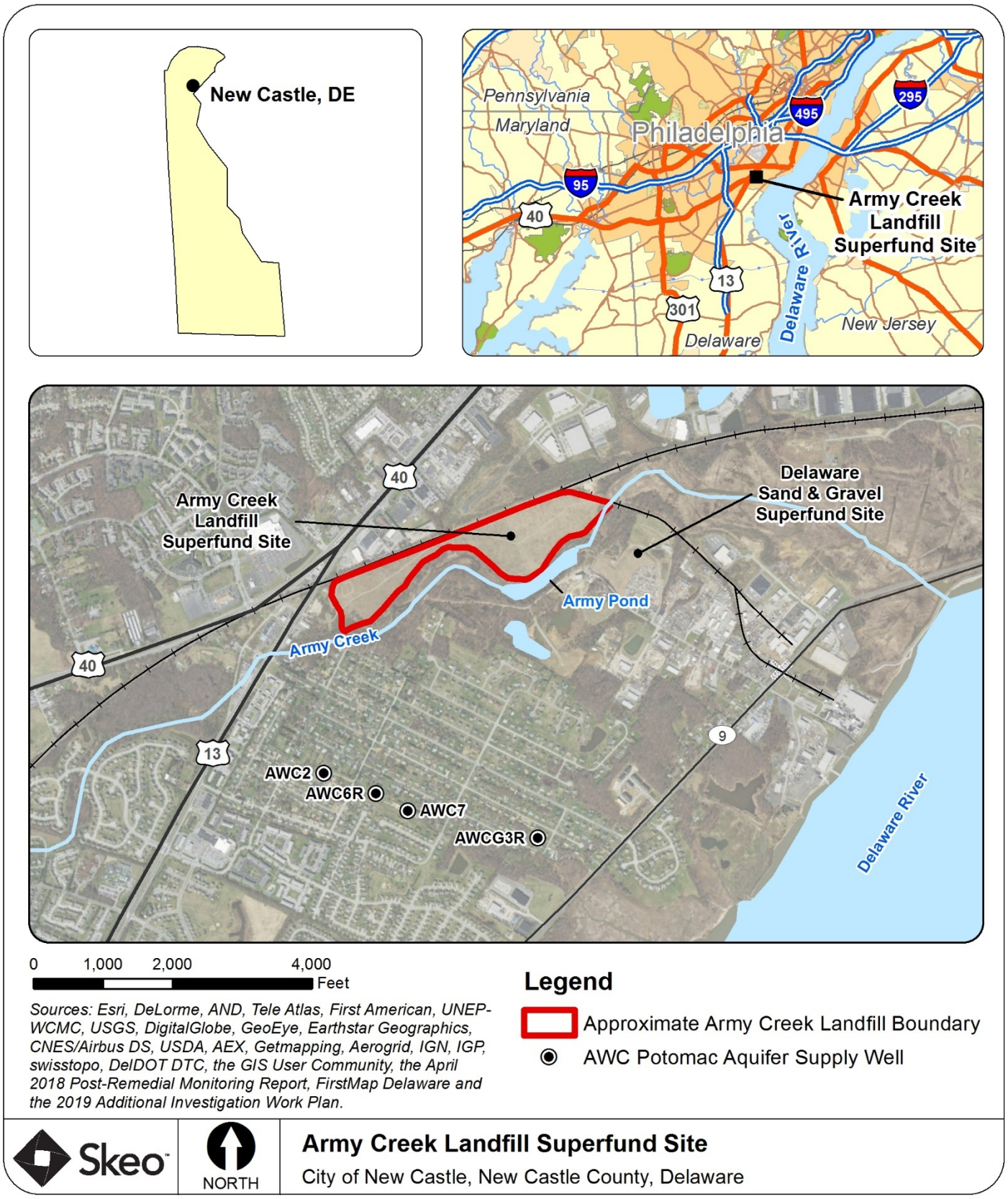
Potomac Aquifer. In addition, during landfill operations, deep excavations for expansion of the landfill may have removed portions of the UPCU, potentially creating additional pathways for leachate migration from the Columbia Aquifer into the Upper Potomac Aquifer. Both aquifers have been contaminated by the ACL Site. AWC supplies water to all area homes and businesses. The natural groundwater flow direction in the Upper Potomac Aquifer is toward the Delaware River. Near the ACL Site, the groundwater flow direction is toward AWC's Llangollen well field (located a half mile south of the two Superfund sites), which is the largest pumping center in the area (Figure 1).

Appendix A includes documents consulted during the preparation of this report. A chronology of activities at the ACL Site is included in Appendix B.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Army Creek Landfill		
EPA ID: DED980494496		
Region: 3	**State:** DE	**City/County:** New Castle / New Castle
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the Site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name: Debra Rossi, with additional support provided by Skeo		
Author affiliation: EPA Region 3		
Review period: 9/27/2018 – 9/8/2019		
Date of site inspection: 2/5/2019		
Type of review: Statutory		
Review number: 5		
Triggering action date: 9/8/2014		
Due date *(five years after triggering action date)*: 9/8/2019		

Figure 1: Site Vicinity Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Groundwater contamination was initially detected in 1971, when landfill leachate constituents were discovered in a residential well in the Llangollen Estates housing development, which lies south of and adjacent to the landfill. In response, the County began environmental investigations and actions which are described below in the Response Actions section of this FYR. Investigations indicated that leachate originating from the ACL and DS&G Sites was contaminating local aquifers with volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and metals at concentrations exceeding drinking water standards. A formal risk assessment was not conducted for OU1.

In 1990, a focused remedial investigation for OU2 evaluated human health and ecological risks based on potential exposures to surface water and sediment. The risk assessment indicated there was no unacceptable risk for human health. The OU2 assessment indicated unacceptable risks (for surface water and sediment) to freshwater aquatic receptors due to the presence of iron in surface water.

Response Actions

Following the 1971 discovery of private well contamination, the County began monitoring groundwater in 1972. The County determined that ACL Site leachate was contaminating groundwater and that contaminated groundwater in the Upper Potomac Aquifer was moving toward downgradient receptors. The County paid for an extension of AWC water supply lines to residences with contaminated wells. There was also a settlement with the homeowners to offset monthly service costs. In 1973, the County installed a groundwater recovery system designed to maintain a groundwater divide between the ACL Site and AWC's downgradient Llangollen well field. Contaminated groundwater pumped from the recovery well system was discharged to Army Creek. The system was modified in 1980 to replace some wells with recovery wells located closer to the landfill.

EPA placed the ACL Site on the National Priorities List (NPL) in September 1983. In August 1984, EPA entered into a Consent Order with the County to perform a Feasibility Study (FS) at the ACL Site; the County submitted the FS in 1986. The September 30, 1986 OU1 Record of Decision (ROD) selected a source control remedy to prevent contaminated groundwater from migrating to potable water supply wells. The 1986 OU1 ROD stated that the remedial action objectives (RAOs) were to control the migration of contaminated groundwater and to minimize further groundwater contamination by reducing leachate generated by the landfill. The OU1 ROD outlined the remedy in two phases as follows:

- Phase I
  - Installation of a multi-layer landfill cap.
  - Continued operation of the downgradient recovery well network.
  - Evaluation of the remedial action for five years after the cap is installed to assess the effectiveness of the system during operation.
- Phase II
  - Installation of upgradient groundwater controls, if determined to be necessary based on the five-year evaluation.[1]

The June 29, 1990 OU2 ROD selected a remedy to address the need to treat the recovery well effluent before discharge to Army Creek/Pond. The OU2 ROD stated that the RAO was to ensure that recovery well discharges did not exceed applicable Delaware Surface Water Quality Standards that are protective of the designated uses of Army Creek/Pond. The OU2 remedial action included:

[1] The County submitted a Five-Year Evaluation Report in 2000. Based on the report, EPA determined that installation of upgradient groundwater controls was not necessary.

- Construction and operation of a water treatment plant capable of reducing the concentration of iron in the extracted groundwater to a level that is protective of the designated uses of Army Creek.
- Long-term monitoring of the surface water, sediments and recovered groundwater quality to gauge the effectiveness of the remedy, and a wetland monitoring and evaluation plan.

In September 1991, the United States, the state of Delaware and 18 cooperating potentially responsible parties (PRPs) entered into a Consent Decree (CD), which established groundwater cleanup levels (Table 1). According to Exhibit 4 of the CD, Scope of Work-2, groundwater collection and treatment could be terminated once the groundwater cleanup levels in Table 1 were met at the property boundary.

Table 1: Groundwater Cleanup Levels

Contaminant	Primary Drinking Water Standard in CD[a] (mg/L)
Metals	
Arsenic	0.05
Barium	1
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10
Selenium	0.01
Silver	0.05
VOCs	
Total trihalomethanes	0.10
Benzene	0.005
Vinyl chloride	0.002
Carbon tetrachloride	0.005
1,2-Dichloroethane (DCA)	0.005
Trichloroethylene	0.005
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.20
1,4-Dichlorobenzene	0.075
Pesticides	
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
2,4-Dichlorophenoxyacetic acid	0.1
2,4,5-Trichlorophenoxypropionic acid	0.01

Notes:
Source: 1991 CD, Exhibit 4 Army Creek Remediation Scope of Work-2, Table A.
mg/L = milligrams per liter
a. All of the site groundwater cleanup levels are maximum contaminant levels (MCLs) for primary drinking water contaminants, which are to be met at the boundary wells as specified in the 1991 CD, Exhibit 4 Army Creek Remediation Scope of Work-2, Section 6.2 Implementation.

The OU2 ROD established the iron cleanup level of 1,000 micrograms per liter (µg/L) for recovered groundwater before discharge to Army Creek/Pond based on the Delaware Surface Water Quality Standards - Water Quality Criteria for the Protection of Aquatic Life. While the OU2 remedy required monitoring of surface water and sediment, cleanup levels were not identified for these media.

Status of Implementation

In August 1989, EPA completed the remedial design for the landfill cap. In accordance with the CD, the PRPs implemented the OU1 remedial action and OU2 remedial design and remedial action. In 1992, EPA accepted a revised landfill cap design prepared by the PRPs following a value engineering analysis of EPA's 1989 cap design. The PRPs initiated the cap construction in May 1992. During the grading activities in preparation for cap construction, buried drums were unearthed along the northwestern end of the landfill. A drum detection and removal plan was prepared, approved by EPA, and implemented. The cap construction included:

- Site filling and grading necessary to achieve design contours and slopes for the cap system.
- Installation of a multilayer cap system.[2]
- Installation of settlement markers and gas vents.
- Installation of a security fence.

The remedial design for the groundwater treatment plant was completed by the PRPs and approved by EPA in July 1991. The construction of the treatment plant occurred from June 1992 to December 1993. The major components of the treatment plant remedial action included:

- Construction of treatment plant building and influent pump station.
- Installation of underground piping to reroute the recovery well discharge water from Army Creek to the new pump station.
- Installation of water treatment support structures (e.g., aerators, chemical oxidant tank, etc.).
- Start-up and testing.

EPA, the State and the PRPs conducted a final inspection of the cap in November 1993 and of the treatment plant in January 1994. Treatment plant effluent laboratory results submitted to EPA by letter report in January 1994 indicated that the system was achieving performance standards and effluent was meeting the 1,000 µg/L discharge limit for iron. EPA and the State determined that all remedial action construction activities were performed according to specifications.

The County operated the groundwater recovery wells until 2004, when their operation was suspended for a pilot study. In 2004, EPA recommended that the County implement its proposal to suspend operation of the ACL Site groundwater recovery and treatment system for a one-year period, while pumping a substantially smaller volume of highly-contaminated groundwater from the DS&G Site. The purposes of this pilot study were to: 1) determine whether rising groundwater elevations following shutdown of the ACL Site well field would cause new releases of contaminants to groundwater or Army Creek, and 2) evaluate focused source control measures as an alternative to the high-volume groundwater extraction needed to capture contaminants from the two Superfund sites using the County's recovery well network.

EPA authorized several extensions to the original 2004 pilot study. In May 2009, EPA approved the County's request to terminate groundwater collection and treatment because groundwater cleanup levels had been met at the property boundary for known site-related contaminants since October 2005. Based on the results of extensive groundwater and stream monitoring programs during the pilot study, EPA concluded that suspension of pumping at the ACL Site well field had not resulted in new releases of contamination from the landfill. The PRPs properly abandoned unneeded wells in April 2010.

[2] Comprised (from bottom to top) of a 12-inch thick low-permeability base layer; a barrier layer of 40-mil linear low-density polyethylene geomembrane; a drainage layer of continuous polyethylene web geonet; 18 inches of select fill material and 6 inches of topsoil and seeding with annual and perennial grasses and a wildflower mix.

Emerging contaminants have been detected in the ACL Site vicinity. Since 2012, groundwater monitoring at the DS&G Site has demonstrated the presence of 1,4-dioxane in groundwater between the two Superfund sites and AWC's Llangollen well field. In addition, samples collected between 2013 and 2017 revealed the presence of perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS) and other per- and polyfluoroalkyl substances (PFAS) in groundwater downgradient of the two sites. In 2014, AWC began using an ultraviolet/hydrogen peroxide advanced oxidation process at the Llangollen water treatment plant to treat 1,4-dioxane. The updated treatment process ensures that 1,4-dioxane does not enter the potable water supply. In 2000, AWC installed a granular activated carbon (GAC) system at the Llangollen well field to address bis(2-chloroethyl)ether (BCEE); the GAC also removes PFOA and PFOS.

During this FYR period, EPA determined that the extent of several contaminants in groundwater downgradient of the western lobe of the landfill has not been adequately delineated. In response to a recommendation from the 2014 ACL Site FYR, the PRPs performed a metals (iron, manganese and cobalt) plume stability analysis in 2016. In 2017, EPA requested that the PRPs conduct additional groundwater characterization to delineate metals and 1,2-DCA in groundwater downgradient of the western lobe of the landfill and to determine if ACL is a source of PFAS in area groundwater. In May 2019, EPA approved the PRPs' work plan for additional investigation. In accordance with the work plan, the PRPs installed additional monitoring wells and increased the scope of the site groundwater monitoring program. It is expected that the additional investigations will be completed and summarized in a report in 2020. AWC recently installed new filtration technology to remove iron and manganese from groundwater pumped from the Llangollen well field; the system became fully operational in July 2019 and is effectively removing those metals. Testing by AWC indicates that the GAC system currently removes cobalt.

Institutional Control (IC) Review

Institutional controls are summarized below in Table 2 and mapped in Figure 2. Neither the 1986 OU1 ROD nor the 1990 OU2 ROD required institutional controls as part of the site remedy. The 1991 CD established the need for and implemented certain land use and property conveyance restrictions to protect the landfill cap and other remedy components and to prevent exposure to contaminated materials in the landfill (see Appendix C). In the CD the County agreed:

- Not to interfere with or disturb the work performed by the Private Settlors pursuant to the CD;
- Not to convey any title, easement, or other interest in the County's site property unless such conveyance includes a covenant that: (i) permits the United States, State, Private Settlors and their respective representatives to enter the property conveyed for purposes of effectuating all terms of the CD; (ii) contains a binding agreement not to interfere with or disturb the work and any future response activities; and (iii) contains a binding agreement to inform any person or entity that subsequently acquires any title, easement, or other interest in the property of the requirements of the Site Access section of the CD.

The restrictions set forth in the CD run with the land and shall be binding upon any and all persons or entities that acquire any title, easement, or other interest in the County's site property (tax map parcels 10-035.00-056 and 10-035.10-001, shown in Figure 2), or any portion thereof.

The land use restrictions established in the CD, however, are insufficient to ensure long-term remedy protectiveness because the majority of the landfill property (tax map parcel 10-035.00-002 in Figure 2) is owned by the State of Delaware which is not bound by the CD provisions cited above.

Groundwater restrictions have been in effect at the ACL Site since June 2006 when DNREC's Division of Air and Waste Management (DAWM) and Division of Water Resources (DWR) entered into a Memorandum of

Agreement establishing a Groundwater Management Zone (GMZ) encompassing the ACL Site.[3] The Memorandum of Agreement is included in Appendix C, Figure C-2. The GMZ includes the following restrictions:

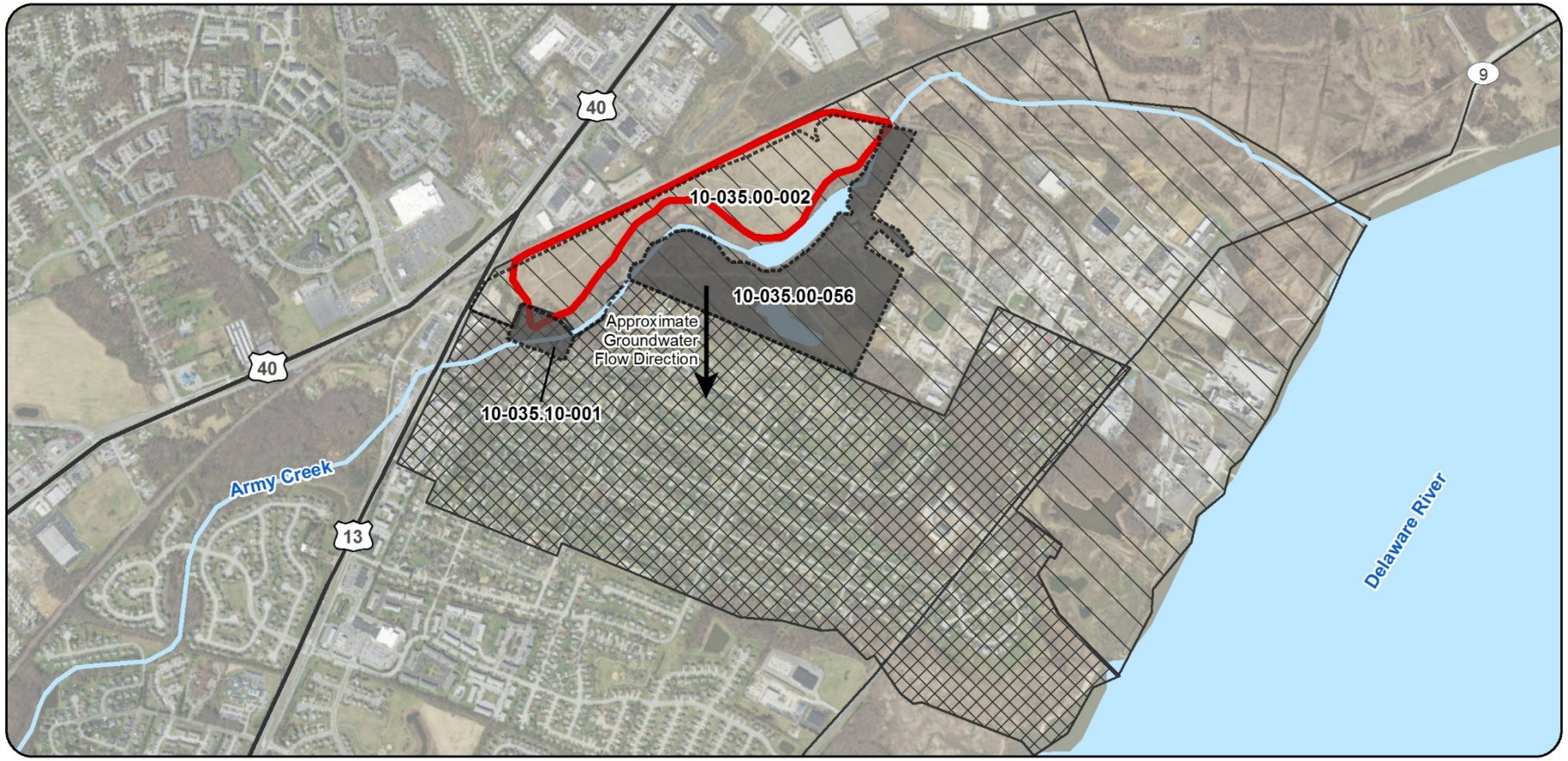
- No new public or domestic water supply wells will be allowed or permitted in the unconfined Columbia aquifer and any hydraulically interconnected or confined Potomac aquifer units within the GMZ Area A.
- No new public or domestic water supply wells or non-potable wells will be allowed in the unconfined Columbia aquifer and any hydraulically interconnected Potomac aquifer units within the GMZ Area B without demonstrating that well construction will likely prevent the movement of potential contaminants into the well. The potentially contaminated groundwater will be sufficiently treated to applicable use standards following joint review and approval by both DWR and DAWM.
- Monitoring, observation and contaminant recovery wells may be installed in the GMZ Areas A and B following joint review and approval by DWR and DAWM.
- Permits for any wells in the GMZ Areas A and B may be issued by DWR following joint review and approval by both DWR and DAWM.

Table 2: Summary of Institutional Controls (ICs)

Media and Areas That Do Not Support UU/UE Based on Current Conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date
Groundwater	Yes	No	See Figure 2	Prevent unacceptable use of contaminated groundwater	2006 GMZ
Landfill	Yes	No	Parcels 0-035.00-056 and 10-035.10-001	Protect landfill cap and other remedy components Prevent exposure to contaminated materials in the landfill	1991 CD
Landfill	Yes	No	Parcel 10-035.00-002	Protect landfill cap and other remedy components Prevent exposure to contaminated materials in the landfill	No instrument in place

[3] DAWM is now known as the Division of Waste and Hazardous Substances and DWR is now known as the Division of Water.

Figure 2: Institutional Control Map



0 1,000 2,000 4,000 Feet

Sources: Esri, DeLorme, AND, Tele Atlas, First American, UNEP-WCMC, USGS, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, the GIS User Community, the April 2018 Post-Remedial Monitoring Report, FirstMap Delaware, the New Castle County Parcel Viewer and the 2019 Additional Investigation Work Plan.

Legend

- Approximate Army Creek Landfill Boundary
- Area Under 1991 CD
- Parcels
- 2006 GMZ Zone A
- 2006 GMZ Zone B

Skeo

NORTH

Army Creek Landfill Superfund Site

City of New Castle, New Castle County, Delaware

Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Systems Operations/Operation and Maintenance (O&M)

The O&M plan has been changed several times since the remedy was implemented as site conditions have changed over time. Since the previous FYR, EPA approved a revised cap O&M plan in 2014 and a revised groundwater/surface water sampling O&M plan in 2015. The current O&M activities include:

- Groundwater monitoring in the Upper Potomac Aquifer – annual monitoring of 13 wells that include three recovery wells, four boundary wells, one side-gradient well and five downgradient wells. Semi-annual monitoring of one boundary well and four downgradient wells (Table 3 and Figure 3).
- Water level measurements – semiannual measurements to evaluate any changes in groundwater flow direction.
- Army Creek surface water and sediment – sampling every five years.
- Annual inspection and maintenance, as needed, of the landfill cap, including vegetation, gas vents, surface water control features and security fence.
- Mowing of a third of the vegetation on the cap every year.
- Annual surveying of landfill settlement monuments.

Table 3: O&M Monitoring Locations and Analyses

Monitoring Location	Sample Location	Annual Sampling	Semiannual Sampling	Sampling Every 5 Years[1]
Recovery wells downgradient of Army Pond	MW-28	M	-	-
	MW-29	M	-	-
	MW-31	M	-	-
Boundary wells immediately downgradient of recovery wells	BW-1	M and O	-	-
	BW-2	M	M	-
	BW-3	M	-	
	MW-40	M	-	-
Side-gradient of ACL and boundary wells	P-4	M and O	-	-
Downgradient of ACL and DS&G sites	P-6	M and O	M and O	-
	MW-18	M and O	-	-
Furthest downgradient of ACL and DS&G sites	MW-22N	M and O	M	-
	MW-26N	M and O	M and O	
	MW-49N	M	M	-
Surface water and sediment in Army Creek (samples listed from upgradient to the most downgradient locations)	G	-	-	P[1]
	F			
	E			
	D			
	C			
	B			
	A			

Notes:
1. Surface water and sediment were sampled quarterly from 2004 to 2007 and annually from 2009 through 2012, after which EPA approved a reduction in the monitoring frequency to every 5 years

M - Analytical parameters include dissolved iron, dissolved manganese, dissolved cobalt and field parameters.
O - Analytical parameters include VOCs and semivolatile organic compounds (SVOCs).
P - Surface water and sediment samples are analyzed for TAL metals, SVOCs and pesticides. In addition, surface water samples are analyzed for field parameters.
- not sampled.
Source: 2015 O&M Plan

The average annual O&M costs, as provided by the PRPs, for the past five years are presented in Table 4. These costs are substantially lower than the estimated annual O&M costs in the RODs of $87,000 for OU1 and $290,000 for OU2 due to a reduction in the scope of groundwater extraction/treatment and monitoring requirements since 2004. The County's costs increased in 2016 due to the plume stability study. Increased costs in 2017 and 2018 were the result of responding to EPA's request for additional response actions.

Table 4: O&M Costs Over the FYR Period

Year	ACL Trust Costs (cap remedy component)	New Castle County Costs (groundwater/stream monitoring remedy component and additional response actions)
2014	$27,057	$41,000
2015	$30,258	$41,000
2016	$18,453	$141,000
2017	$20,483	$167,000
2018	$21,437	$110,000

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determination and statement from the previous FYR as well as the recommendations from the previous FYR and the status of those recommendations.

Table 5: Protectiveness Determination/Statement from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Short-term Protective	The remedy is functioning as intended by the decision documents. Direct contact threats have been addressed through capping of contaminated soil and waste material, installation of a fence, and institutional controls restricting use of the landfill property. All of the groundwater cleanup standards specified in the Consent Decree have been attained at the property boundary. State implementation of a Groundwater Management Zone is preventing exposure to the remaining site-related contaminants (e.g., iron and manganese) beneath the landfill property. As a result, the Site is protective in the short term and is currently expected to be protective in the long term.

Table 6: Status of Recommendations for OU1 from the 2014 FYR

Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
Localized uneven settlement of the landfill cap and ponded water on the cap have the potential to reduce the effectiveness of the containment system.	Cap settlement should be evaluated, documented and addressed in accordance with the Cap System Operation and Maintenance Plan (Paul C. Rizzo Associates, 1994) (Cap System O&M Plan).	Completed	The ACL Trust completed a landfill cover assessment using five years of data (1994, 2015, 2016, 2017 and 2018) and concluded that the strain in the geomembrane caused by differential settlement would not compromise the effectiveness of the landfill cap. The United States Army Corps of Engineers (USACE), on behalf of EPA, conducted an independent assessment and concluded that the observed differential settlement has not affected the integrity of the geomembrane at this time. The ACL Trust recommended conducting a survey every three years for potential differential settlement and EPA approved the reduced survey frequency.	9/4/2019
Leachate seeps observed in the wetland area between the western sedimentation trap and Army Creek and along the wooded slope between the landfill cap and Army Creek have the potential to impact ecological receptors.	Leachate should be sampled and analyzed and the data evaluated against appropriate ecological benchmarks to ensure that leachate does not pose a potential risk to ecological receptors.	Ongoing	In April 2016, the PRPs submitted, and EPA approved, a seep sampling and analysis plan. However, the PRPs' consultant was not able to locate seeps during site visits. EPA identified three seeps at the Site in May 2019. The PRPs collected sediment samples from these locations in June 2019 and will assess potential impacts to ecological receptors in a report to EPA.	Ongoing

Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
Dissolved manganese and iron concentrations have been increasing in areas of the Upper Potomac Aquifer down gradient of the Army Creek Landfill and Delaware Sand & Gravel Landfill sites and the stability of the plumes has not been adequately assessed.	An evaluation of the sources, fate and transport of dissolved iron and manganese in the aquifer is necessary in order to assess the potential for impacts to Artesian Water Company's Llangollen well field. An iron and manganese plume stability analysis should be performed as part of this assessment.	Ongoing	The PRPs prepared a draft plume stability analysis in December 2016. The analysis documented increasing trends in iron, manganese and/or cobalt concentrations in groundwater at several monitoring locations. In September 2017, EPA notified the PRPs of the need to perform additional investigations to assess the source and extent of selected groundwater contaminants downgradient of the landfill. The PRPs are performing this additional work in accordance with the CD.	Ongoing
Laboratory quantitation limits for certain surface water analytes (e.g., BCEE) exceeded regulatory criteria during this five-year review period.	Data quality objectives for stream monitoring should be reassessed. Laboratory quantitation limits for surface water samples should not exceed State water quality criteria for target analytes. Modifications should be documented in an addendum to the 1992 O&M plan.	Ongoing	The detection limit for BCEE in the 2017 surface water samples was 10 µg/L versus the State standard of 0.53 µg/L (for protection of human health). In 2015, EPA approved the County's April 2015 addendum to the O&M plan. The addendum specifies that surface water samples will be analyzed for SVOCs using a method which provides a BCEE reporting limit that is below the State water quality standard. However, surface water samples collected by the County in 2017 were not analyzed using the approved method for SVOCs. EPA notified the County of this discrepancy and will monitor compliance with the addendum to the O&M plan during the next stream monitoring event in 2022.	Ongoing

Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
Semi-annual groundwater and stream monitoring reports have not included adequate data presentation and analysis.	Monitoring reports should include temporal trend analysis of selected contaminants in groundwater and surface water and plots of surface water levels and contemporaneous ground water elevations (Columbia and Upper Potomac) over time. Characteristics of surface water and sediment sampling locations should also be described in the reports.	Completed	Monitoring reports include trend analysis for groundwater. However, the stream monitoring report for 2017 did not include contaminant trend analyses for surface water or sediment, or describe the characteristics of surface water and sediment sampling locations. The PRPs submitted a supplemental analysis to remedy this omission on August 27, 2019 and agreed to include adequate data analysis in future monitoring reports.	8/27/19

Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
Annual mowing has resulted in diminished habitat value of the landfill cover vegetation and adds unnecessary maintenance costs. It also increases the attractiveness of the cover area to burrowing animals such as groundhogs.	The Cap System O&M Plan should be modified to allow a reduction in the frequency of mowing. Specifically, one-third of the landfill cover should be mowed once a year in early spring (before April 1) and the area mowed should be rotated so that each area of the cover system is mowed approximately once every three years. The revised plan should specify a mowing height no less than eight inches and call for "haying" or mulching of the cut grass. The plan should also include provisions for control (localized cutting) of woody species and require that cover inspections be performed shortly after mowing so areas in need of repair can be identified and addressed in a timely manner. In addition, consideration should be given to allowing non-woody vegetation to grow in the drainage channels in order to reduce stormwater runoff volume and velocity.	Completed	EPA approved the December 2014 Cap System O&M Plan, which included modifications to the mowing frequency. During the February 2019 FYR site inspection, the group noted that some vegetation was large and, in some cases, woody; EPA will consider whether the mowing schedule should be revisited to better address large woody vegetation.	3/3/2015

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Community Involvement and Site Interviews

A public notice was published in mid-May 2019 in the Delaware News Journal. The results of the review and the report will be made available at the ACL Site's information repository, located at the DNREC visitor's office at 391 Lukens Drive, New Castle, and online at http://www.nav.dnrec.delaware.gov/DEN3/.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. The interviews are summarized below; forms completed during the interviews are provided in Appendix E.

From February 5 to February 26, 2019, Community Involvement Coordinators (CICs) Megan Keegan and Andrew Wynne conducted community interviews via telephone, email, and in person. The CICs interviewed a representative from local water supplier AWC, the site operation and maintenance contractors, community members of the Llangollen Estates neighborhood, and State and County government officials concerning their knowledge and perceptions of EPA's activities at the ACL Site.

Interview responses indicated mixed levels of awareness of activities at the ACL Site. Residents of the Llangollen Estates neighborhood generally knew of the ACL Site but were unfamiliar and not involved with the cleanup decisions or activities. From the responses gathered, it is also unclear that community members distinguish between the ACL Site and the adjacent DS&G Site. Representatives from the State, County, and AWC were familiar with the cleanup activities to date.

Responses also indicated mixed views on whether the community was well-informed about the ACL Site. Residents of the Llangollen Estates neighborhood did not feel well informed about the Site, while AWC reported that communication had improved since the last FYR. Llangollen Estates residents suggested a fact sheet, or regular email updates would be appropriate to keep them informed of the activities at the ACL Site.

Residents of the Llangollen Estates neighborhood indicated frustration at the long timeline and lack of communication about the ACL Site, noting perceptions that the cleanup seems to be low priority. AWC also reported a negative impression regarding the time required for decisions and action within the Superfund process and described the financial impacts of the additional treatment required at the Llangollen well field.

Site operation and maintenance contractors indicated that the landfill cap is performing as designed and progress has been made with the groundwater remedy. The landfill cap is inspected monthly and maintenance is performed as required. Evidence of trespassing on the landfill property by bikers and hunters has been observed. Additional groundwater monitoring, focusing on the western lobe of the landfill, is planned or underway.

Data Review

This FYR evaluates the effectiveness and protectiveness of the landfill cap and groundwater remedies at the ACL Site, and included a review of cap inspection reports; groundwater, surface water and sediment monitoring reports; and AWC's annual water quality reports. Supporting information is available in Appendix H. Historical monitoring data are included in Appendix K.

Cap Inspections

Annual cap inspection reports document the monthly observations of the PRPs' Project Engineer and routine maintenance activities. Maintenance activities included annual mowing, removal of shrubby vegetation from the landfill cap, minor fence, gate and access road repairs, settlement monument repairs and vegetation clearing from drainage ditches. Observations during this FYR period included some standing water in low areas of the surface water control structures, primarily in spring and fall.

The PRPs' contractor completed a landfill cover assessment in July 2015 to evaluate three areas with some settlement and ponding. Tension in the geomembrane was evaluated based on the so-called "refrigerator effect" which assumes that a void approximately 6 to 9 feet in diameter develops immediately beneath the liner. The report concluded that tension in the liner caused by differential settlement from 1994 to 2015 did not exceed the tensile strength of the geomembrane and that the liner had not been compromised. At EPA's request, the PRPs' contractor completed annual settlement surveys at the westernmost area in 2016, 2017 and 2018 and summarized these findings in a November 2018 memorandum. The memorandum stated that minimal settlement occurred during the assessment period and recommended a reduction in the differential settlement surveying frequency to once every 3 years, which EPA approved.

In August 2019, EPA requested support from USACE to evaluate the PRPs' landfill cover assessment. Areas affected by differential settlement at ACL are 50 to 100 feet wide. USACE used a state-of-the-practice equation to estimate the tensile strain (i.e., elongation) in the geomembrane under such conditions and compared this value with the allowable strain for the installed geomembrane. Based on this assessment, the differential settlement observed on the landfill cover has not affected the integrity of the geomembrane at this time.

Groundwater Monitoring

The data evaluated in this FYR include samples collected from October 2013 through October 2018. In addition, long-term historical trends are highlighted where applicable. Monitoring requirements have changed over the years as conditions at the ACL Site have changed. Starting in 2015, groundwater samples were collected on an annual basis from 13 wells, as summarized in Table 3 and shown in Figure 3. In addition, five of these wells are monitored semiannually (see the O&M section of this FYR). Depending on the sample location, the groundwater samples are analyzed for three dissolved metals (iron, manganese and cobalt), VOCs and SVOCs, or only the three dissolved metals. Some wells in the program monitor contamination near the ACL Site that is related to the adjacent DS&G Site.

The 1991 CD required the attainment of groundwater cleanup standards at monitoring wells located near the site property boundary (BW-1, BW-2, BW-3 and MW-40). Historical results were compared to the cleanup levels set in the 1991 CD; all four of the boundary wells continue to meet these cleanup levels for monitored contaminants, as they have since 2005. In addition, groundwater quality at the boundary wells has met current primary drinking water standards, including the standard for lead, since 2009, as discussed in the 2014 FYR Report. See historical data in Appendix K.

According to the 2009 FYR Report, BCEE and other contaminants, including benzene and 1,4-dioxane, are related to releases from the Drum Disposal Area of the DS&G Site.[4] BCEE and 1,4-dioxane were detected in this FYR period in BW-1 at concentrations that would not pose an unacceptable risk in tap water. Concentrations of BCEE and 1,4-dioxane which would present an unacceptable risk (one in 10,000 excess lifetime cancer risk) in tap water are 1.4 µg/L and 46 µg/L, respectively, while the BCEE and 1,4-dioxane concentrations in the groundwater samples collected from BW-1 in October 2018 were 0.30 J[5] µg/L and 2.4 µg/L, respectively. In well BW-2 in April 2018, BCEE was detected at a concentration of 0.24 µg/L, which would not present an unacceptable risk in tap water, while 1,4-dioxane was detected at a concentration of 120 µg/L, which would pose an unacceptable risk. The concentrations were generally stable during the FYR monitoring period. The presence of these two contaminants in groundwater is being addressed by the DS&G remedy.

Scope of Work-2 of the 1991 CD did not establish cleanup levels for iron and manganese in groundwater at the ACL Site. Iron and manganese occur naturally as minerals in the aquifer matrix. However, these metals become mobilized in groundwater when oxygen levels in the aquifer decline as a result of microbial decomposition of the organic waste in the landfill. Following the shutdown of the ACL Site groundwater recovery wells in 2004,

[4] An investigation is underway at the DS&G Site to determine if there are sources of 1,4-dioxane, in addition to the Drum Disposal Area.
[5] J = Estimated concentration.

monitoring results have indicated an increasing trend in dissolved iron and manganese concentrations in groundwater at several monitoring wells with concentrations exceeding EPA's tap water RSLs of 14,000 µg/L for iron and 430 µg/L for manganese. From 2004 to 2007, iron concentrations in BW-1 increased; since then concentrations have decreased, and during this FYR period concentrations have fluctuated around the RSL (Figure H-1). Manganese concentrations in BW-1 have shown an increasing trend and are above the RSL (Figure H-2). Manganese concentrations in BW-2 have remained stable and above the RSL, while concentrations in BW-3 were historically below the RSL but have increased to exceed it in this FYR period (Figure H-2). Wells downgradient of the boundary wells also exhibited increases in iron and manganese with the most notable iron increase observed in well P-4 (Figure H-3) and notable manganese increases in wells P-4 and MW-26N (Figure H-4).

Other notable detections of contaminants at boundary wells and other site monitoring wells in this FYR period included 1,2-DCA, PFOA and PFOS. This is explained in more detail in Appendix H. Based on these findings, additional site characterization field work was requested by EPA in 2017 to determine:

1. The extent of the dissolved metals and 1,2-DCA contamination in groundwater within the Upper Potomac Aquifer downgradient of the western lobe of the ACL Site.
2. Whether the ACL Site is a source of PFOA and PFOS in groundwater within the Upper Potomac Aquifer.
3. The vulnerability of the Llangollen well field to contaminant releases from the western lobe of the ACL Site.

The PRPs prepared a draft work plan to address EPA's 2017 requests. EPA approved the work plan in May 2019. The PRPs installed additional monitoring wells from May to June 2019 and collected groundwater samples from new and existing wells in July 2019. The July 2019 groundwater sampling results will be summarized in a report in late September 2019 and a PFAS source evaluation report will be submitted in March 2020.

Artesian Monitoring Reports

AWC has several well fields in the vicinity of the ACL Site. Adjustments over time in the rate of pumping from AWC's production wells, particularly at the Llangollen well field, affect the groundwater flow direction and gradient in the vicinity of the ACL Site. Since 2014, AWC has been withdrawing from wells AWC-2, AWC-6R, AWC-7 and AWC-G3R at the Llangollen well field (Figure 3).

AWC's 2014 through 2018 Water Quality Reports were reviewed during this FYR period. The Water Quality Reports for drinking water supplies in northern New Castle County show that the water meets state and federal drinking water standards for regulated inorganic and organic contaminants. As noted in the Status of Implementation section of this FYR Report, AWC provides treatment at the Llangollen well field for BCEE and 1,4-dioxane. The treatment systems also remove cobalt, PFOA and PFOS. In addition, AWC recently installed a new filtration technology to remove iron and manganese.

Surface Water and Sediment Monitoring

In 2013, EPA approved a reduction in the surface water and sediment monitoring frequency from annually to once every five years. The samples evaluated in this review were collected in 2017. Surface water and sediment samples were collected from locations A through G in Army Creek (Figure 3) in October 2017. Sediment results were compared with EPA's BTAG screening levels. Surface water results were compared to BTAG screening levels, Delaware Surface Water Quality Standards for protection of human health and aquatic life, or 10 times the value of EPA's tap water RSLs, whichever was most stringent. SVOC concentrations reported for surface water samples did not exceed surface water standards. However, detection limits for many metals, SVOCs and pesticides exceeded the surface water standards, often by several orders of magnitude. Most pesticides were not detected; however, detection limits for many pesticides exceed surface water standards. The concentration for gamma-chlordane exceeded the Delaware surface water quality criterion of 0.0008 µg/L for chlordane with a concentration of 0.0037 J µg/L at location G, which is the upgradient sampling location. Other locations in the

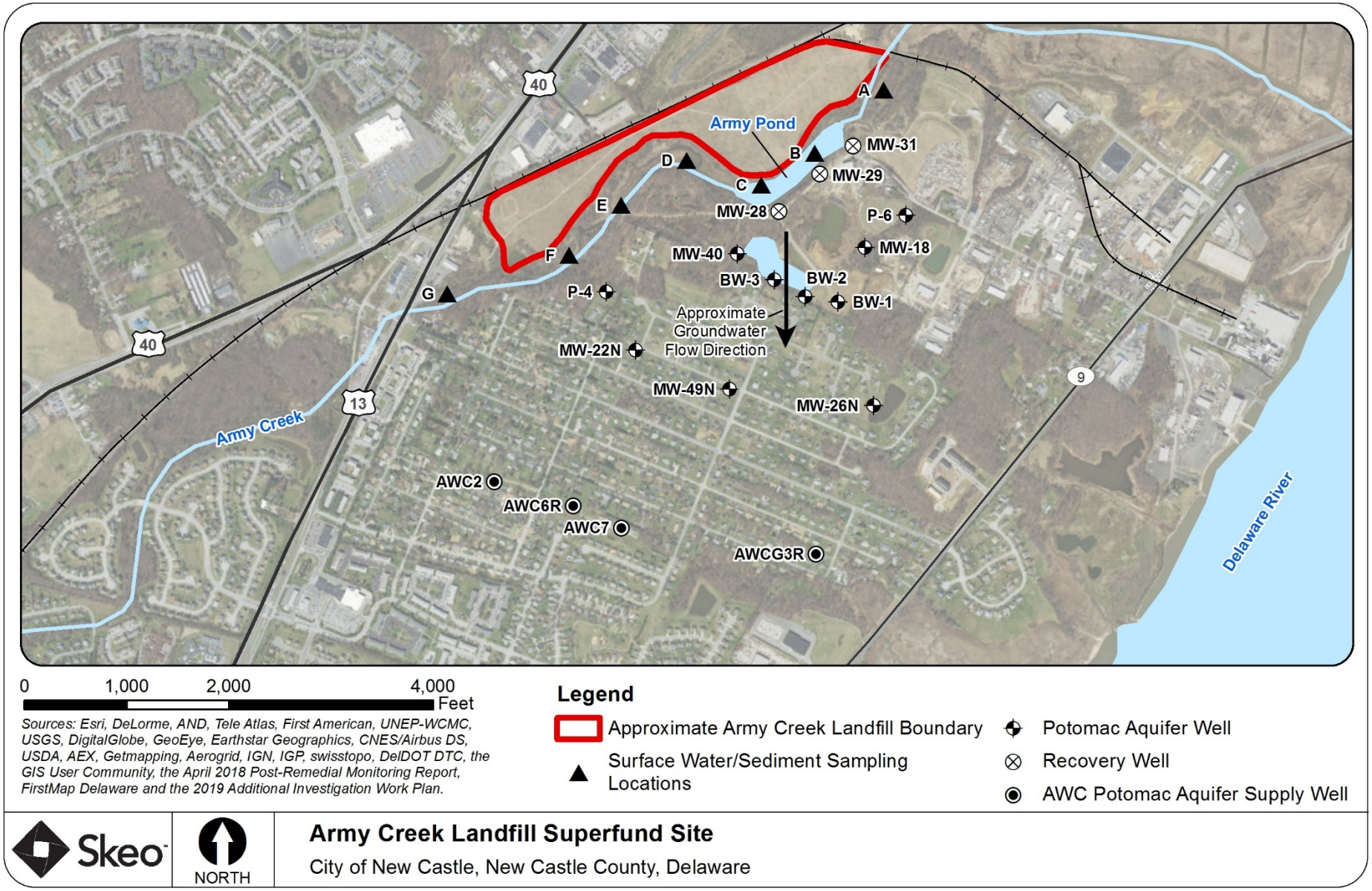
2017 sampling event had non-detect concentrations of gamma-chlordane, but the detection limits were orders of magnitude above the surface water quality criterion.

One metal, barium, was detected in all surface water samples above the BTAG value of 4 µg/L. Location G is the upgradient sampling location with a concentration of 36.4 J µg/L. Locations A (78.5 J µg/L), B (64.4 J µg/L) and C (85.8 J µg/L) were higher than the upgradient G concentration. Manganese exceeded the BTAG screening level (0.12 mg/L) at locations A (0.362 mg/L), B (0.128 mg/L), C (0.363 mg/L) and F (0.248 mg/L). Manganese and barium concentrations at upgradient sampling location G have fluctuated over time and the exceedances at downgradient locations in October 2017 appear to be consistent with historical upgradient concentrations, indicating that these exceedances may not be related to the ACL Site. These exceedances are similar to exceedances that have periodically occurred since 2004 and there are no apparent trends. The iron concentration at location F (0.875 K[6] mg/L) exceeded the BTAG screening level of 0.3 mg/L; iron concentrations at the upgradient location G exceeded the BTAG screening level in 2005, but have since remained below the screening level. It is unclear if other metals exceed BTAG values as the detection limits for most of the metals exceed the BTAG screening values, as noted as an issue in the 2014 FYR.

Sediment samples indicated several polycyclic aromatic hydrocarbons (PAHs) and pesticides were detected above BTAG screening levels. The frequency and magnitude of these detections were greatest at sampling locations A, D, E and G. Location G is the upstream, or background sampling location, and location D is adjacent to an outfall that receives run-off from Route 13. Metals were also present in sediments at concentrations that exceed the screening levels at multiple sample locations, with higher concentrations generally coinciding with higher concentrations of PAHs at sampling stations A, D, E and G. Iron was the only metal with concentrations exceeding the BTAG screening level (at locations A, D and E) that was not detected in background sampling location G, indicating it may be related to the ACL Site.

[6] K = Analyte present; may be biased high.

Figure 3: Detailed Site Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Site Inspection

The site inspection took place on February 5, 2019. The purpose of the inspection was to assess the protectiveness of the remedy. The site inspection checklist and photographs are included in Appendices F and G, respectively. Site inspection participants included EPA RPM Debra Rossi, EPA community involvement coordinator Andrew Wynne, EPA hydrogeologist Kathy Davies, EPA BTAG representative Matthew Taynor, Christina Wirtz and Paul Will from DNREC, Private Settlors' Project Coordinator John Andrade, Army Creek Landfill Technical Steering Committee Project Engineer Beth Klotzbach, New Castle County consultant Michele Ruth of Ruth Associates, and Amanda Goyne and Kelly MacDonald from EPA FYR support contractor Skeo.

The group began the inspection at the location of leachate seeps identified during the previous FYR inspection near the western part of the landfill; these seeps were not active during this inspection. Beer cans and other litter were observed along Army Creek, and dirt bike tracks were present on the site road (but not noted on the cap), indicating trespassing. There was no evidence of hunting observed as has been observed in the past (e.g., deer stands). The ACL Site is fenced except for along the creek, and the fence includes signage notifying that this area is a Superfund site. There were several holes in the fence that the O&M contractor noted would be fixed. The group then walked the extent of the landfill. The cap was well vegetated with tall grasses and some woody vegetation. Woody vegetation was larger in areas of the cap that were mowed less recently; the current mowing schedule is to mow a third of the cap every year. The gas vents and settlement monuments appeared to be in good condition. The cap is serving as wildlife habitat, as evidenced by the presence of birds, animal droppings and insect egg casings. There was some ponding on the cap. The group noted the groundwater treatment plant, which is no longer in use.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Yes. The remedy is generally functioning as intended by the RODs. The OU1 landfill cap prevents direct contact with buried wastes and reduces precipitation infiltration, which in turn reduces leachate generation and groundwater contamination. Annual settlement studies between 2015 and 2018 indicate that minimal to zero settlement occurred during that period, and the cap retains sufficient tensile strength. The mowing frequency at the ACL Site was updated to allow for growth of vegetation, including woody vegetation, to ensure the area can serve as wildlife habitat. However, the 2019 FYR site inspection found some woody vegetation that has grown quite large in an area of the cap, indicating the mowing frequency may need to be revisited. The site fence is maintained and limits site access. O&M activities ensure that the fence is secured, and the cap and associated drainage structures are operating properly. Groundwater recovery (OU1) and treatment (OU2) continued until 2004; the groundwater cleanup goals have been met at the boundary wells since 2005.

Institutional controls have been implemented, in part, for the landfill and groundwater via the CD and GMZ, respectively. However, the ACL Site's decision documents did not specify a requirement for institutional controls, and comprehensive land use restrictions have not been implemented for the portion of the landfill property owned by the State of Delaware. Therefore, EPA intends to 1) establish through an appropriate decision document that institutional controls are necessary to maintain remedy protectiveness and 2) implement the institutional control.

During this FYR period, the groundwater quality at boundary wells consistently met the groundwater cleanup levels specified in the CD. However, additional contaminants have been noted in groundwater downgradient of the landfill above risk-based criteria or drinking water standards, including iron, manganese, 1,2-DCA, PFOA and PFOS. Based on these findings, EPA requested in 2017 that additional site characterization be completed. The PRPs prepared a work plan and installed additional monitoring wells to further characterize these contaminants and evaluate the vulnerability of AWC's Llangollen well field to releases from the ACL Site western lobe.

The 2017 surface water and sediment sampling data indicate that many of the metals and organic compounds are present at concentrations that are below laboratory detection limits, but in many instances the detection limits exceed the BTAG screening values and surface water standards, often by several orders of magnitude. The surface water and sediment data are generally consistent with past results, but without more sensitive analytical methods a review of concentration trends is not possible for every contaminant which may exceed screening levels. Iron concentrations in sediment and surface water exceeded the BTAG screening level at downgradient locations but not at background location G, indicating iron may be site-related. EPA will monitor trends in iron concentrations to assess the potential for adverse impacts to ecological receptors. Iron contamination in groundwater is already under investigation via the ACL Site western lobe study, which should consider potential effects on surface water.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. The RAOs remain valid as site conditions have not changed. The exposure assumptions remain valid, including those for the pathways of potential residential use of contaminated groundwater in the Upper Potomac Aquifer, recreational exposure to surface water and sediment in Army Creek (including ingestion of contaminated fish), and exposure of aquatic organisms to contaminated surface water and sediment in Army Creek. A vapor intrusion pathway evaluation was performed for the ACL Site in 2009. As documented in the 2010 Addendum to the 2009 FYR Report, EPA concluded that this potential exposure pathway was incomplete. The environmental setting has not changed since 2010; therefore, the vapor intrusion pathway remains incomplete.

Scope of Work-2 of the 1991 CD established cleanup levels for site-related contaminants for which primary drinking water standards had been promulgated. Additional contaminants without primary drinking water standards (iron, manganese, cobalt, PFOA, PFOS and 1,4-dioxane) are present in groundwater downgradient of the ACL Site. EPA is currently evaluating the nature and extent of these contaminants to determine if they are site-related contaminants of concern (COCs) and if additional response actions are warranted. In the interim, the public water treatment system has been upgraded to address all contaminants identified.

Applicable or Relevant and Appropriate Requirements (ARARs) were reviewed as part of this FYR. The OU2 ROD established a chemical-specific ARAR for iron in surface water, which has not changed (Appendix I). The 1991 CD established the national primary drinking water standards as groundwater ARARs. A review of the drinking water standards indicates that many have become more stringent (Appendix I). Some of the groundwater contaminants for which cleanup levels were established in the 1991 CD are no longer monitored, as approved by EPA. The PRPs' monitoring reports continue to use the 1991 drinking water standard for total trihalomethanes, which is not as stringent as the current drinking water standard. It is recommended that monitoring data interpretation use current standards.

The 1991 CD did not specify groundwater cleanup levels for contaminants that lacked primary drinking water standards. However, in order to be protective, the remedy must prevent exposure to site-related contaminants at levels that present a risk that exceeds EPA's cancer benchmark value of 1×10^{-4} or a noncancer hazard index (HI) greater than 1.0. Thus, a screening-level risk evaluation was performed using the October 2018 laboratory analytical results for groundwater samples collected from boundary wells BW-1, BW-2, BW-3 and MW-40. The risk evaluation (Appendix J, Table J-1) shows that exposure to the levels of cobalt and manganese detected at BW-1 would result in adult and child non-cancer risks that exceed EPA's non-cancer threshold value of 1.0. The PRPs are conducting additional groundwater characterization to address the historical increase in metals and 1,2-DCA downgradient of the ACL Site. In the interim, exposure is not occurring as institutional controls prevent exposure to groundwater, and all homes and businesses near the ACL Site are served by a public water supply (AWC), which treats the water before distribution.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the

remedy?

No additional information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the FYR:
OU2

Issues and Recommendations Identified in the FYR:

OU(s): OU1	**Issue Category: Remedy Performance**			
	Issue: Contaminants not included in the 1991 CD are detected at concentrations above risk-based values in groundwater.			
	Recommendation: Upon completion of the ongoing additional site characterization, determine if groundwater contaminants not included in the 1991 CD are site-related COCs. If unacceptable risks from newly identified site-related COCs are present, perform a focused feasibility study to evaluate remedial alternatives to address all site-related COCs and modify the remedy in an appropriate decision document.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/PRP	EPA	9/8/2022

OU(s): OU1	**Issue Category: Monitoring**			
	Issue: The CD's groundwater cleanup level for total trihalomethanes is not as stringent as the current federal drinking water standard.			
	Recommendation: Update the groundwater cleanup levels in accordance with current federal and State standards and risk-based criteria via an appropriate decision document.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	9/8/2022

OU(s): OU1	Issue Category: Monitoring			
	Issue: Contaminant trends cannot be determined in surface water or sediment to assess ecological risks due to elevated detection limits for many metals and organic analytes.			
	Recommendation: Update analytical methods for metals and organics in surface water and sediment, where feasible, to achieve detection limits which support contaminant trend analyses.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/8/2021

OU(s): OU1	Issue Category: Monitoring			
	Issue: Leachate seeps observed along the wooded slope between the landfill cap and Army Creek have the potential to impact ecological receptors.			
	Recommendation: Evaluate seep sediment data against appropriate ecological benchmarks to ensure that leachate seep sediment does not pose a potential risk to ecological receptors.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2019

OU(s): OU1	Issue Category: Institutional Controls			
	Issue: The ACL Site's decision documents do not specify that institutional controls are needed.			
	Recommendation: Add institutional controls to the ACL Site's remedy via the appropriate decision document and implement land use restrictions.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	3/30/2020

OTHER FINDINGS

Several additional recommendations were identified during the FYR. These recommendations do not affect current and/or future protectiveness.

- Groundwater monitoring reports use some outdated primary drinking water standards. In addition, the monitoring reports do not include risk-based criteria to interpret the detections of contaminants not included in the 1991 CD. Consider including current primary drinking water standards and risk-based criteria in groundwater monitoring reports in order to appropriately interpret groundwater results.
- Consider adjusting the cap mowing schedule to control growth of woody vegetation.
- Consider mapping plumes for the groundwater monitoring reports.
- Consider issuing regular fact sheets to update community members about ACL and DS&G Site activities.

- Consider surveying each of the three areas where differential settlement has occurred on the western lobe of the landfill on a regular basis (e.g. every two to three years).

VII. PROTECTIVENESS STATEMENTS

Protectiveness Statement	
Operable Unit: OU1	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU1 is protective, in the short term, of human health and the environment because the landfill is capped and fenced, institutional controls are in place for the landfill and groundwater, and all the groundwater cleanup levels specified in the CD have been attained at the property boundary. However, in order for the remedy to be protective in the long term, the following activities are warranted: • Upon completion of the ongoing additional site characterization, determine if groundwater contaminants not included in the 1991 CD are site-related COCs. If unacceptable risks from newly identified site-related COCs are present, perform a focused feasibility study to evaluate remedial alternatives to address all site-related COCs and modify the remedy in an appropriate decision document • Update the groundwater cleanup levels in accordance with the current federal standards and health-based criteria via an appropriate decision document. • Update analytical methods for metals and organics in surface water and sediment, where feasible, to achieve detection limits which support contaminant trend analyses. • Evaluate seep sediment data against appropriate ecological benchmarks to ensure that leachate seep sediment does not pose a potential risk to ecological receptors. • Add institutional controls to the ACL Site's remedy via the appropriate decision document and implement land use restrictions.	

Protectiveness Statement	
Operable Unit: OU2	*Protectiveness Determination:* Protective
Protectiveness Statement: The remedy at OU2 is protective of human health and the environment. Treatment of extracted groundwater to remove iron to achieve the cleanup goal of 1,000 µg/L has been completed, and groundwater recovery ended in 2004.	

Sitewide Protectiveness Statement
Protectiveness Determination: Short-term Protective
Protectiveness Statement: The ACL Site's remedy currently protects human health and the environment because the landfill is capped and fenced, institutional controls are in place for the landfill and groundwater, all the groundwater cleanup standards specified in the CD have been attained at the property boundary, and treatment of extracted groundwater has been completed. However, for the remedy to be protective in the long term, the following activities are warranted: • Upon completion of the ongoing additional site characterization, determine if groundwater contaminants not included in the 1991 CD are site-related COCs. If unacceptable risks from newly identified site-related COCs are present, perform a focused feasibility study to evaluate remedial alternatives to address all site-related COCs and modify the remedy in an appropriate decision document. • Update the groundwater cleanup levels in accordance with the current federal standards and health-based criteria via an appropriate decision document. • Update analytical methods for metals and organics in surface water and sediment, where feasible, to achieve detection limits which support contaminant trend analyses. • Evaluate seep sediment data against appropriate ecological benchmarks to ensure that leachate seep sediment does not pose a potential risk to ecological receptors. • Add institutional controls to the ACL Site's remedy via the appropriate decision document and implement land use restrictions.

GPRA Measure Review

As part of this five-year review, the GPRA Measures have also been reviewed. The GPRA Measures and their status are as follows:

Environmental Indicators

Human Health: Current Human Exposure Controlled (HEUC)
Groundwater Migration: Contaminated Groundwater Migration Not Under Control (GMNC)

Site-Wide RAU

The ACL Site was determined Site-Wide Ready for Anticipated Use (SWRAU) on March 12, 2010.

VIII. NEXT REVIEW

The next FYR Report for the ACL Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Artesian Water Company Water Quality Report for 2014, Public Water System I.D. DE0000552, Artesian Water Company. Prepared Spring 2015.

Artesian Water Company Water Quality Report for 2015, Public Water System I.D. DE0000552, Artesian Water Company. Prepared Spring 2016.

Artesian Water Company Water Quality Report for 2016, Public Water System I.D. DE0000552, Artesian Water Company. Prepared Spring 2017.

Artesian Water Company Water Quality Report for 2017, Public Water System I.D. DE0000552, Artesian Water Company. Prepared Spring 2018.

Cap System Operation and Maintenance Plan, Army Creek Landfill Superfund Site, New Castle, Delaware, Paul C. Rizzo Associates, Inc., July 29, 1994.

Cap System Operation and Maintenance Plan, Army Creek Landfill Superfund Site, New Castle, Delaware, Addendum 2, Army Creek Landfill Trust Fund Steering Committee, December 2014.

Consent Decree, Army Creek Landfill Superfund Site, New Castle, Delaware, September 1991. Consolidated Civil Action Nos. 91-409-007JJF and 91-418.

Email Re: Cap Maintenance - Survey Differential Settlement on an Annual Basis and Mowing Schedule. From Debra Rossi to Michael Sherrie. November 12, 2015.

Email Re: EPA Approval of Addendum 2 of the Cap System Operation and Maintenance Plan, dated December 2014. From Debra Rossi to Michael Sherrie. March 3, 2015.

Facility Inspection Report - 1Q2014 - 4Q2014. Army Creek Landfill Cap, Army Creek Landfill Trust Fund Steering Committee.

Facility Inspection Report - 1Q2015 - 4Q2015. Army Creek Landfill Cap, Army Creek Landfill Trust Fund Steering Committee.

Facility Inspection Report - 1Q2016 - 4Q2016. Army Creek Landfill Cap, Army Creek Landfill Trust Fund Steering Committee.

Facility Inspection Report - 1Q2017 - 4Q2017. Army Creek Landfill Cap, Army Creek Landfill Trust Fund Steering Committee.

Five-Year Review Report, Army Creek Landfill Superfund Site, New Castle, DE, U.S. EPA, September 28, 2009.

Five-Year Review Report Addendum. Army Creek Landfill Superfund Site. Prepared by EPA. April 2010.

Five-Year Review Report, Army Creek Landfill Superfund Site, New Castle, DE, U.S. EPA, September 8, 2014.

Five-Year Review Report, Army Creek Landfill Superfund Site, New Castle, DE, U.S. EPA, September 2014.

Focused Remedial Investigation. Army Creek Landfill Superfund Site, New Castle, Delaware. Prepared by NUS, Corporation. January 1990.

Landfill Cover Assessment. Army Creek Landfill Superfund Site. New Castle County, Delaware. Prepared by GHD. July 2015.

Landfill Cover Assessment (2015 – 2018). Army Creek Landfill Superfund Site. New Castle County, Delaware. Prepared by GHD. November 2018.

Letter Re: Additional Response Actions at the Army Creek Landfill, New Castle County, Delaware. From Debra Rossi to Michael Harris and Michael Sherrier. September 28, 2017.

Letter Re: Army Creek Landfill Inspection Report; Addendum - Cap System Operation and Maintenance Plan (O&M Plan), from Michael Barbara to Debra Rossi, August 26, 2009.

Post-Remedial Monitoring Report October 2017 Event, Army Creek Landfill, Ruth Associates, Inc. January 2018.

Post-Remedial Monitoring Report October 2018 Event, Army Creek Landfill, Ruth Associates, Inc. December 2018.

Preliminary Closeout Rep Army Creek Landfill Superfund Site. New Castle County, Delaware. Prepared by U.S. EPA. April 1994.

Proposed Seep Sampling and Analysis Plan. Army Creek Landfill - New Castle County, Delaware. April 2016.

Record of Decision, Army Creek Landfill Operable Unit Two, U.S. EPA, June 29, 1990.

Record of Decision, Remedial Alternative Selection, Site: Army Creek Landfill Site, New Castle County, Delaware, U.S. EPA, September 30, 1986.

Response to USEPA Five-Year Review Report. RE: Army Creek Landfill - New Castle County, Delaware. Prepared by Ruth Associates, Inc. December 2014.

Review Comments. Landfill Cover Assessment. Army Creek Landfill Superfund Site. New Castle County, Delaware. Prepared by USACE, Philadelphia District, Geotechnical Section. September 2019.

Semi-Annual Monitoring Report January - June 2018 Delaware Sand & Gravel Superfund Site New Castle County, Delaware. Prepared by Golder and Associates, Inc. August 2018.

State of Delaware Surface Water Quality Standards, As Amended, July 11, 2011.

Supplemental Response to USEPA Five-Year Review Report. RE: Army Creek Landfill - New Castle County, Delaware. Prepared by Ruth Associates, Inc. January 2015.

Revision 2 - Work Plan for Additional Investigation. Army Creek Landfill - New Castle County, Delaware. Prepared by Ruth Associates, Inc. July 2019.

APPENDIX B – SITE CHRONOLOGY

Table B-1: Site Chronology

Event	Date
New Castle County operated a municipal and industrial waste landfill at the former sand and gravel quarry	1960-1968
Residential well developed water quality problems in Llangollen Estates	Late 1971
PRP conducted a groundwater monitoring program and determined that leachate originating from the ACL and DS&G landfill was contaminating groundwater and moving toward downgradient receptors	1972
PRP extended water supply lines to affected residences	1970-1975
PRP installed groundwater recovery wells in the Upper Potomac Aquifer to prevent landfill leachate from reaching AWC's Llangollen well field	1973
PRP modified the groundwater recovery system with the addition of more recovery wells	1980
EPA proposed the Site for inclusion on the NPL	October 1981
EPA finalized the Site on the NPL	September 8, 1983
EPA entered into an Administrative Order on Consent with PRP to perform the OU1 FS; PRP began the OU1 FS	August 1984
PRP finalized the OU1 FS	August 21, 1986
EPA issued the OU1 ROD	September 30, 1986
EPA began the OU1 RD	March 31, 1988
EPA completed the OU1 RD	August 8, 1989
EPA began the OU2 RI/FS	August 9, 1989
EPA completed the OU2 RI/FS	February 1990
EPA issued the OU2 ROD	June 29, 1990
PRPs began the OU2 RD	October 1, 1990
PRPs completed the OU2 RD	July 23, 1991
PRPs entered into a Consent Decree with EPA and the state of Delaware to implement OU1 and OU2 remedies and implement land use and property conveyance restrictions	September 12, 1991
PRP contractors began OU1 remedial construction activities	May 11, 1992
PRP contractors began OU2 remedial construction activities	June 1, 1992
EPA, DNREC and PRPs conducted the final inspection of OU1 remedial construction activities	November 18, 1993
EPA, DNREC and the PRPs conducted the final inspection of OU2 remedial construction activities	December 21, 1993
EPA issued the Preliminary Close Out Report for OU1 and OU2 remedial construction activities	April 29, 1994
EPA approved OU1 RA Report documenting completion of OU1 remedial activities	November 1, 1994
EPA approved O&M manual	June 12, 1995
EPA approved OU2 RA Report documenting completion of OU2 remedial activities	September 29, 1995
EPA completed the first FYR	November 25, 1998
EPA completed the second FYR	September 30, 2004
PRPs initiated a pilot study to determine if rising groundwater elevations following shutdown of the ACL well field would cause new releases of contaminants to groundwater and creek. Groundwater recovery operations shifted to adjacent DS&G site.	October 2004
DNREC established a GMZ at the Site	June 2006
EPA approved County's request to terminate groundwater collection, treatment and monitoring activities	May 2009
EPA completed the third FYR	September 28, 2009
EPA completed the addendum to the third FYR	April 9, 2010
PRP abandoned wells no longer needed	April 2010
EPA completed the fourth FYR	September 8, 2014
EPA approved revised O&M plan	March 2015
PRP prepared a draft plume stability analysis	December 12, 2016
PRPs prepared a work plan for additional groundwater investigation	February 14, 2018
PRPs completed a landfill cover assessment report	November 9, 2018
PRP completed a draft work plan for additional characterization of groundwater and evaluation of vulnerability of Llangollen well field to releases from ACL western lobe	December 2018

APPENDIX C – INSTITUTIONAL CONTROLS

Figure C-1: Site Access Section of 1991 CD

validation summary reports, along with sample data and summary sheets, to the EPA Remedial Project Manager in accordance with reporting requirements to be described in the Work Plans.

XIII. SITE ACCESS

A. The County, which owns or controls access to certain portions of the properties constituting the Army Creek Landfill Site (such areas referred to hereinafter as the "Property"), is hereby ordered and hereby agrees:

1. To permit the United States, its representatives or its contractors, the State, its representatives or its contractors, the Private Settlors, the Technical Steering Committee, Prime Contractors, subcontractors and their respective representatives to enter upon the Property for the purpose of effectuating all terms of this Consent Decree;

2. Not to interfere with or disturb the Work to be performed under this Consent Decree by the Private Settlors or alter the remedial facilities constructed by the Private Settlors pursuant to this Consent Decree;

3. Not to convey any title, easement, or other interest in the Property or any portion thereof, unless such conveyance includes a covenant that: (i) permits the United States, its representatives or its contractors, the State, its representatives or its contractors, Private Settlors, the Technical Steering Committee, Prime Contractors, subcontractors and their respective representatives to enter upon the Property or portions thereof conveyed, for purposes of effectuating all

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terms of this Consent Decree; (ii) contains a binding agreement not to interfere with or disturb the Work and any future response activities (including O & M) that may be performed; and (iii) contains a binding agreement to inform any person or entity that subsequently acquires any title, easement, or other interest in the Property or any portions thereof of the requirements, conditions, and operative effect of this Section XIII (SITE ACCESS).

B. At least ninety (90) days prior to any conveyance that is subject to this Section, the County shall notify, by registered mail, the United States, the State and the other Settlors of the intent to convey any title, easement, or other interest in the Property , or any portion thereof, and of the proposed wording of the covenant required under this Section XIII (SITE ACCESS). The notice shall include the name, address and telephone number of the transferee. The restrictions and obligations set forth in this Section XIII (SITE ACCESS) shall be made to run with the land and shall be binding upon any and all persons or entities that acquire any title, easement, or other interest in the Property or any portion thereof.

C. The Private Settlors are hereby ordered and hereby agree:

1. Not to interfere with or disturb the Work to be performed under this Consent Decree by the County or alter the remedial facilities constructed by the County pursuant to this Consent Decree.

2. Within thirty days after entry of this Consent Decree, the Private Settlors and the County shall meet and develop a plan for their coordinated implementation of all construction and operation and maintenance activities associated with their respective undertaking of Work 1 or Work 2. The plan shall be framed to permit the most cost-effective implementation of both Work 1 and Work 2 consistent with the schedules for such work set forth in this Consent Decree. The plan shall not alter any of the requirements imposed under this Consent Decree.

3. Representatives of the Private Settlors and the County shall at regular intervals review this plan and make such adjustments as may be necessary to achieve the above-stated purpose of this plan.

D. In the event access is needed to property not owned or controlled by the County and such owner refuses access, the Settlors shall use their best efforts to secure voluntary access. In the event that the Settlors are unable, despite best efforts, to obtain such access at reasonable cost within thirty (30) days, they shall notify the EPA, in writing, of their failure to obtain such access, and the efforts made to obtain such access. If the Settlors have used their best efforts and failed to obtain access, and the Settlors satisfy the requirements of Section XVII (FORCE MAJEURE), failure to obtain access shall be considered a force majeure event. The Settlors shall bear all reasonable and necessary costs and expenses to obtain such access (including all costs or expenses incurred by the United States in exercising any

legal authority it may have to assist the Settlors in obtaining such access; which costs shall be considered oversight costs under Section XXII (CLAIMS AGAINST THE FUND AND PAYMENT OF RESPONSE COSTS) of this Consent Decree), except to the extent that the Court may order such costs to be paid by a person or entity other than the United States.

E. The State and the County shall cooperate to assure that the property owned or controlled by the County shall not be used in a manner inconsistent with the remedial action for Operable Units One and Two, including any wetlands or other natural resource restoration and/or preservation project required by the State of Delaware, the United States Department of the Interior, and/or the United States Department of Commerce, as a result of subsequent proceedings or settlement agreements.

F. The Settlors shall not prevent the Federal and/or State governments, or their designated representatives, from gaining access to the Site.

G. Nothing in this Section XIII (SITE ACCESS) shall limit the authority of the United States or State to enter the Site under federal or state law.

H. Any disputes concerning this Site Access provision shall be resolved via the dispute resolution procedure established by Section XVIII (DISPUTE RESOLUTION) herein. In the event of any dispute between the Private Settlors and the County concerning this Site Access provision, either the Private Settlors or the County may file a petition under Section XVIII(A)

(DISPUTE RESOLUTION) if the parties cannot resolve within five working days any such dispute.

XIV. SAMPLING AND DATA/DOCUMENT AVAILABILITY

A. The Settlors shall promptly make available to the United States the results of all sampling and/or tests or other data, including raw data, generated by the Settlors, or on their behalf, pursuant to this Consent Decree. The Settlors shall submit these results in reports as described in Section IX (REPORTING REQUIREMENTS) of this Consent Decree, and as described in the Work Plans. EPA promptly will make available to the Settlors the validated results of sampling and/or tests or other validated data similarly generated by EPA.

B. At the request of EPA, the Settlors shall allow split or duplicates samples to be taken by the United States and/or its authorized representatives of any samples collected by the Settlors pursuant to the implementation of this Consent Decree. The Settlors shall notify EPA seven (7) days in advance of any sampling activity.

C. The Settlors may assert a claim of business confidentiality covering part of the information or documentation developed in connection with this Consent Decree in the manner described in 40 C.F.R. § 2.203(b). Such claims shall be supported by documentation when the assertion is made by the Settlors in accordance with the requirements of 40 C.F.R. § 2.204(e)(4). Analytical data and other information specified in Section 104(e) of CERCLA, 42 U.S.C. § 104(e), shall not be

Figure C-2: Delaware GMZ

Memorandum of Agreement

Department of Natural Resources and Environmental Control

Between:
Division of Air and Waste Management
and
Division of Water Resources

For:

Army Creek & Vicinity
New Castle, Delaware

January 2006

SCANNED
APR 1 0 2006
File # ae 30 D4

WHEREAS, the Army Creek Landfill site (DE-0001), Army Creek Marsh site (DE-1163), Denton Landfill site (DE-0015), Industrial Products Company site (DE-0030), Former Amoco Polymer site (DE-0084), Amoco Asbestos Landfill site (DE-0083), Former Amoco Film site (DE-1152), Petrillo Property site (DE-1281), Wilson Contracting Company Landfill site (DE-0146), and the Delaware Sand & Gravel site (DE-0017) ("sites") shown in Attachment 1 have been investigated by the United States Environmental Protection Agency ("US EPA") and/or the Delaware Department of Natural Resources and Environmental Control, Site Investigation & Restoration Branch ("DNREC-SIRB"); and

WHEREAS, the findings are available in the remedial investigation ("RI") reports (or similar), and subsequent reports, which are contained within each site's administrative records; and those reports document the extent of groundwater contamination in the area of the sites; and

WHEREAS, the DNREC Division of Air and Waste Management ("DAWM") is responsible for the investigation and cleanup of hazardous substance releases in the State of Delaware; and

WHEREAS, the DNREC Division of Water Resources ("DWR") is responsible for management of the withdrawal of waters in the State of Delaware; and

WHEREAS, DNREC's intent is to formally establish a groundwater management zone ("GMZ") for the sites that is consistent with Subsections 2.2, 3.2, 3.6, 4.2, and 4.4 of Delaware's Comprehensive State Ground Water Protection Program ("CSGWPP"); and

WHEREAS, significant water bearing units in the vicinity of the sites include the Columbia and Potomac aquifers (McKenna et al., 2004 and McLaughlin et al., 2002); and

WHEREAS, the Columbia aquifer and any hydraulically interconnected Potomac aquifer units have been or have the potential for being impacted by the sites; and

WHEREAS, public drinking water wells in the Llangollen Wellfield, each screened within the Potomac Aquifer at depths ranging from 90 to 200 feet below ground surface, have documented ground-water contamination by volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and metals (DNREC 2002); and

WHEREAS, DNREC has determined that a GMZ for the Columbia aquifer and any hydraulically interconnected Potomac aquifer units underlying the sites and surrounding areas is appropriate to protect exposure of the public by way of known and/or potential groundwater contamination and for management of known and/or potential releases at the sites and surrounding areas; and

WHEREAS, the intent of this GMZ agreement is to provide administrative control aimed at minimizing the risks posed by contaminated groundwater beneath and in the vicinity of the sites and is only part of the approved final remedial actions; and

WHEREAS, DNREC determined that two GMZ Areas (Attachment 2), are appropriate for management of releases at the sites, and to protect exposure of the public by way of potential groundwater contamination; the GMZ Areas consist of the following:

- GMZ Area A: approximately from the convergence of Route 13 and Route 40/301 to the northeast along the Norfolk Southern rail line to Army Creek; southeast along Army Creek to the Delaware River; and southwest along the Delaware River to the southern boundary of the Denton Landfill property. The southern boundaries of GMZ Area A are defined by Army Creek, Grantham Lane and Route 9 to Tiger Avenue in New Castle County, as shown on Attachments 1, 2 and 3; and

- GMZ Area B: approximately from the convergence of Route 13 and Route 40/301 east-northeast along Army Creek to Grantham Lane; southwest along Route 9 to Tiger Avenue and the Denton Landfill property; and southwest along the Delaware River to Gambles Gut. The southern boundaries of GMZ Area B is generally defined by Werden Drive, tax parcels 453, 536, and 551 and a tributary Gambles Gut in New Castle County, as shown on Attachments 1, 2, and 3; and

WHEREAS, Attachment 3 shows tax parcels within the GMZ Areas; and Attachment 4 lists the tax parcel numbers of the properties affected.

NOW, THEREFORE, IT IS AGREED BY DAWM AND DWR AS FOLLOWS:

1. A GMZ shall be established to include the sites and surrounding areas as defined both in the text and on the attached maps, Attachments 1, 2 and 3.

2. No new public or domestic water supply wells will be allowed or permitted in the unconfined Columbia aquifer and any hydraulically interconnected or confined Potomac aquifer units within the GMZ Area A.

3. No new public or domestic water supply wells or non-potable wells will be allowed in the unconfined Columbia aquifer and any hydraulically interconnected Potomac aquifer units within the GMZ Area B without demonstrating that well construction will likely prevent the movement of potential contaminants into the well. The potentially contaminated groundwater will be sufficiently treated to applicable use standards; and following joint review and approval by both DWR and DAWM.

4. Monitoring, observation, and contaminant recovery wells may be installed in the GMZ Areas A and B following joint review and approval by DWR and DAWM.

5. Permits for any wells in the GMZ Areas A and B may be issued by DWR following joint review and approval by both DWR and DAWM.

This MOA may be modified or terminated only upon the agreement of both parties. Any modifications must be made in writing and signed by the Director of DAWM and the Director of DWR. A copy of this MOA will be placed within the administrative record for each of the sites.

1 Feb 2006

James D. Werner, Director
Division of Air and Waste Management
Date: _____

Kevin C. Donnelly, Director
Division of Water Resources
Date: 2/8/06

TTR:sbk
TTR05008.doc
DE 0001/0017 II H3

Attachment 1:	SIRB Sites Within GMZ For Army Creek & Vicinity
Attachment 2:	GMZ Area A & B For Army Creek & Vicinity – New Castle, Delaware
Attachment 3:	Tax Parcels Within Army Creek & Vicinity GMZ Area A & B – New Castle, Delaware
Attachment 4:	List of Tax Parcel Numbers of Properties included in the GMZ Area A & B

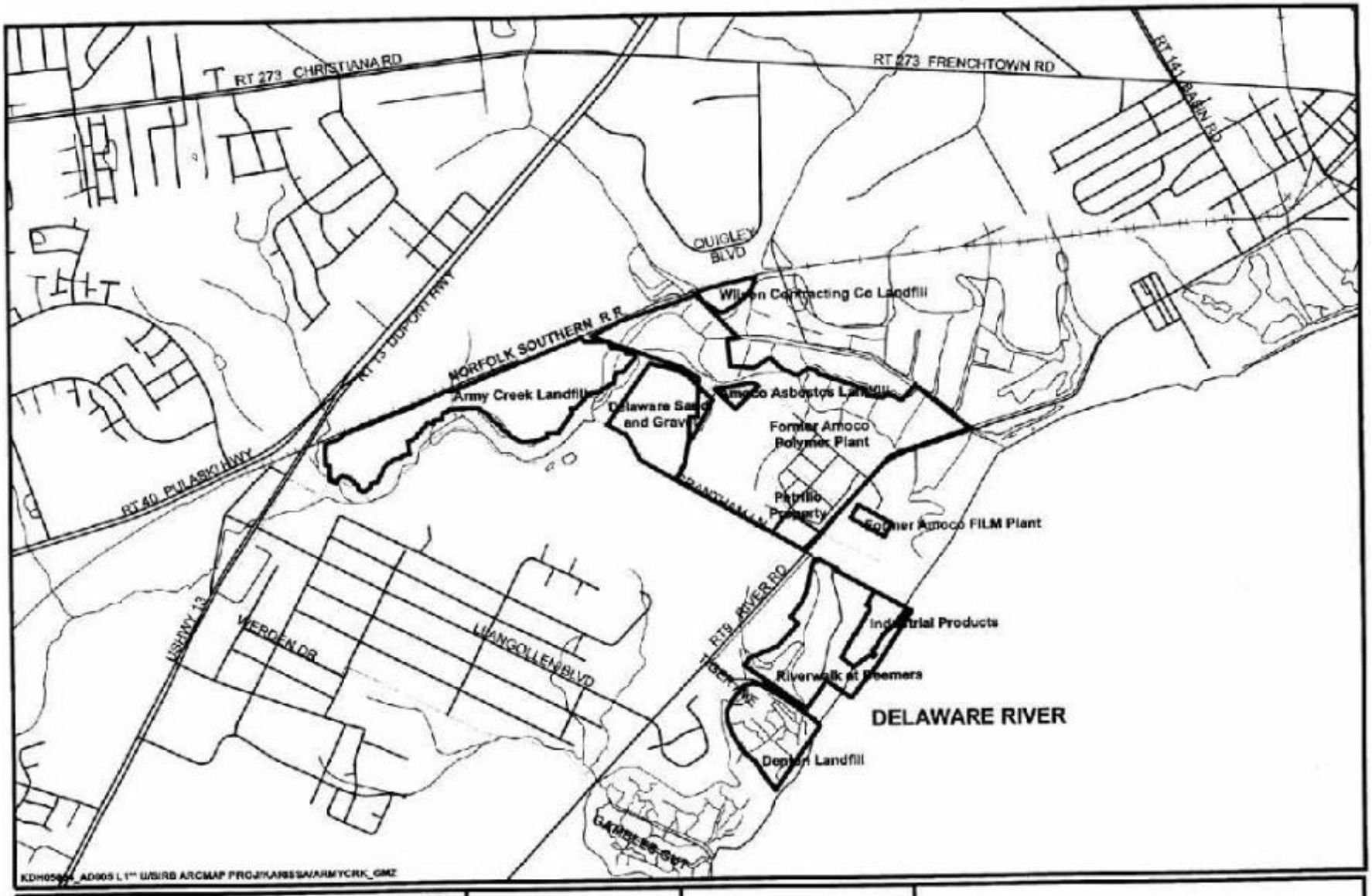
pc: Kathy Stiller Bunning, DNREC DAWM with Attachments
John Barndt, DNREC DWR with Attachments

REFERENCES

Department of Natural Resources and Environmental Control, 2002, *The Impact of Known and Suspected Contaminant Sources on Select Public Drinking Water Supplies in Delaware*, 80 p.

McKenna, T. E., McLaughlin, P. P., and Benson, R. N., 2004, *Characterization of the Potomac Aquifer, an extremely heterogeneous fluvial system in the Atlantic Coastal Plain of Delaware*, 4 p.

McLaughlin, P.P, Baxter, S.J., Ramsey, K.W., McKenna, T.E., and Strohmeier, S.A., 2002, *Results of Trenching Investigations Along the New Castle Railroad Survey-1 Seismic Line, New Castle, Delaware*, 19 p.



ARMY CREEK GMZ

AREA

A

B

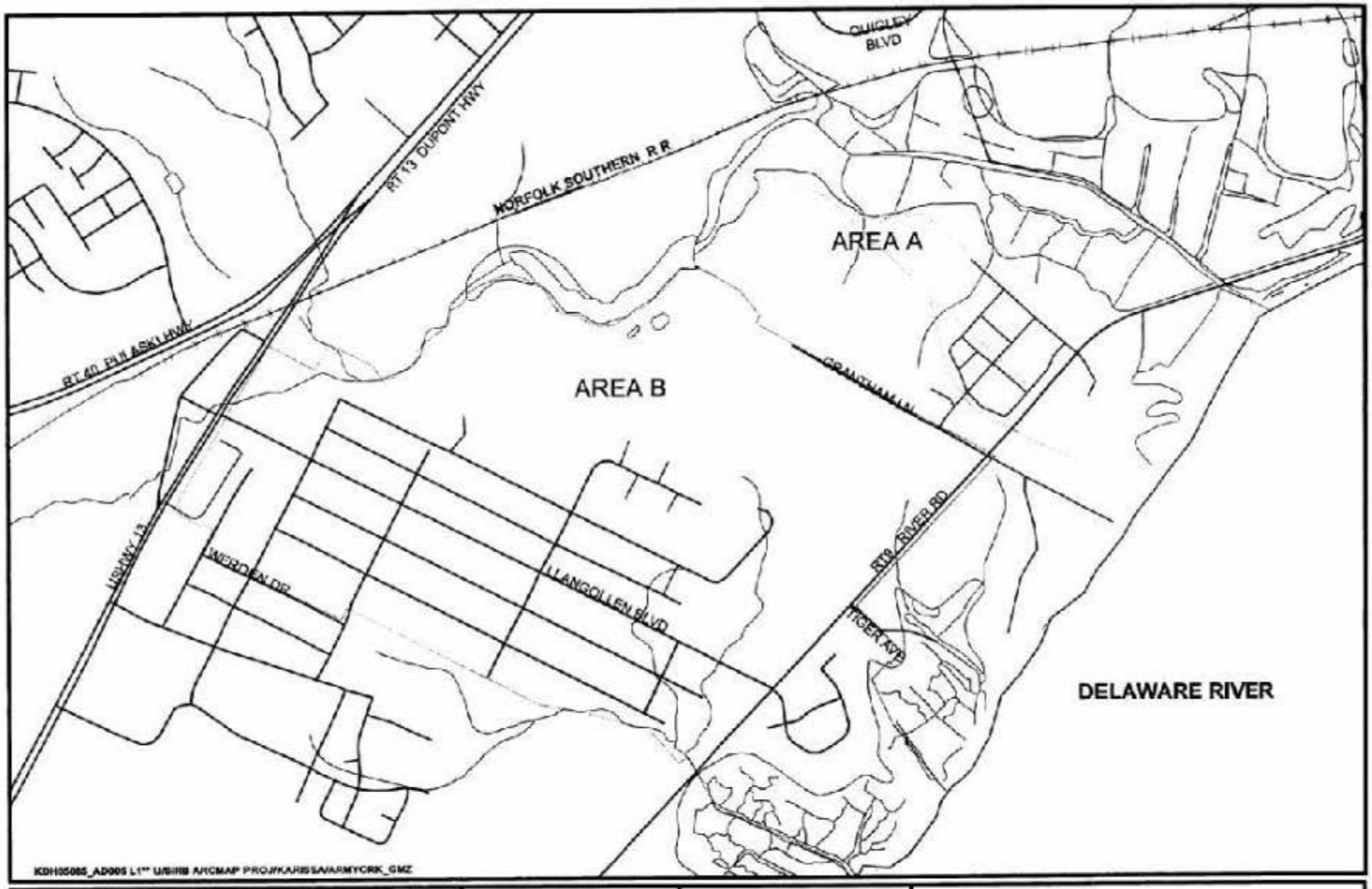
0 0.25 0.5 Miles

N

SITE INVESTIGATION & RESTORATION BRANCH
391 LUKENS DR
NEW CASTLE, DE 19720-2774
302.395.2600

This map is provided by the DNREC-SIRB solely for display and reference purposes and is subject to change without notice. DNREC-SIRB will not be held responsible for the assumed accuracy contained in the map or for use other than its intended purposes.

ATTACHMENT 1
SIRB SITES WITHIN GMZ FOR ARMY CREEK & VICINITY



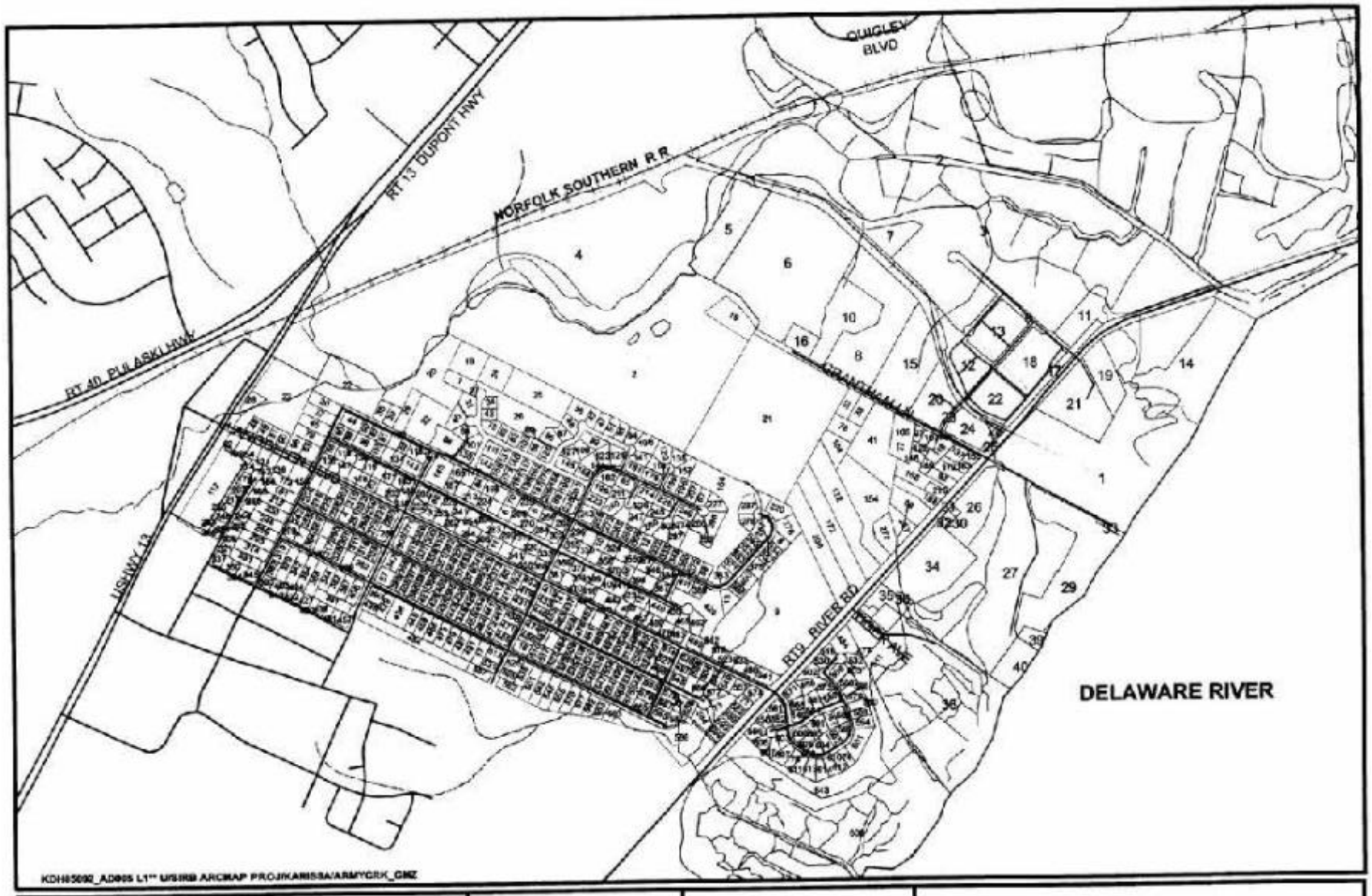
ARMY CREEK GMZ
AREA
A
B
0 0.25 0.5 Miles

N

SITE INVESTIGATION & RESTORATION BRANCH
391 LUKENS DR
NEW CASTLE, DE 19720-2774
302.395.2600

This map is provided by the DNREC-SIRB solely for display and reference purposes and is subject to change without notice. DNREC-SIRB will not be held responsible for the assumed accuracy contained in the map or for use other than its intended purposes.

ATTACHMENT 2
GMZ AREA A & B FOR
ARMY CREEK & VICINITY
NEW CASTLE, DELAWARE



ARMYCRK_PARCELS_AREA_A

NCC TAX PARCELS

ARMCRK_PARCELS_AREA_B1

0 0.25 0.5 Miles

N

SITE INVESTIGATION & RESTORATION BRANCH
391 LUKENS DR
NEW CASTLE, DE 19720-2774
302.395.2600

This map is provided by the DNREC-SIRB solely for display and reference purposes and is subject to change without notice. DNREC-SIRB will not be held responsible for the assumed accuracy contained in the map or for use other than its intended purposes.

ATTACHMENT 3
TAX PARCELS WITHIN
ARMY CREEK & VICINITY
GMZ AREA A & B
NEW CASTLE, DELAWARE

Attachment 4

List of Tax Parcel Numbers of Properties included in the GMZ Area A & B

TAX PARCELS FOR ARMY CREEK & VICINITY GMZ AREA A

Parcel ID	Map ID	Parcel ID	Map ID	Parcel ID	Map ID	Parcel ID	Map ID
1003600003	1						
1003000046	2						
1003600007	3						
1003500002	4						
1003500056	5						
1003500006	6						
1003000076	7						
1003500060	8						
1003500066	9						
1003500008	10						
1003600008	11						
1003500064	12						
1003500009	13						
1003600010	14						
1003500061	15						
1003500007	16						
1003500010	17						
1003500065	18						
1003600001	19						
1003500062	20						
1003600006	21						
1003500058	22						
1003500066	23						
1003500063	24						
1003500010	25						
1003500052	26						
1003500043	27						
1003500011	28						
1003600009	29						
1003500046	30						
1003500045	31						
1003500044	32						
1003600005	33						
1003500067	34						
1003500042	35						
1003500040	36						
1003500041	37						
1003500039	38						
1003500070	39						
1003500050	40						

TAX PARCELS FOR ARMY CREEK & VICINITY GMZ AREA B

Parcel ID	Map ID	Parcel ID	Map ID	Parcel ID	Map ID	Parcel ID	Map ID
1003510035	1	1003510068	51	1003510045	101	1004120049	151
1003500056	2	1003510022	52	1003400086	102	1004120044	152
1003530215	3	1003420002	53	1003510057	103	1003500019	153
1003530023	4	1003400085	54	1003500053	104	1003500031	154
1003530264	5	1003510012	55	1003500069	105	1003420006	155
1003530251	6	1003510058	56	1003510071	106	1003530001	156
1003440075	7	1003530111	57	1003500016	107	1003530321	157
1003540031	8	1003530241	58	1003500017	108	1003420004	158
1003500035	9	1003540019	59	1003510077	109	1003530295	159
1003530269	10	1003530073	60	1003510016	110	1003510008	160
1003530066	11	1003530018	61	1003510047	111	1003530319	161
1003530281	12	1003500022	62	1003400087	112	1003530296	162
1003540037	13	1003530004	63	1003510021	113	1003500020	163
1003530168	14	1003530259	64	1003420003	114	1003540016	164
1003530234	15	1003530305	65	1003510009	115	1003530257	165
1003530199	16	1003530217	66	1003510073	116	1003500025	166
1003530124	17	1003540011	67	1003510050	117	1003530002	167
1003500006	18	1003500028	68	1003500018	118	1003530301	168
1003510036	19	1003530289	69	1003510039	119	1003500023	169
1003510040	20	1003530262	70	1003510074	120	1003500021	170
1003500005	21	1004120011	71	1003400084	121	1003530010	171
1003510001	22	1004110019	72	1003500032	122	1003500033	172
1003400077	23	1004120004	73	1003510081	123	1003530294	173
1003510037	24	1004120031	74	1003510082	124	1003440041	174
1003510038	25	1004120037	75	1003510059	125	1003530297	175
1003510060	26	1003500054	76	1003510017	126	1003440001	176
1003510041	27	1003500014	77	1003510078	127	1003530258	177
1003400078	28	1003510054	78	1003510020	128	1003530003	178
1003510030	29	1003510005	79	1003500055	129	1003530320	179
1003510002	30	1003510013	80	1003510046	130	1003530019	180
1003510042	31	1003400081	81	1003510048	131	1003530293	181
1003510031	32	1003510025	82	1003510011	132	1003530302	182
1003500012	33	1003510069	83	1003400083	133	1003530009	183
1003510052	34	1003510044	84	1003510018	134	1003530298	184
1003510028	35	1003510055	85	1003510075	135	1003440020	185
1003510065	36	1003510032	86	1003510006	136	1003530292	186
1003510003	37	1003510063	87	1003500051	137	1003530256	187
1003500013	38	1003510014	88	1003510010	138	1003530008	188
1003510029	39	1003510061	89	1003420005	139	1003530322	189
1003510043	40	1003400082	90	1003510049	140	1003530299	190
1003500068	41	1003510024	91	1003510072	141	1003440040	191
1003510066	42	1003400102	92	1003510051	142	1003530017	192
1003510053	43	1003510056	93	1003510019	143	1003440002	193
1003510027	44	1003510070	94	1003510080	144	1003530005	194
1003510004	45	1003510062	95	1003510033	145	1003530260	195
1003400079	46	1003510015	96	1003500024	146	1003530323	196
1003510067	47	1003500015	97	1003510007	147	1003530291	197
1003510064	48	1003420001	98	1003510079	148	1003500027	198
1003400080	49	1003510076	99	1004120018	149	1003530303	199
1003510026	50	1003510023	100	1004120043	150	1003530255	200

TAX PARCELS FOR ARMY CREEK & VICINITY GMZ AREA B

Parcel ID	Map ID	Parcel ID	Map ID	Parcel ID	Map ID	Parcel ID	Map ID
1003530300	201	1003530024	251	1003530031	301	1003530088	351
1003530016	202	1003530308	252	1003530315	302	1003530039	352
1003530006	203	1003530061	253	1003530247	303	1003540023	353
1003440071	204	1003530220	254	1003440076	304	1003440077	354
1003530216	205	1003440072	255	1003530084	305	1003530272	355
1003500034	206	1003530265	256	1003530065	306	1003530069	356
1003540010	207	1003500029	257	1003530268	307	1003540033	357
1003530261	208	1003530250	258	1003440026	308	1003530243	358
1003530290	209	1003530286	259	1003530282	309	1003530227	359
1003440021	210	1003530025	260	1003530080	310	1003530277	360
1003530306	211	1003530034	261	1003530030	311	1003440030	361
1003440039	212	1003530062	262	1003530035	312	1003440132	362
1003530254	213	1003440006	263	1003530224	313	1003530075	363
1003530311	214	1003530221	264	1003440034	314	1003530089	364
1003530015	215	1003440024	265	1003530246	315	1003530109	365
1003500026	216	1003540015	266	1003530029	316	1003530044	366
1003440003	217	1003530266	267	1003530036	317	1003530273	367
1003530020	218	1003540013	268	1003530085	318	1003530070	368
1003530007	219	1003440036	269	1003440080	319	1003440031	369
1003540029	220	1003530249	270	1003530225	320	1003530242	370
1003530012	221	1003530083	271	1003440027	321	1003540022	371
1003530014	222	1003530285	272	1003530280	322	1003540018	372
1003530304	223	1003530026	273	1003530078	323	1003530074	373
1003530253	224	1003530317	274	1003530270	324	1003530228	374
1003530021	225	1003530033	275	1003530067	325	1003540034	375
1003530312	226	1003540030	276	1003530028	326	1003530090	376
1003540012	227	1003500030	277	1003530086	327	1003530108	377
1003530288	228	1003540027	278	1003530037	328	1003530091	378
1003530218	229	1003440074	279	1003440079	329	1003530229	379
1003440038	230	1003530314	280	1003530245	330	1003530107	380
1003440022	231	1003530063	281	1003440033	331	1003530146	381
1003530059	232	1003540014	282	1003540024	332	1003530042	382
1003530263	233	1003530222	283	1003530226	333	1003540021	383
1003530013	234	1003530248	284	1003540032	334	1003530275	384
1003440004	235	1003530284	285	1003530279	335	1003530104	385
1003530310	236	1003440007	286	1003530077	336	1003530114	386
1003540028	237	1003540026	287	1003440028	337	1003530238	387
1003530022	238	1003530027	288	1003530087	338	1003540036	388
1003530252	239	1003530082	289	1003530038	339	1003540039	389
1003530307	240	1003530032	290	1003530271	340	1003530134	390
1003530219	241	1003440025	291	1003530068	341	1003530049	391
1003440073	242	1003530079	292	1003440078	342	1003530072	392
1003530287	243	1003540025	293	1003530244	343	1003440081	393
1003440023	244	1003530064	294	1003530043	344	1003530240	394
1003530313	245	1003440035	295	1003440032	345	1003530092	395
1003440005	246	1003530267	296	1003530274	346	1003530106	396
1003530309	247	1003530316	297	1003530110	347	1003530041	397
1003440037	248	1003530283	298	1003530278	348	1003530112	398
1003530318	249	1003530223	299	1003530076	349	1003530230	399
1003530011	250	1003530081	300	1003440029	350	1003540035	400

TAX PARCELS FOR ARMY CREEK & VICINITY GMZ AREA B

Parcel ID	Map ID	Parcel ID	Map ID	Parcel ID	Map ID	Parcel ID	Map ID
1003530147	401	1003530047	451	1003530208	501	1004120007	551
1003530071	402	1003530165	452	1003540041	502	1004110003	552
1003440082	403	1003530172	453	1003540046	503	1004110017	553
1003530093	404	1003530049	454	1003540008	504	1004110012	554
1003530105	405	1003530236	455	1003530211	505	1004110005	555
1003530040	406	1003530098	456	1003540047	506	1004120006	556
1003530239	407	1003530048	457	1003530158	507	1004120009	557
1003530113	408	1003530119	458	1003530179	508	1004120023	558
1003530231	409	1003530130	459	1003530193	509	1004120002	559
1003530148	410	1003530164	460	1003530200	510	1004120027	560
1003530276	411	1003530154	461	1003500036	511	1004120045	561
1003440083	412	1003540040	462	1003540002	512	1004120012	562
1003530094	413	1003530173	463	1003530145	513	1004110010	563
1003440084	414	1003530120	464	1003530185	514	1004120019	564
1003530232	415	1003530237	465	1003530180	515	1004110015	565
1003530149	416	1003530129	466	1003530192	516	1004120017	566
1003530095	417	1003530163	467	1003530201	517	1004110021	567
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1003530103	420	1003500038	470	1003530181	520	1004110006	570
1003530324	421	1003530123	471	1003530191	521	1004120016	571
1003440085	422	1003530121	472	1003530202	522	1004120005	572
1003530233	423	1003530128	473	1003540004	523	1004120022	573
1003530150	424	1003530197	474	1003530182	524	1004120010	574
1003540038	425	1003530162	475	1003530210	525	1004110014	575
1003530102	426	1003530175	476	1003530212	526	1004110016	576
1003440086	427	1003500037	477	1003530184	527	1004110007	577
1003530115	428	1003530156	478	1003530190	528	1004110020	578
1003530133	429	1003530127	479	1003530203	529	1004120026	579
1003440087	430	1003530161	480	1003540042	530	1004120021	580
1003530096	431	1003530176	481	1003530144	531	1004120020	581
1003530151	432	1003530196	482	1003540045	532	1004110008	582
1003530170	433	1003530157	483	1003540005	533	1004110009	583
1003530101	434	1003540044	484	1003530189	534	1004120003	584
1003530116	435	1003530122	485	1003530204	535	1004110022	585
1003530132	436	1003530198	486	1003530209	536	1004110023	586
1003530167	437	1003530126	487	1003530143	537	1004110023	587
1003530135	438	1003530160	488	1003540007	538	1004120028	588
1003530045	439	1003530177	489	1003530187	539	1004120050	589
1003530235	440	1003530195	490	1003530206	540	1004120013	590
1003530100	441	1003530125	491	1004120001	541	1004120048	591
1003530152	442	1003530159	492	1003530207	542	1004120057	592
1003530117	443	1003530178	493	1004120056	543	1004120014	593
1003530166	444	1003530194	494	1003540009	544	1004120029	594
1003530046	445	1003540001	495	1004110018	545	1004120047	595
1003530171	446	1003530183	496	1003530186	546	1004120042	596
1003530099	447	1003530213	497	1004110011	547	1004120038	597
1003530118	448	1003540006	498	1004110004	548	1004120051	598
1003530131	449	1003530188	499	1004120008	549	1004120015	599
1003530153	450	1003530205	500	1004120024	550	1004120046	600

TAX PARCELS FOR ARMY CREEK & VICINITY GMZ AREA B

Parcel ID	Map ID	Parcel ID	Map ID	Parcel ID	Map ID	Parcel ID	Map ID
1004120030	601						
1004120052	602						
1004120039	603						
1004120053	604						
1004120055	605						
1004120041	606						
1004120040	607						
1004120054	608						
1004100004	609						
1004120032	610						
1004120036	611						
1004120033	612						
1004120035	613						
1004120034	614						

APPENDIX D – PRESS NOTICE

EPA PUBLIC NOTICE

EPA Reviews Cleanup
ARMY CREEK LANDFILL SUPERFUND SITE

The U.S. Environmental Protection Agency (EPA) is reviewing the cleanup that was conducted at the Army Creek Landfill Superfund Site located in New Castle, DE. EPA inspects Sites regularly to ensure that cleanups conducted remain protective of public health and the environment. EPA's previous review of the site in 2014 concluded that the remedy was working as intended and did not identify any issues that affected the short-term protectiveness of the remedy. Findings from the current review will be available in September 2019.

To access detailed site information including the Review Report once finalized:
https://www.epa.gov/superfund/armycreek

For questions or to provide site-related information for the review: Contact Meg Keegan, EPA Community Involvement Coordinator at 215-814-5494 or keegan.megan@epa.gov.

APPENDIX E – INTERVIEW FORMS

Army Creek Landfill Superfund Site Five-Year Review Interview Form

Site Name: **Army Creek Landfill** **EPA ID No.:** **DED980494496**
Interviewer Name: **Andrew Wynne** **Affiliation:** **EPA**
Subject Name: **Michele Ruth** **Affiliation:** **New Castle County consultant Ruth Associates**
Time: **12:30 p.m.** **Date:** **2/5/2019**
Interview Location: **Army Creek Landfill Superfund Site**
Interview Format (circle one): **In Person: X** **Phone** **Mail** **Other:**

Interview Category: **Site Owner/Local Authority**

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   There has been huge progress made with the groundwater and the cap. There has been discussion to do other reuse with the cap but no real movement on that. Potentially athletic fields or solar panels. Currently it supports wildlife.

2. What is your assessment of the current performance of the remedy in place at the Site?

   It is 100 percent effective.

3. What is the scope and frequency of New Castle County's monitoring, inspection and reporting activities at the Site?

   We monitor groundwater semiannually and surface water and sediment every five years. There will be quarterly groundwater monitoring for the lobe investigation once those wells are installed.

4. How is the site property being used? Are site reuse activities compatible with the site remedy? How?

   The property is currently used by wildlife for habitat, which is great because the surrounding area has been developed. Other uses could be a park or athletic fields in the future.

5. Are you aware of any complaints of inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?

   No. The only issue is the contaminated groundwater flowing toward the Artesian Water Company wells, but we are investigating that.

6. Are you aware of any events, incidents or activities at the Site such as vandalism, trespassing or emergency response from local authorities? If so, please provide details.

   No. Our maintenance responsibility is for the wells, and we have had no issues with them.

7. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?

   Yes.

8. Are you aware of any changes in projected land use(s) at the Site?

   No.

9. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   No.

10. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

    Yes.

Army Creek Landfill Superfund Site Five-Year Review Interview Form

Site Name: Army Creek Landfill **EPA ID No.:** DED980494496
Interviewer Name: Andrew Wynne **Affiliation:** EPA
Subject Name: Beth Klotzbach **Affiliation:** Project Engineer, Army Creek Landfill Technical Steering Committee
Time: 12:45 p.m. **Date:** 2/5/2019
Interview Location: Army Creek Landfill Superfund Site
Interview Format (circle one): In Person X Phone Mail Other:

Interview Category: O&M Contractor

1. What is your assessment of the current performance of the remedy in place at the Site?

   It has not changed. The cap is currently performing as it has. There is no failure of the capping system.

2. What is the scope and frequency of site inspection and maintenance activities?

   There are monthly site inspections where I drive through and observe the cap vegetation, evidence of trespassing, the stormwater drains, and the sedimentation ponds. If I see something that requires maintenance, we repair it. I have also had to address occasional dumping on the roads, which occurs on occasion if the County has left the gate open.

3. Have there been any significant changes in site O&M requirements or inspection and maintenance schedules in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

   The only change has been to the mowing frequency, which is now one third of the site every year.

4. Are there currently any maintenance checklist items that need to be addressed? If so, please provide details, including the time frame for completing maintenance activities.

   We need to add stone to the access road to fill in ruts and fix some fence holes.

5. Are you aware of any events, incidents or activities at the site such as vandalism, trespassing or emergency response from local authorities? If so, please provide details.

   There have been dirt bikers and hunters trespassing on the site. I have seen dirt bike tracks and deer stands.

6. Do you have any comments, suggestions or recommendations regarding the inspection and maintenance activities and schedules at the Site?

   No, the only issue is the mowing schedule. We could better maintain the woody brush under a different mowing schedule.

7. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

   Yes.

Army Creek / Delaware Sand & Gravel Landfill
Superfund Sites
Five-Year Review
Interview Questions

Respondent:
Joseph A. DiNunzio, Executive Vice President
Artesian Water Company, Inc.
Newark, Delaware

February 15, 2019

Interview Category: Public Water Supplier

1. Are you familiar with the Five-Year Review process?

   Yes.

2. Do you think that the site's contamination impacts public perception of water safety in this local area? If yes, how?

   Yes. There is continued heightened community and media concern with regard to what might be present in the raw water, the effectiveness of the treatment before water is delivered to residents, the need for reassurance that raw and finished water quality is effectively monitored, and that all involved (EPA, DNREC, the identified responsible parties and Artesian) are fully engaged and working cooperatively. For its part, Artesian attempts to address these matters by educating its customers and the general public about water quality and treatment as part of its customer information and community relations programs.

3. How does the contamination affect Artesian's profitability and ability to serve its customers?

   The additional capital and operating costs to ensure proper treatment of contaminants before water is delivered to customers is currently being borne by all Artesian customers in Delaware without any recovery of those costs from the responsible parties. Because of the need for several types of treatment (iron and manganese filtration, ultraviolet light advanced oxidation process, and granular activated carbon), the cost of water from Artesian's Llangollen wellfield is now the highest among Artesian's sources.

   In accordance with the way the Delaware Public Service Commission sets utility rates, these capital and operating costs are incorporated into the rates that Artesian's customers must pay. If the Delaware Public Service Commission refused to include any of these costs in customer rates, there would be a dollar for dollar reduction in revenues and profitability for Artesian. Also, a protracted loss of the use of the Llangollen wellfield could result in other costs, such as increased purchased water expense.

   From an operational perspective, Artesian's New Castle County, Delaware water system fortunately has multiple sources of supply and several interconnections with neighboring utilities that allow for

temporary periods during which the Llangollen wellfield is out of service. However, the Llangollen wellfied is critical to the long-term water supply for Artesian's customers, providing as much as 15% of total supply to our northern New Castle County, Delaware system and including an aquifer storage and recovery well.

4. What mechanism(s) exist to compensate Artesian for its losses associated with the site?

   In the most recent Record of Decision, Artesian was recognized as due compensation for the capital and operating costs incurred for treatment of BCEE, 1,4-dioxane, and manganese contaminants. Artesian is currently completing construction of treatment for manganese, which is expected to be in service in the second quarter of 2019. This additional treatment was necessary because levels of manganese in Artesian's Llangollen wellfield continue to rise and will soon exceed the secondary drinking water standard. The levels have risen in accordance to what both Artesian's and Delaware Sand and Gravel Trust's (DS&G Trust) hydrogeologists anticipated. Though Artesian is due compensation, the responsible parties (New Castle County, Army Creek Settlors and the DS&G Trust) have not been able to agree upon the allocation of costs, particularly concerning manganese, which has only further delayed Artesian, and thus our customers, being made whole.

   It remains unclear and uncertain as to when and how Artesian will be compensated for historical capital and operating costs and the on-going operational costs associated with its granular activated carbon and ultraviolet advanced oxidation treatment systems, which are required to remove contaminants originating from the site.

   It is critical that the responsible parties (DS&G Trust, Army Creek Settlors and New Castle County) be held accountable for making Artesian's customers financially whole. To date, Artesian's customers have borne the capital and operating costs for the treatment required at the Llangollen wellfield even though the responsible parties created the need for treatment.

5. How has EPA's communication about the Site been?

   Communication has improved compared to five and more years ago. EPA Staff have responded to inquiries and concerns as they have been raised. Most notable has been the active on-going communication provided by the DS&G Trust. Regular communication with the DS&G Trust provides Artesian much greater comfort that we will be aware of potential matters of concern sufficiently in advance to take appropriate actions, rather than being forced to shut down the wellfield until treatment can be installed for a newly detected contaminant that has reached our wellfield.

6. Do you have any comments, suggestions or recommendations regarding the project?

   Artesian remains frustrated by the length of time required for decisions and actions within the Superfund process. For instance, upon the parties recognizing that high levels of manganese and iron were migrating towards Artesian's Llangollen wellfield, Artesian requested timely installation of interceptor wells between the landfill sites and Artesian's wellfield. If installed expeditiously, the concentrations of manganese and iron reaching Artesian's wellfield may have been mitigated or the length of time that treatment will be required at the Llangollen wellfield may have been shortened. Over two years has passed since Artesian's request, and the installation of interceptor wells is still in

the approvals and assessment stage, rather than accomplished. Meanwhile, Artesian has moved forward with installing new treatment that will be in service in the second quarter of 2019.

7. What have been the positive impacts of EPA's actions over the past 15 years?

   There has been improved communication among the parties (EPA, DNREC, DS&G Trust and Artesian) since the last five year review, particularly between the DS&G Trust and Artesian, which provides greater assurance that matters are detected, discussed and addressed before any threat to drinking water quality results; and there has been recognition of the importance of including Artesian in the process. Prior to then, Artesian too often learned of matters of concern as a result of the detection of a contaminant that had migrated to its wellfield. The full protection of our customers is our primary concern, and it is critical that Artesian is included in all discussions with regard to matters arising at the Superfund sites and any proposed actions to be taken.

8. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

   Yes.

APPENDIX F – SITE INSPECTION CHECKLIST

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Army Creek Landfill	**Date of Inspection:** 2/5/2019
Location and Region: New Castle, DE; Region 3	**EPA ID: DED980494496**
Agency, Office or Company Leading the Five-Year Review: EPA	**Weather/Temperature:** 60s and sunny

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment (no longer active)
- ☐ Surface water collection and treatment
- ☐ Other: _____
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** Beth Klotzbach (Name) | Project Engineer, Army Creek Landfill Technical Steering Committee (Title) | 2/5/19 (Date)

   Interviewed ☒ at site ☐ at office ☐ by phone Phone: _____

   Problems, suggestions ☐ Report attached: See Appendix E

2. **O&M Staff** _____ (Name) | _____ (Title) | _____ (Date)

   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____

   Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency New Castle County consultant Ruth Associates
   Contact Michele Ruth (Name) | Professional Engineer (Title) | 2/5/19 (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: See Appendix E

   Agency _____
   Contact _____Name | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached:_____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached:_____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone No.
Problems/suggestions ☐ Report attached:_____

4. **Other Interviews** (optional) ☐ Report attached: _____

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

2. **Site-Specific Health and Safety Plan**	☐ Readily available	☐ Up to date	☒ N/A
☐ Contingency plan/emergency response plan	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

3. **O&M and OSHA Training Records**	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits: _____	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

5. **Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

6. **Settlement Monument Records**	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

7. **Groundwater Monitoring Records**	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

8. **Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for state

☐ PRP in-house ☒ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☒ Readily available ☒ Up to date

☐ Funding mechanism/agreement in place ☐ Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: Date	To: Date	Total cost	
From: 1/1/2014	To: 12/31/2014	27,056.51	☐ Breakdown attached
From: 1/1/2015	To: 12/31/2015	30,258.39	☐ Breakdown attached
From: 1/1/2016	To: 12/31/2016	18,452.74	☐ Breakdown attached
From: 1/1/2017	To: 12/31/2017	20,483.35	☐ Breakdown attached
From: 1/1/2018	To: 12/31/2018	21,436.69	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks: Fencing generally in good condition; some holes encountered that O&M contractor will address.

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☐ N/A

Remarks: There is a sign at the entrance indicating this property is a Superfund site.

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): _____

Frequency: _____

Responsible party/agency: _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☐ Yes ☐ No ☒ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☒ N/A

Violations have been reported ☐ Yes ☒ No ☐ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: _____

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☐ No vandalism evident

Remarks: Some trespassing evident in the form of dirt bike tracks and beer cans left on site. This trespassing does not appear to affect the protectiveness of the remedy as remedial components are not affected.

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

3. **Land Use Changes Off Site** ☒ N/A

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: _____

B. Other Site Conditions

Remarks: _____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (low spots) ☐ Location shown on site map ☐ Settlement not evident

Area extent: Some settlement evident in locations previously identified; these areas are being monitored. Depth: _____

Remarks: _____

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident

	Lengths: _____	Widths: _____	Depths: _____
	Remarks: _____		
3.	**Erosion**	☐ Location shown on site map	☒ Erosion not evident
	Area extent: _____		Depth: _____
	Remarks: _____		
4.	**Holes**	☐ Location shown on site map	☒ Holes not evident
	Area extent: _____		Depth: _____
	Remarks: _____		
5.	**Vegetative Cover**	☒ Grass	☒ Cover properly established
	☐ No signs of stress	☒ Trees/shrubs (indicate size and locations on a diagram)	
	Remarks: Vegetative cover is well established on site. There is some woody vegetation that looks potentially too large. During the inspection, the group discussed altering the mowing period.		
6.	**Alternative Cover** (e.g., armored rock, concrete)		☒ N/A
	Remarks: _____		
7.	**Bulges**	☐ Location shown on site map	☒ Bulges not evident
	Area extent: _____		Height: _____
	Remarks: _____		
8.	**Wet Areas/Water Damage**	☐ Wet areas/water damage not evident	
	☒ Wet areas	☐ Location shown on site map	Area extent: _____
	☒ Ponding	☐ Location shown on site map	Area extent: _____
	☐ Seeps	☐ Location shown on site map	Area extent: _____
	☐ Soft subgrade	☐ Location shown on site map	Area extent: _____
	Remarks: Some ponding evident in the western part of the cap; see site inspection photographs for more details.		
9.	**Slope Instability**	☐ Slides	☐ Location shown on site map
	☒ No evidence of slope instability		
	Area extent: _____		
	Remarks: _____		
B. Benches		☐ Applicable	☒ N/A
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		
2.	**Bench Breached**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		
3.	**Bench Overtopped**	☐ Location shown on site map	☐ N/A or okay

Remarks: _____

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ No evidence of settlement
   Area extent: _____ Depth: _____
   Remarks: _____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
   Material type:_____ Area extent: _____
   Remarks: _____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
   Area extent: _____ Depth: _____
   Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
   Area extent: _____ Depth: _____
   Remarks: _____

5. **Obstructions** Type: _____ ☐ No obstructions
   ☐ Location shown on site map Area extent: _____
   Size: _____
   Remarks: _____

6. **Excessive Vegetative Growth** Type: _____
   ☐ No evidence of excessive growth
   ☐ Vegetation in channels does not obstruct flow
   ☐ Location shown on site map Area extent: _____
   Remarks: _____

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☒ Passive
   ☐ Properly secured/locked ☒ Functioning ☐ Routinely sampled ☒ Good condition
   ☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
   Remarks: _____

2. **Gas Monitoring Probes**
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
   Remarks: _____

3. **Monitoring Wells** (within surface area of landfill)
   ☐ Properly secured/locked ☒ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

4. **Extraction Wells Leachate**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

5. **Settlement Monuments** ☒ Located ☒ Routinely surveyed ☐ N/A

Remarks: _____

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Gas Collection Wells, Manifolds and Piping**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs maintenance ☐ N/A

Remarks: _____

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A

Remarks: _____

2. **Outlet Rock Inspected** ☒ Functioning ☐ N/A

Remarks: Outlet rocks were in place.

G. Detention/Sedimentation Ponds ☒ Applicable ☐ N/A

1. **Siltation** Area extent: _____ Depth: _____ ☐ N/A

☐ Siltation not evident

Remarks: _____

2. **Erosion** Area extent: _____ Depth: _____

☐ Erosion not evident

Remarks: _____

3. **Outlet Works** ☐ Functioning ☐ N/A

Remarks: _____

4. **Dam** ☐ Functioning ☐ N/A

Remarks: _____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident

Horizontal displacement: _____ Vertical displacement: _____

Rotational displacement: _____

Remarks: _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident

Remarks: _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A

☐ Vegetation does not impede flow

Area extent: _____ Type: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident

Area extent: _____ Depth: _____

Remarks: _____

4. **Discharge Structure** ☐ Functioning ☐ N/A

Remarks: _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Performance Monitoring** Type of monitoring: _____

☐ Performance not monitored

Frequency: _____ ☐ Evidence of breaching

Head differential: _____

Remarks: _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps and Pipelines ☐ Applicable ☒ N/A (system no longer operating)

1. **Pumps, Wellhead Plumbing and Electrical**

☐ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps and Electrical**

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

C. Treatment System ☐ Applicable ☒ N/A (system no longer operating)

1. **Treatment Train** (check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☐ Carbon adsorbers

☐ Filters: _____

☐ Additive (e.g., chelation agent, flocculent): _____

☐ Others: _____

☐ Good condition ☐ Needs maintenance

☐ Sampling ports properly marked and functional

☐ Sampling/maintenance log displayed and up to date

☐ Equipment properly identified

☐ Quantity of groundwater treated annually: _____

☐ Quantity of surface water treated annually: _____

Remarks: _____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☐ N/A ☐ Good condition ☐ Needs maintenance

Remarks: _____

5. **Treatment Building(s)**

☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair

☐ Chemicals and equipment properly stored

Remarks: _____

6. **Monitoring Wells** (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

D. Monitoring Data

1. **Monitoring Data**

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring Data Suggests:**

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☒ N/A

Remarks: _____

X. OTHER REMEDIES

If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).

The remedy appears to be generally functioning as designed. Contaminated soil has been capped, and the cap appears functional. Some differential settlement was detected and is being monitored. An alternate mowing schedule may be needed to address the growth of large woody vegetation and is being discussed. There is some trespassing on site, but it does not appear to be negatively affecting the remedy. The groundwater treatment system operated for years and stopped operation in 2004 because cleanup goals were met. Institutional controls are in place. Groundwater investigations are ongoing for the area downgradient of the western lobe of the ACL.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M appears adequate with the exception of mowing. The mowing schedule may need to be revised to prevent the growth of woody vegetation.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

There are no early indicators of potential remedy problems.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

There are no opportunities for optimization.

APPENDIX G – SITE INSPECTION PHOTOS

Gated entrance to the Site (gate is normally locked)

Sign on the main site entrance gate

Looking northeast across the sedimentation trap

Looking northeast across the western end of the landfill

One of many praying mantis egg cases on landfill vegetation

Looking west across the landfill with landfill access road on right

Dirt bike tracks on the landfill access road

Landfill area with standing water

Large woody vegetation on the eastern end of the landfill

Looking southwest along Army Creek from the eastern end of the landfill

Evidence of beaver activity near the eastern end of the landfill

APPENDIX H – DETAILED DATA ANALYSIS

Figure H-1: Iron Concentration Trends in Boundary Wells[7]

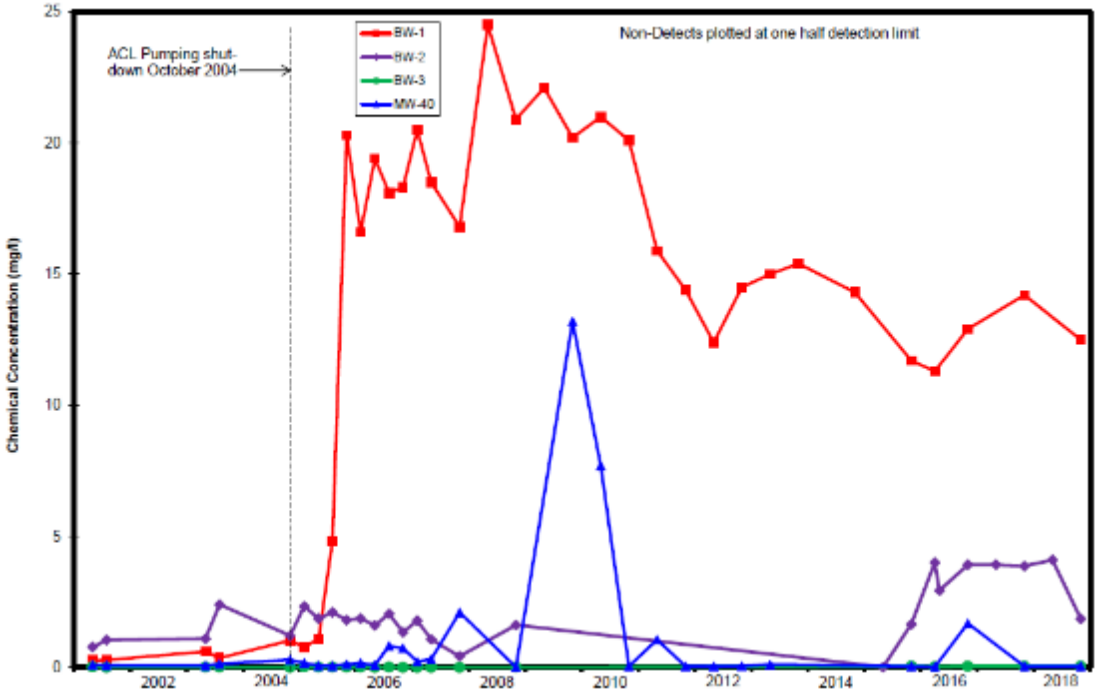
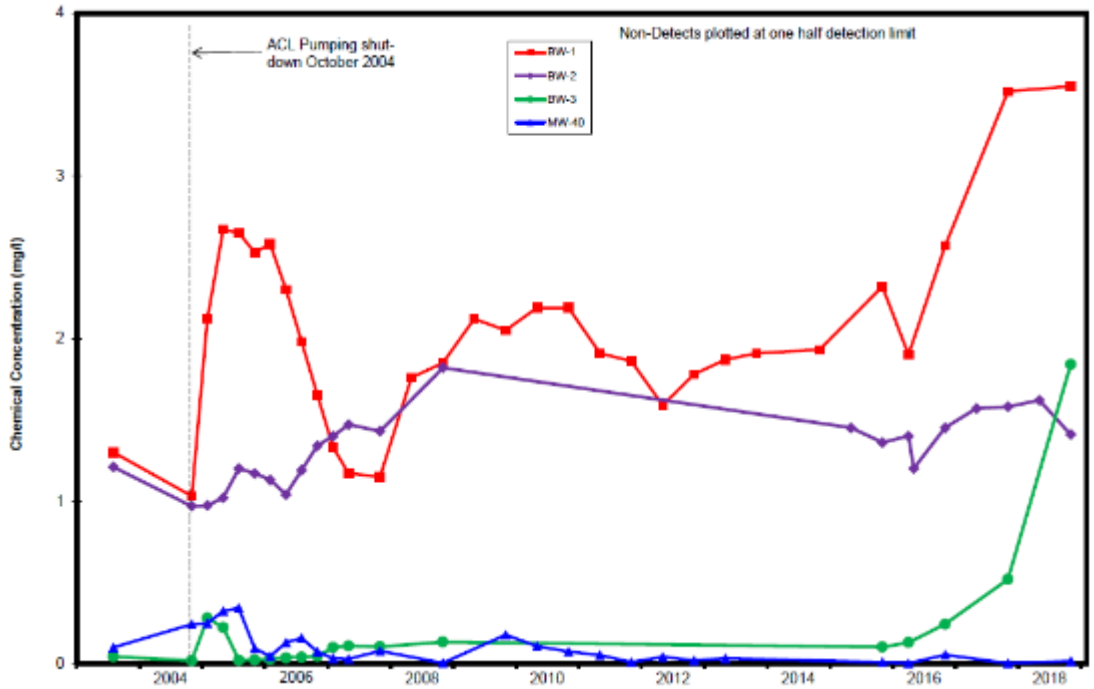


Figure H-2: Manganese Concentration Trends in Boundary Wells



[7] Trend figures are from the Post-Remedial Monitoring Report, October 2018 Event, Ruth Associates, Inc.

Figure H-3: Iron Concentration Trends in Downgradient Well P-4

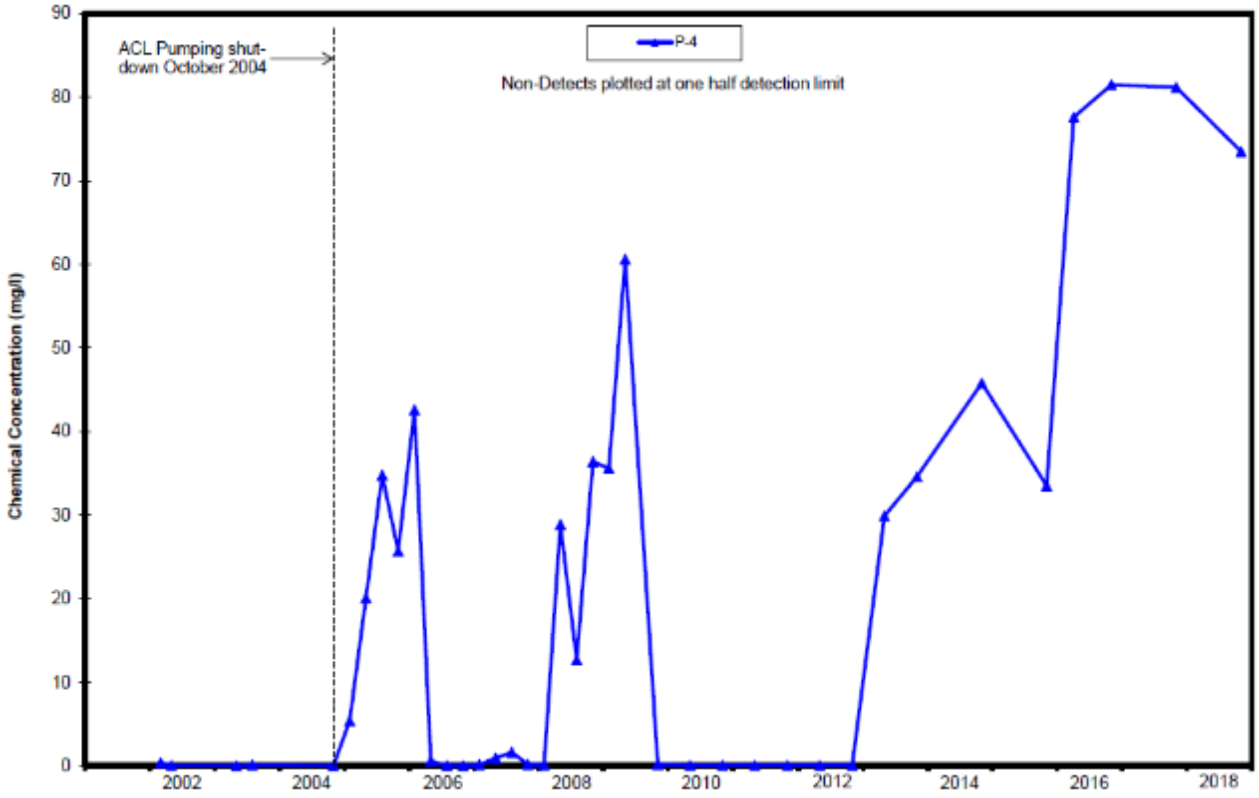
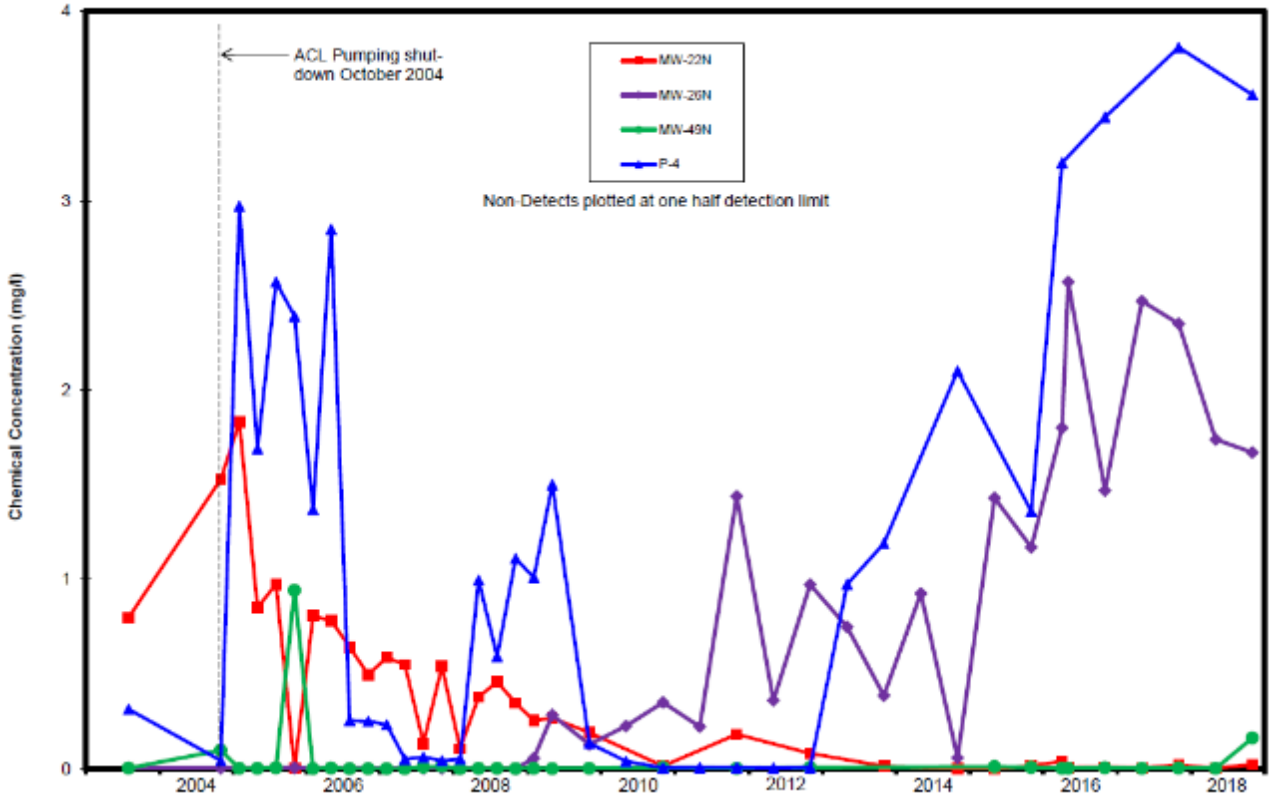


Figure H-4: Manganese Concentration Trends in Downgradient Wells



Other notable detections of contaminants were identified in boundary wells and monitoring wells downgradient of the ACL and DS&G sites. 1,2-DCA was detected above the primary drinking water standard of 5 µg/L in well P-4 located downgradient of the western lobe of the landfill starting in October 2013 (8.1 µg/L). Concentrations have increased up to 16 µg/L in October 2017 with a slight decrease in October 2018 to 13 µg/L. In addition, as part of the semiannual monitoring of the DS&G Site, emerging contaminants PFOA and PFOS (not included as site contaminants in the CD) were detected in 2016 at levels above EPA's health advisory of 70 parts per trillion (ppt, equivalent to nanograms per liter (ng/L)) in ACLs wells (Table H-2).[8] PFOA and PFOS were detected individually and combined in recovery wells next to the landfill, boundary wells, and downgradient wells as seen below in Table H-2.

Table H-2: Summary of 2016 PFOA/PFOS Health Advisory Exceedances in Groundwater (ng/L)

Emerging Contaminant[9]	Recovery Wells		Boundary Wells		Downgradient Wells					
	MW-29	MW-31	BW-1	BW-2	P-4	P-5U	P-6	MW-18	MW-26N	MW-34
PFOA	**130 (dup)**	**190**	**130**	**83**	**170**	**76**	**140**	**150**	**87**	66
PFOS	**130**	**100**	18	17	28	<5	21	47	11	14
Total PFOA+PFOS	**260**	**290**	**148**	**100**	**198**	**76**	**161**	**197**	**98**	**80**

Notes:
Bold - individual PFOA or PFOS concentration, or combined PFOA and PFOS concentration exceeds health advisory of 70 ng/L.
Source: EPA Memorandum to New Castle County Department of Special Services and the ACL Remedial Trust, dated September 28, 2017.
< = not detected above reporting detection limit

[8] Health advisory fact sheet accessed 4/18/19 at: https://www.epa.gov/sites/production/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf
[9] Contaminants that EPA has identified that had not previously been detected (or were previously found in far lesser concentrations) that are discovered in water supplies and are not well understood from a toxicological or environmental chemistry standpoint.

APPENDIX I – DETAILED ARARS REVIEW

Groundwater

The 1991 CD established the national primary drinking water standards as the chemical-specific groundwater ARARs for site COCs. As shown below, several primary drinking water standards have changed since 1991. Many have become more stringent, while some have become less stringent than what was established in 1991. In July 2007, EPA approved the discontinuation of analyzing for pesticides, herbicides and metals (except for iron and manganese) in groundwater, so the changes in these drinking water standards are not relevant. For contaminants still analyzed, the monitoring reports use the most current drinking water standard except for trihalomethanes. The reports continue to use the 1991 drinking water standard, which is less stringent than today's standard. Although groundwater is treated by AWC to meet current federal and state drinking water standards, it is recommended that current standards be used to interpret monitoring data.

Table I-1: Groundwater ARAR Review

Contaminant	1991 Drinking Water Standard[a] (mg/L)	Current Drinking Water Standard (mg/L)	Change
Metals			
Arsenic	0.05	0.010	More stringent
Barium	1	2	Less stringent
Cadmium	0.010	0.005	More stringent
Chromium	0.05	0.1	Less stringent
Lead	0.05	0.015	More stringent
Mercury	0.002	0.002	None
Nitrate (as N)	10	10	None
Selenium	0.01	0.05	Less stringent
Silver	0.05	NA	Withdrawn
Volatile Organics			
Total trihalomethanes	0.10	0.080	**More stringent**
Benzene	0.005	0.005	None
Vinyl chloride	0.002	0.002	None
Carbon tetrachloride	0.005	0.005	None
1,2-DCA	0.005	0.005	None
TCE	0.005	0.005	None
1,1-DCE	0.007	0.007	None
1,1,1-Trichloroethane	0.20	0.20	None
1,4-Dichlorobenzene	0.075	0.075	None
Pesticides			
Endrin	0.0002	0.002	Less stringent
Lindane	0.004	0.0002	More stringent
Methoxychlor	0.1	0.04	More stringent
Toxaphene	0.005	0.003	More stringent
2,4-D (2,4-Dichlorophenoxyacetic acid)	0.1	0.07	More stringent
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid)	0.01	0.05	Less stringent

Notes:

a. Primary drinking water standards to be met at the boundary wells as specified in the 1991 CD, Exhibit 4 Army Creek Remediation Scope of Work-2, Section 6.2 Implementation.

b. Federal and state primary MCLs available at https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations (last accessed 3/20/2019).

Bold = contaminant still analyzed for and currently compared to outdated standard in monitoring reports

mg/L = milligrams per liter

Surface Water

The OU2 ROD established a chemical-specific ARAR of 1,000 µg/L for iron based on the Delaware Surface Water Quality Criteria for the protection of aquatic life. As outlined in the OU2 ROD, if the treated groundwater effluent discharge concentrations met the 1,000 µg/L criterion, then the effluent would be protective of the aquatic environment. The state surface water regulations were reviewed and the surface water quality criteria for iron has not changed.[10]

[10] Delaware water quality criteria for the protection of aquatic life (Section 4.5.9.3.1 Aquatic Life Criteria) were accessed on 3/20/2019 at http://regulations.delaware.gov/AdminCode/title7/7000/7400/7401.shtml

APPENDIX J – SCREENING LEVEL RISK EVALUATION

Table J-1: Screening-Level Risk Evaluation of Contaminants Detected in Boundary Wells in 2018

Contaminant	Maximum Boundary Well Concentration (µg/L)[a]	Tap Water RSLs[b]		Cancer Risk[c]	Noncancer HQ[d]
		Risk-Based	Noncancer HQ=1		
BCEE	0.30 J	0.014	-	2×10^{-5}	NA
Chlorobenzene	6.1	-	78	NA	0.08
1,4-Dichlorobenzene	1.5	0.48	570	3×10^{-6}	0.003
1,4-Dioxane	2.4	0.46	57	5×10^{-6}	0.04
Cobalt	29.4	-	6	NA	**5**
Iron	12,500	-	14,000	NA	0.9
Manganese	3,550	-	430	NA	**8**

Notes:

a. The maximum concentrations were detected in boundary well BW-1 in October 2018.

b. RSLs obtained from EPA's website https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables (accessed 2/27/2019)

c. The cancer risks were calculated using the following equation, since RSLs are derived based on 10^{-6} risk: cancer risk = (maximum concentration ÷ cancer RSL) × 10^{-6}.

d. Noncancer HQs were calculated using the following equation and reported as one significant figure as per EPA risk assessment guidance: HQ = maximum concentration ÷ RSL.

µg/L = micrograms per liter

J = estimated concentration

Bold = exceeds HQ of 1

NA – not applicable; a carcinogenic or noncarcinogenic screening level is not available for this COC.

- = toxicity value not established by EPA

APPENDIX K – HISTORICAL MONITORING DATA

Table K-1: Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek Landfill and DSG Landfill. Source: Post Remedial Monitoring Report Army Creek Landfill, October 2018, Ruth Associates, Inc.

Table K-2: Summary of Surface Water Quality Data for Army Creek and Army Pond. Source: Post Remedial Monitoring Report Army Creek Landfill, October 2017, Ruth Associates, Inc.

Table K-3: Summary of Sediment Data for Army Creek and Army Pond. Source: Post Remedial Monitoring Report Army Creek Landfill, October 2017, Ruth Associates, Inc.

Table K-4: September-October 2016 Semi-Annual Monitoring Program – Summary of Detected Perfluorinated Chemicals. Source: "Re: Army Creek Landfill Superfund Site, New Castle, Delaware" Letter, September 2017, EPA.

Table K-1: Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek Landfill and DSG Landfill.

Table 2

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	RW-10																		
	6/93	6/94	6/95	6/96	6/97	6/98	6/99	7/00	10/00	12/00	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03
Non-Halogenated VOCs **(mg/l)**																			
Benzene	5 U	5 U	0.2 J	0.2 J	0.5 U	0.2 J	0.1 J	0.5 U	--	--	0.2 J	0.2 J	--	--	--	0.5 U	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	0.2 B	0.5 J	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--
Xylene (total)	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--
2-Butanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Halogenated VOCs **(mg/l)**																			
Bromoform	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--
Carbon Tetrachloride	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	0.5 U	--	--	--	0.5 U	--	--	--
Chlorobenzene	--	--	--	--	--	--	--	--	--	--	0.4 J	0.3 J	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--	--	--	--	1 U	0.2 J	--	--	--	--	--	--	--
Chloromethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--
Dibromochloromethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--
1,2-Dichloroethane	55	28	18	19	0.5 U	3.8	3.8	5.1	--	--	4	3	--	--	--	6	--	--	--
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	2 U	2 U	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--
1,4-Dichlorobenzene	5 U		0.5 U	0.2 J	0.5 U	0.1 J	0.1 J	0.5 U	--	--	0.1 B	0.2 J	--	--	--	0.5 U	--	--	--
Chloroethane	--	--	--	--	--	--	--	--	--	--	1 U	0.1 UJ	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	7	6	--	--	--	--	--	--	--
1,1,1-Trichloroethane	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--
Trichloroethene	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--
Vinyl Chloride	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi-Volatiles **(mg/l)**																			
Bis(2-chloroethyl)Ether	--	--	--	--	--	--	--	0.0241 J	0.024 U	0.03 U	0.02 J	0.024 U	0.025 U	0.026 U	0.018	0.04 U	0.05 U	0.02 J	0.05 U
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Inorganics (mg/l)																			
Dissolved Manganese	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Iron	1.15	0.60	0.25	0.29	1.90	0.40	5.40	0.11	--	--	0.138 B	0.141	--	--	--	0.23	--	--	0.296
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																			
Temperature (Degrees Celcius)	--	--	--	--	--	--	--	--	--	--	--	--	--	12.39	--	--	--	--	14.2
Conductivity (ms/cm)	--	--	--	--	--	--	--	--	--	--	--	--	--	180	--	--	--	--	185
pH (standard units)	5.80	5.51	5.53	5.96	6.63	5.88	5.92	5.84	--	--	--	5.75	--	6.52	--	6.26	--	--	5.47
Dissolved Oxygen (mg/l)	--	--	--	--	--	--	--	--	--	10.04	--	--	--	--	--	--	--	--	2.27
ORP (mV)	--	--	--	--	--	--	--	--	--	--	--	--	--	251.0	--	--	--	--	121.1
Water-Level Elevation (ft, MSL)	--	--	--	--	--	--	--	--	--	-56.54	-59.04	-60.61	-61.94	-60.01	-30.33	-30.46	-31.13	-29.98	-26.93

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	RW-10																					
	7/03	7/04	10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/07	10/08	10/09	10/10	10/11	10/12	10/15	3/16	4/16
Non-Halogenated VOCs **(mg/l)**																						
Benzene	0.2 J	0.1 J	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Toluene	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Ethylbenzene	0.5 U	0.5 U	0.29 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Xylene (total)	1.0 U	1.0 U	1	5 U	5 U	5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	--	--	--
2-Butanone	--	--	5 U	10 U	10 R	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	--	--	--
Acetone	--	--	5 U	20 U	20 R	20 R	20 R	10 U	5 UJ	6.6 U	5 U	5 U	5 U	5 UJ	5 U	5 U	7.5 U	5 U	5 U	--	--	--
Carbon Disulfide	--	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Cyclohexane	--	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	--	--	--
Isopropylbenzene	--	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Methy-tert-butyl ether	--	--	2.2	--	--	--	--	10 U	0.49 J	0.85 J	1 U	1 U	0.40 J	0.33 J	0.56 J	1 U	0.48 J	1 U	1 U	--	--	--
Methylcyclohexane	--	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
4-Methyl-2-pentanone	--	--	5 U	10 U	10 U	10 UJ	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	--	--	--
Halogenated VOCs **(mg/l)**																						
Bromoform	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Bromodichloromethane	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Carbon Tetrachloride	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	--	--	--
Chlorobenzene	0.3 J	0.2 J	0.22 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Chloroform	0.5 U	0.5 U	0.13 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Chloromethane	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	0.21 J	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	--	--	--
Dibromochloromethane	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
1,2-Dichloroethane	1.7	0.8	0.64	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
cis-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
trans-1,2-Dichloroethene	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
1,1-Dichloroethene	0.1 J	0.5 U	0.22 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
1,2-Dichloroethene (total)	1.0 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	0.5 U	0.5 U	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
1,3-Dichlorobenzene	0.5 U	0.5 U	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
1,4-Dichlorobenzene	0.1 J	0.5 U	0.14 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Chloroethane	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 UJ	1 R	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Tetrachloroethene	4.4	2.7	6.3	7	7	5 U	5 U	10 U	0.53 J	0.49 J	0.32 J	0.53 J	0.39 J	0.29 J	0.27 J	0.29 J	0.29 J	0.30 J	0.34 J	--	--	--
1,1,1-Trichloroethane	0.5 U	0.2 J	0.58	1 J	0.8 J	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Trichloroethene	0.5 U	0.5 U	0.1 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Vinyl Chloride	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
1,2,4-Trichlorobenzene	--	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
cis-1,3-Dichloropropene	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Methylene Chloride	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	--	--	--
Trichlorofluoromethane	--	--	0.5 U	--	--	--	--	10 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--	--
Semi-Volatiles **(mg/l)**																						
Bis(2-chloroethyl)Ether	0.05 U	--	0.054 U	0.019 U	0.02 U	0.02 U	0.018 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
Bis(2-ethylhexyl)phthalate	--	--	5 U	5 U	5 U	5 U	5.9	160 D	5 UL	5 UL	5 U	5 UL	5 UL	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
2,2'-oxybis (1-Chloropropane)	--	--	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
2,4-Dimethylphenol	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
2-Methylnaphthalene	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
2-Methylphenol	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
4-Methylphenol	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
Acetophenone	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
Caprolactam	--	--	5 UJ	5 U	5 U	5 UL	5 U	5 U	5 UL	5 UL	5 U	5 UL	5 UL	5 U	5 UJ	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
Diethylphthalate	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
N-Nitrosodiphenylamine	--	--	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
Naphthalene	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
Phenol	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	--	--	--
Inorganics (mg/l)																						
Dissolved Manganese	0.145	--	0.241	0.806	1.50	3.69	5.12	2.68	3.69	2.03	0.250	0.124	0.0424	0.0336	0.0165	0.0227	0.0075 J	0.0130 J	0.0090 J	0.0023 J	0.96	0.996
Dissolved Iron	0.221	--	0.511	2.35	7.61	3.88	0.269	2.85	0.146	1.46	0.0075 U	0.0153 U	0.010 U	0.009 U	0.0177 U	0.100 U	0.100 U	0.100 U	0.1 U	0.100 U	27.7	17.3
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0500 U	0.011	0.0102 J
Biological Oxygen Demand (mg/l)	--	--	--	--	0	1.7	< 1	1.4	< 2	< 2	< 2	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																						
Temperature (Degrees Celcius)	14.07	--	14.5	13.43	14.15	15.65	13.88	13.1	14.1	14.6	14.2	13.0	14.7	15.3	13.9	13.6	14.7	15.3	12.8	13.1	10.4	13.1
Conductivity (ms/cm)	192.2	--	269	165	203	261	292	439	381	551	401	366	177	140	302	322	341	422	450	370	403	363
pH (standard units)	5.55	--	6.66	5.50	5.87	5.13	5.83	5.66	5.81	5.61	5.50	5.89	3.70	6.45	5.73	6.44	5.49	5.74	5.54	6.16	7.13	6.85
Dissolved Oxygen (mg/l)	0.27	--	--	8.80	3.59	2.19	0.70	0.00	1.20	1.20	1.23	0.77	0.83	4.56	3.94	4.92	0.00	4.13	2.81	4.13	0.00	0.00
ORP (mV)	96.5	--	57.1	150.7	68.7	183.6	231.2	63	232	98	240	218	259	191	255	196	196	235	277	217	-175	-130
Water-Level Elevation (ft, MSL)	-27.74	-26.17	-16.05	-11.30	-0.17	-6.95	-11.36	-0.96	-4.59	-8.21	-9.49	-6.20	-7.06	-11.30	-9.90	-10.06	-4.82	-7.55	-4.09	-7.05	-4.83	-4.66

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-28																	
	6/93	6/94	6/95	6/96	6/97	6/98	6/99	7/00	10/00	12/00	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03
***Non-Halogenated VOCs* (mg/l)**																		
Benzene	5 U	5 U	1.5	1.7	1.2	1.3	1.6	0.5 J	--	--	0.2 J	0.6 J	--	--	--	0.8 J	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	0.1 B	0.2 J	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--
Xylene (total)	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--
2-Butanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Halogenated VOCs* (mg/l)**																		
Bromoform	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--
Carbon Tetrachloride	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--
Chlorobenzene	--	--	--	--	--	--	--	--	--	--	1	5	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--
Dibromochloromethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--
1,2-Dichloroethane	5 U	5 U	0.5 U	0.2 J	1.3	5.3	0.5 J	0.1 J	--	--	3	1 U	--	--	--	0.5 U	--	--
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--	--	1 U	0.2 J	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	1 U	0.1 J	--	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.4 J	0.1 J	--	--	1 U	1 U	--	--	--	0.5 U	--	--
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	2 U	2 U	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	1 U	0.2 JB	--	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--
1,4-Dichlorobenzene	5 U	--	3.1	2.9	2.2	3.3	3.6	1.5	--	--	0.3 B	2	--	--	--	0.5 U	--	--
Chloroethane	--	--	--	--	--	--	--	--	--	--	1 U	0.2 J	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	3	0.3 J	--	--	--	--	--	--
1,1,1-Trichloroethane	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--
Trichloroethene	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--
Vinyl Chloride	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	0.7 J	--	--	--	0.5 U	--	--
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Semi-Volatiles* (mg/l)**																		
Bis(2-chloroethyl)Ether	--	--	--	--	--	--	--	1.0900	0.81	1	2 J	2.2	1.3	0.96	0.98	0.37	0.23	0.2
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Inorganics* (mg/l)**																		
Dissolved Manganese	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Iron	17.03	19	26.50	16	6.20	16	18	13.47	--	--	25.7	24.8	--	--	--	18.64	--	--
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																		
Temperature (Degrees Celcius)	--	--	--	--	--	--	--	--	--	--	--	--	--	12.17	14.30	--	14.27	13.67
Conductivity (ms/cm)	--	--	--	--	--	--	--	--	--	--	--	--	--	280	320.2	--	318.2	339
pH (standard units)	6.60	6.02	6.55	6.55	6.63	6.80	6.61	6.41	--	--	--	6.34	--	6.37	6.32	6.31	6.65	6.31
Dissolved Oxygen (mg/l)	--	--	--	--	--	--	--	--	--	10.61	--	--	--	--	0.17	--	0.09	0.02
ORP (mV)	--	--	--	--	--	--	--	--	--	--	--	--	--	272.1	301.3	--	106.2	40.5
Water-Level Elevation (ft, MSL)	--	--	--	--	--	--	--	--	--	-27.47	-20.37	-25.98	-28.56	-30.63	-23.63	--	-29.18	-28.88

-- Not analyzed or data not available to RAI as of December 14, 2018
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
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B - Analyte Detected in Method Blank
R - Data Rejected

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-28															
	10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/07	4/08	10/08	4/09	10/09
***Non-Halogenated VOCs* (mg/l)**																
Benzene	0.5 U	5 U	5 U	5 U	1 J	10 U	1 U	1 U	1.9	1 U	1 U	2.8	0.58 J	2.8	1 U	3.1
Toluene	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (total)	0.5 U	5 U	5 U	5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
2-Butanone	5 U	10 U	10 U	10 R	10 U	10 UJ	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U
Acetone	5 U	20 R	20 U	20 R	20 R	10 UJ	5 UJ	5.9 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 UJ	3.6 U
Carbon Disulfide	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U
Isopropylbenzene	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methy-tert-butyl ether	0.48 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	0.16 J	0.13 J	1 U	1 U	1 U
Methylcyclohexane	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone	5 U	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
***Halogenated VOCs* (mg/l)**																
Bromoform	0.25 J	5 U	5 U	5 U	5 U	10 UJ	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Bromodichloromethane	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 UJ
Chlorobenzene	0.11 J	5 U	5 U	5 U	6	10 U	1 U	0.37 J	11	0.33 J	1 U	16	4.1	17	1.9	24
Chloroform	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	0.5 U	5 UJ	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,2-Dichloroethane	0.16 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	0.15 J	1 U	1 U	0.33 J	1 U	0.23 J	1 U	1 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	0.5 U	5 U	5 U	5 U	1 J	10 U	1 U	1 U	1.4	1 U	1 U	1.7	0.53 J	1.5	1 U	1.8
cis-1,2-Dichloroethene	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	0.26 J	1 U	1 U	1 U	0.25 J
trans-1,2-Dichloroethene	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	0.5 U	--	--	--	--	10 U	1 U	1 U	0.43 J	1 U	1 U	0.7 J	0.20 J	0.75 J	1 U	1.1
1,3-Dichlorobenzene	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	0.5 U	--	--	--	--	10 U	1 U	1 U	2.9	1 U	1 U	4.8	1.4	5.1	0.61 J	7.2
Chloroethane	0.5 U	5 U	5 U	5 U	5 U	10 U	1 R	1 U	0.57 J	1 U	1 U	1 U	1 U	0.38 J	1 U	0.86 J
Tetrachloroethene	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	0.62 U	5 U	5 U	5 U	5 U	10 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Trichlorofluoromethane	0.5 U	--	--	--	--	10 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
***Semi-Volatiles* (mg/l)**																
Bis(2-chloroethyl)Ether	0.076	0.06	0.046	0.02 U	0.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6.9	5 U	5.1 U	5.0 U
Bis(2-ethylhexyl)phthalate	5 U	5 U	5.1	4.4 J	5 U	5 U	5 UL	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 U	5.1 U	5.0 UJ
2,2'-oxybis (1-Chloropropane)	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U
2,4-Dimethylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U
2-Methylnaphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U
2-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U
4-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U
Acetophenone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U
Caprolactam	5 UJ	5 U	5 U	5 U	5 UJ	5 UL	2.3 L	5 U	5.5	5 UL	2.7 R	5 UL	5 UL	5 UJ	5.1 R	5.0 U
Diethylphthalate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 U	5.1 U	5.0 U
N-Nitrosodiphenylamine	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U
Naphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U
Phenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U
***Inorganics* (mg/l)**																
Dissolved Manganese	1.09	1.16	1.25	0.954	1.51	1.11	1.10	0.997	1.68	1.18	0.958	1.5	1.49	1.42	1.59	1.22
Dissolved Iron	18.3	19.7	20.3	18.9	33.0	19.6	20.0	18.1	31.3	20.2	17.0	28.4	27.1	23.7	29.4	21.9
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)	--	--	0.6	2.3	2.3	2.2	< 2	< 2	< 2	--	--	--	--	--	--	--
Field Parameters																
Temperature (Degrees Celcius)	13.73	13.21	13.14	14.07	13.44	13.9	15.5	16.2	15.1	13.8	14.5	15.2	14.8	14.0	12.8	13.7
Conductivity (ms/cm)	281	231	214	468	653	284	287	387	657	218	134	920	479	1350	607	1080
pH (standard units)	6.08	6.28	5.88	5.46	6.60	5.93	5.72	6.06	6.81	5.75	7.97	6.67	6.17	8.08	6.36	7.28
Dissolved Oxygen (mg/l)	0.17	0.06	0.13	0.69	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.09	0.00	0.00	0.00
ORP (mV)	-14.1	-7.0	43.3	74.1	-45	-18	-8	-36	-189	-48	-21	-226	-94	-163	-53	-178
Water-Level Elevation (ft, MSL)	-15.65	-10.25	0.46	-5.43	-11.82	-0.58	-3.59	-6.74	-8.88	-5.36	-5.23	-11.34	-7.14	-9.80	-5.69	-9.70

-- Not analyzed or data not available to RAI as of December 14, 2018
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Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-28							
	10/10	10/11	10/12	10/15	3/16	10/16	10/17	10/18
***Non-Halogenated VOCs* (mg/l)**								
Benzene	1 U	0.64 J	1 U	--	--	--	--	--
Toluene	1 U	1 U	1 U	--	--	--	--	--
Ethylbenzene	1 U	1 U	1 U	--	--	--	--	--
Xylene (total)	3 U	3 U	3 U	--	--	--	--	--
2-Butanone	5 U	5 U	5 U	--	--	--	--	--
Acetone	10 U	5 U	5 U	--	--	--	--	--
Carbon Disulfide	1 U	1 U	1 U	--	--	--	--	--
Cyclohexane	1 U	1 U	1 U	--	--	--	--	--
Isopropylbenzene	1 U	1 U	1 U	--	--	--	--	--
Methy-tert-butyl ether	1 U	1 U	1 U	--	--	--	--	--
Methylcyclohexane	1 U	1 U	1 U	--	--	--	--	--
4-Methyl-2-pentanone	5 U	5 U	5 U	--	--	--	--	--
***Halogenated VOCs* (mg/l)**								
Bromoform	1 U	1 U	1 U	--	--	--	--	--
Bromodichloromethane	1 U	1 U	1 U	--	--	--	--	--
Carbon Tetrachloride	1 U	1 UJ	1 U	--	--	--	--	--
Chlorobenzene	0.67 J	4.2	1 U	--	--	--	--	--
Chloroform	1 U	1 U	1 U	--	--	--	--	--
Dibromochloromethane	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethane	1 U	1 U	1 U	--	--	--	--	--
1,3 Chlorobenzene	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	0.47 J	1 U	--	--	--	--	--
cis-1,2-Dichloroethene	1 U	1 U	1 U	--	--	--	--	--
trans-1,2-Dichloroethene	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethene	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	0.17 J	1 U	--	--	--	--	--
1,3-Dichlorobenzene	1 U	1 U	1 U	--	--	--	--	--
1,4-Dichlorobenzene	1 U	1.2	1 U	--	--	--	--	--
Chloroethane	1 U	1 U	1 U	--	--	--	--	--
Tetrachloroethene	1 U	1 U	1 U	--	--	--	--	--
1,1,1-Trichloroethane	1 U	1 U	1 U	--	--	--	--	--
Trichloroethene	1 U	1 U	1 U	--	--	--	--	--
Vinyl Chloride	1 U	1 U	1 U	--	--	--	--	--
1,2,4-Trichlorobenzene	1 U	1 U	1 U	--	--	--	--	--
cis-1,3-Dichloropropene	1 U	1 U	1 U	--	--	--	--	--
Methylene Chloride	1 U	1 U	1 U	--	--	--	--	--
Trichlorofluoromethane	1 U	1 U	1 U	--	--	--	--	--
***Semi-Volatiles* (mg/l)**								
Bis(2-chloroethyl)Ether	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2,4-Dimethylphenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2-Methylnaphthalene	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2-Methylphenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
4-Methylphenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Acetophenone	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Caprolactam	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Diethylphthalate	5.0 U	5.0 U	5.0 U	--	--	--	--	--
N-Nitrosodiphenylamine	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Naphthalene	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Phenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
***Inorganics* (mg/l)**								
Dissolved Manganese	1.23	1.24	0.946	1.13	0.86	0.865	0.924	1.39
Dissolved Iron	25.4	24.2	17.8	31.5	15.2	25.2	23.5	25.6
Dissolved Cobalt	--	--	--	0.0769	0.034	0.0252 J	0.0756	0.0394 J
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--
Field Parameters								
Temperature (Degrees Celcius)	14.1	14.9	12.7	14.7	10.0	12.5	13.2	12.5
Conductivity (ms/cm)	276	496	311	732	398	478	716	373
pH (standard units)	6.05	6.45	5.90	7.09	6.17	6.27	7.32	6.43
Dissolved Oxygen (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ORP (mV)	-24	-58	-22	-134	5	-48	-145	-13
Water-Level Elevation (ft, MSL)	-3.79	-6.32	-3.26	-6.11	-3.23	-9.23	-8.51	-5.29

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Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-29																			
	6/93	6/94	6/95	6/96	6/97	6/98	6/99	7/00	10/00	12/00	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03	7/03
***Non-Halogenated VOCs* (mg/l)**																				
Benzene	5	13	2.2	0.5 U	0.6	0.6	0.7	0.3 J	--	--	0.7 J	0.6 J	--	--	--	0.8 J	--	--	--	5
Toluene	--	--	--	--	--	--	--	--	--	--	0.2 B	0.3 B	--	--	--	--	--	--	--	0.5 U
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	1 U	--	--	--	--	--	--	--	--	0.5 U
Xylene (total)	--	--	--	--	--	--	--	--	--	--	1 U	--	--	--	--	--	--	--	--	1.0 U
2-Butanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Halogenated VOCs* (mg/l)**																				
Bromoform	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
Bromodichloromethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
Carbon Tetrachloride	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
Chlorobenzene	--	--	--	--	--	--	--	--	--	--	9	1 U	--	--	--	--	--	--	--	16
Chloroform	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
Chloromethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
Dibromochloromethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
1,2-Dichloroethane	5	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.3 J
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.1 J
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	2 U	2 U	--	--	--	--	--	--	--	1.0 U
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	0.7 J	0.7 J	--	--	--	--	--	--	--	0.5 U
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	1 U	0.1J	--	--	--	--	--	--	--	0.9
1,4-Dichlorobenzene	5 U	--	6.1	1.0	3.0	3.3	4.5	1.6	--	--	2	2	--	--	--	0.5 U	--	--	--	1.7
Chloroethane	--	--	--	--	--	--	--	--	--	--	1 U	0.1 J	--	--	--	--	--	--	--	0.2 J
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
1,1,1-Trichloroethane	5 U	5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
Trichloroethene	5 U	5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
Vinyl Chloride	5 U	5 U	0.5 U	0.2 J	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	5 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Semi-Volatiles* (mg/l)**																				
Bis(2-chloroethyl)Ether	--	--	--	--	--	--	--	0.1282	4 D	13 D	10	9	5.5	1.7	11	12	9.3	10	14	14 D
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Inorganics* (mg/l)**																				
Dissolved Manganese	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.480
Dissolved Iron	28.50	21.30	37.80	35.60	17.20	23.60	33.20	28.49	--	--	33.9	46.0	--	--	--	25.50	--	--	32.6	31.9
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																				
Temperature (Degrees Celcius)	--	--	--	--	--	--	--	--	--	--	--	--	--	12.15	13.94	--	--	--	14.96	14.49
Conductivity (ms/cm)	--	--	--	--	--	--	--	--	--	--	--	--	--	320	393.1	--	--	--	337.2	374.6
pH (standard units)	6.00	6.31	6.56	6.42	6.63	6.66	6.38	6.39	--	--	--	6.58	--	8.43	6.28	6.54	--	--	5.74	5.75
Dissolved Oxygen (mg/l)	--	--	--	--	--	--	--	--	--	6.95	--	--	--	--	0.04	--	--	--	0.3	0.01
ORP (mV)	--	--	--	--	--	--	--	--	--	--	--	--	--	266.5	280.9	--	--	--	38.2	0.7
Water-Level Elevation (ft, MSL)	--	--	--	--	--	--	--	--	--	-20.94	-24.49	-21.39	-30.96	-25.98	-24.62	-26.14	--	-27.23	-25.43	-26.41

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-29																
	7/04	10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/07	4/08	10/08	4/09	10/09
***Non-Halogenated VOCs* (mg/l)**																	
Benzene	5.3	0.43 J	0.6 J	5 U	5 U	5 U	10 U	0.20 J	0.16 J	1 U	1 U	1 U	1 U	1 U	8.4	1 U	0.19 J
Toluene	0.5 U	0.5 U	5 U	5 U	5 U	5 U	1.1 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	9.7	1 U	0.20 J
Ethylbenzene	0.2 J	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.26 J	1 U	1 U
Xylene (total)	1.0 U	0.5 U	5 U	5 U	5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	2.4 J	3 U	3 U
2-Butanone	--	5 U	10 U	10 R	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U
Acetone	--	5 UJ	20 U	20 R	20 R	20 R	1.1 J	5 U	5.8 U	5 U	5 U	5 U	5 UJ	5 U	2.6 J	5 UJ	5 U
Carbon Disulfide	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.23 J	1 U	1 U
Cyclohexane	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U
Isopropylbenzene	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methy-tert-butyl ether	--	0.95	--	--	--	--	10 U	0.62 J	0.63 J	0.67 J	0.69 J	1.2	1.6	1.2	1.5	1.2	1.2
Methylcyclohexane	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone	--	5 U	10 UJ	10 U	10 UJ	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
***Halogenated VOCs* (mg/l)**																	
Bromoform	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 UJ	5 UJ	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Bromodichloromethane	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 UJ
Chlorobenzene	24	4.2	6	4 J	5	6	3.1 J	3.9	3.2	2.1	2.1	2.1	3.1	5.0	2.8	3.1	7.0
Chloroform	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Dibromochloromethane	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,2-Dichloroethane	0.8	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	0.3 J	0.14 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	0.2 J	0.15 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	0.7	0.22 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	0.11 J	1 U	1 U	1 U
1,3-Dichlorobenzene	0.7	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	2.8	1.3	--	--	--	--	1.2 J	1.7	1.6	0.83 J	0.93 J	0.77 J	1.3	2.0	0.71 J	1 U	2.2
Chloroethane	0.2 J	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Tetrachloroethene	0.1 J	0.39 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	0.16 J	0.2 J	0.34 J	1 U	1 U	1 U
1,1,1-Trichloroethane	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	0.1 J	0.12 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Trichlorofluoromethane	--	0.5 U	--	--	--	--	10 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
***Semi-Volatiles* (mg/l)**																	
Bis(2-chloroethyl)Ether	--	0.67	0.89	0.29	0.4	0.29	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
Bis(2-ethylhexyl)phthalate	--	5 U	5 U	5.6 U	5 U	5 U	5 U	3.9 L	5 U	5 U	5 U	5 U	5 U	5 U	5.7 J	5.1 U	5.3 U
2,2'-oxybis (1-Chloropropane)	--	5 UJ	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
2,4-Dimethylphenol	--	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
2-Methylnaphthalene	--	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
2-Methylphenol	--	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
4-Methylphenol	--	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
Acetophenone	--	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
Caprolactam	--	5 U	5 U	5.6 U	5 U	5 U	5 U	5 UL	5 UL	5 U	5 U	5 U	5 U	5 UL	5.3 UJ	5.1 R	5.3 U
Diethylphthalate	--	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
N-Nitrosodiphenylamine	--	5 U	5 U	5.6 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
Naphthalene	--	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
Phenol	--	5 U	5 U	5.6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.1 U	5.3 U
***Inorganics* (mg/l)**																	
Dissolved Manganese	--	0.944	0.835	0.857	1.15	0.912	0.802	0.735	0.662	0.443	0.445	0.452	0.385	0.514	0.526	0.653	0.654
Dissolved Iron	--	26.5	25.2	29.9	34.5	31.7	34.7	36.1	31.1	26.9	33.1	38.4	40.7	52.7	55.1	47.0	66.2
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)	--	--	--	5.0	10.5	8.7	10.1	< 2	< 2	< 2	--	--	--	--	--	--	--
Field Parameters																	
Temperature (Degrees Celcius)	--	15.70	13.90	14.52	14.64	14.10	14.3	15.3	14.9	15.0	13.1	14.6	16.0	15.6	14.4	13.1	14.1
Conductivity (ms/cm)	--	319	278	293	601	430	444	494	624	491	530	360	218	427	415	576	1150
pH (standard units)	--	6.56	6.02	6.04	5.80	6.38	6.21	6.32	6.09	6.08	6.77	6.97	6.83	6.33	7.64	6.89	6.83
Dissolved Oxygen (mg/l)	--	--	0.15	0.50	0.93	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00
ORP (mV)	--	-14.7	15.4	-66.1	-1.4	-35.3	-97	-133	-100	-95	-112	-128	-91	-152	-122	-93	-133
Water-Level Elevation (ft, MSL)	-22.82	-14.35	-8.62	1.11	-3.64	-8.45	0.24	-2.22	-4.78	-5.98	-3.58	-3.52	-8.72	-5.13	-7.53	-4.10	-7.42

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
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UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-29							
	10/10	10/11	10/12	10/15	3/16	10/16	10/17	10/18
Non-Halogenated VOCs **(mg/l)**								
Benzene	1 U	0.16 J	1 U	--	--	--	--	--
Toluene	1 U	1 U	1 U	--	--	--	--	--
Ethylbenzene	1 U	1 U	1 U	--	--	--	--	--
Xylene (total)	3 U	3 U	3 U	--	--	--	--	--
2-Butanone	5 U	5 U	5 U	--	--	--	--	--
Acetone	8.2 U	5 U	5 U	--	--	--	--	--
Carbon Disulfide	1 U	0.29 J	1 U	--	--	--	--	--
Cyclohexane	1 U	1 U	1 U	--	--	--	--	--
Isopropylbenzene	1 U	1 U	1 U	--	--	--	--	--
Methy-tert-butyl ether	0.47 J	0.23 J	1 U	--	--	--	--	--
Methylcyclohexane	1 U	1 U	1 U	--	--	--	--	--
4-Methyl-2-pentanone	5 U	5 U	5 U	--	--	--	--	--
Halogenated VOCs **(mg/l)**								
Bromoform	1 U	1 U	1 U	--	--	--	--	--
Bromodichloromethane	1 U	1 U	1 U	--	--	--	--	--
Carbon Tetrachloride	1 U	1 U	1 U	--	--	--	--	--
Chlorobenzene	4.9	5.7	4.0	--	--	--	--	--
Chloroform	1 U	1 U	1 U	--	--	--	--	--
Chloromethane	1 U	1 U	1 U	--	--	--	--	--
Dibromochloromethane	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethane	1 U	1 U	1 U	--	--	--	--	--
1,3 Chlorobenzene	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	1 U	1 U	--	--	--	--	--
cis-1,2-Dichloroethene	1 U	1 U	1 U	--	--	--	--	--
trans-1,2-Dichloroethene	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethene	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	1 U	1 U	--	--	--	--	--
1,3-Dichlorobenzene	1 U	1 U	1 U	--	--	--	--	--
1,4-Dichlorobenzene	1.3	1.2	0.86 J	--	--	--	--	--
Chloroethane	1 U	1 U	1 U	--	--	--	--	--
Tetrachloroethene	1 U	1 U	1 U	--	--	--	--	--
1,1,1-Trichloroethane	1 U	1 U	1 U	--	--	--	--	--
Trichloroethene	1 U	1 U	1 U	--	--	--	--	--
Vinyl Chloride	1 U	1 U	1.4	--	--	--	--	--
1,2,4-Trichlorobenzene	1 U	1 U	1 U	--	--	--	--	--
cis-1,3-Dichloropropene	1 U	1 U	1 U	--	--	--	--	--
Methylene Chloride	1 U	1 U	1 U	--	--	--	--	--
Trichlorofluoromethane	1 U	1 U	1 U	--	--	--	--	--
Semi-Volatiles **(mg/l)**								
Bis(2-chloroethyl)Ether	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2,4-Dimethylphenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2-Methylnaphthalene	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2-Methylphenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
4-Methylphenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Acetophenone	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Caprolactam	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Diethylphthalate	5.0 U	5.0 U	5.0 U	--	--	--	--	--
N-Nitrosodiphenylamine	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Naphthalene	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Phenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Inorganics **(mg/l)**								
Dissolved Manganese	0.614	1.31	1.41	0.715	0.85	0.369	0.380	0.391
Dissolved Iron	62.1	59.2	53.6	34.3	19.4	33.5	36.2	38.6
Dissolved Cobalt	--	--	--	0.0021 J	0.0050 U	0.0016 J	0.0011 J	0.050 U
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--
Field Parameters								
Temperature (Degrees Celcius)	14.6	17.1	14.2	16.1	11.9	14.4	15.2	14.4
Conductivity (ms/cm)	480	593	483	590	510	667	540	494
pH (standard units)	6.68	6.65	6.22	7.12	6.79	7.02	7.12	6.99
Dissolved Oxygen (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ORP (mV)	-140	-111	-82	-147	-136	-175	-132	-121
Water-Level Elevation (ft, MSL)	-2.12	-4.26	-1.70	-3.86	-1.37	-6.38	-5.67	-3.17

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-31																			
	6/93	6/94	6/95	6/96	6/97	6/98	6/99	7/00	10/00	12/00	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03	7/03
***Non-Halogenated VOCs* (mg/l)**																				
Benzene	5 U	5 U	0.3 J	43	0.5 U	0.5 U	0.5 U	0.1 J	--	--	0.8 J	0.6 J	--	--	--	0.5 U	--	--	--	0.5 U
Toluene	--	--	--	--	--	--	--	--	--	--	1 U	0.5 J	--	--	--	--	--	--	--	0.5 U
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
Xylene (total)	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	1.0 U
2-Butanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Halogenated VOCs* (mg/l)**																				
Bromoform	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
Bromodichloromethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
Carbon Tetrachloride	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
Chlorobenzene	--	--	--	--	--	--	--	--	--	--	5	2	--	--	--	--	--	--	--	0.1 J
Chloroform	--	--	--	--	--	--	--	--	--	--	1 U	0.2 J	--	--	--	--	--	--	--	0.5 U
Dibromochloromethane	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
1,2-Dichloroethane	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--	--	0.2 J	1 U	--	--	--	--	--	--	--	0.5 U
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	2 U	2 U	--	--	--	--	--	--	--	1.0 U
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	0.1 J	1 U	--	--	--	--	--	--	--	0.5 U
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
1,4-Dichlorobenzene	5 U	--	0.2 J	0.4 J	0.5 U	0.5 U	0.4 J	0.5 J	--	--	0.7 B	0.6 J	--	--	--	0.5 U	--	--	--	0.5 U
Chloroethane	--	--	--	--	--	--	--	--	--	--	1 U	0.1 J	--	--	--	--	--	--	--	0.5 U
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	1 U	1 U	--	--	--	--	--	--	--	0.5 U
1,1,1-Trichloroethane	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
Trichloroethene	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
Vinyl Chloride	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	--	--	1 U	1 U	--	--	--	0.5 U	--	--	--	0.5 U
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Semi-Volatiles* (mg/l)**																				
Bis(2-chloroethyl)Ether	--	--	--	--	--	--	--	0.1272	0.13	16 D	21	4 NP	20	0.053	0.16	0.23	0.079	0.1	0.1	0.1
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Inorganics* (mg/l)**																				
Dissolved Manganese	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.47
Dissolved Iron	10.90	0.45	3.30	9.30	7.60	0.24	0.56	3.36	--	--	17.2	7.12	--	--	--	6.08	--	--	12.9	25.4
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																				
Temperature (Degrees Celcius)	--	--	--	--	--	--	--	--	--	--	--	--	--	12.36	14.95	--	--	--	24.26	18.36
Conductivity (ms/cm)	--	--	--	--	--	--	--	--	--	--	--	--	--	130	189.2	--	--	--	166	278.6
pH (standard units)	5.90	6.29	5.87	6.50	6.63	5.79	6.17	6.32	--	--	--	6.29	--	8.43	6.38	6.83	--	--	5.67	5.02
Dissolved Oxygen (mg/l)	--	--	--	--	--	--	--	--	2	--	--	--	--	--	1.19	--	--	--	3.46	0.76
ORP (mV)	--	--	--	--	--	--	--	--	--	--	--	--	--	282	259.7	--	--	--	36.1	74.6
Water-Level Elevation (ft, MSL)	--	--	--	--	--	--	--	--	--	-18.5	-23.97	-18.26	-40.35	-24.85	-21.55	-21.07	-71.01	-30.25	-23.51	-24.13

-- Not analyzed or data not available to RAI as of December 14, 2018
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
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D - Sample diluted in the lab for analysis.
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Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-31														
	7/04	10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/07	10/08	10/09
Non-Halogenated VOCs **(mg/l)**															
Benzene	0.4 J	6.1	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (total)	1.0 U	0.46 J	5 U	5 U	5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
2-Butanone	--	5 U	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	--	5 UJ	20 R	20 U	20 R	20 R	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	3.5 U
Carbon Disulfide	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane	--	0.14 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Isopropylbenzene	--	0.25 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methy-tert-butyl ether	--	1.9	--	--	--	--	25	24	24	25	21	22	0.38 J	0.36 J	0.42 J
Methylcyclohexane	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
4-Methyl-2-pentanone	--	5 U	10 U	10 U	10 UJ	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Halogenated VOCs **(mg/l)**															
Bromoform	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	0.1 J	3.9	5 U	5 U	5 U	5 U	10 U	1 U	1 U	0.41 J	0.31 J	1 U	0.92 J	1.1	0.18 J
Chloroform	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	0.5 U	0.5 U	5 UJ	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	0.5 U	0.22 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	0.5 U	0.11 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.25 J
trans-1,2-Dichloroethene	--	0.14 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	0.5 U	0.15 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	0.5 U	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	0.5 U	0.31 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	0.39 J	0.47 J	1 U
Chloroethane	0.5 U	0.18 K	5 U	5 U	5 U	5 U	10 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	0.1 J	0.17 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	0.39 J	0.37 J	0.34 J	0.61 J	1.2	1.4
1,1,1-Trichloroethane	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	0.1 J	0.13 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	--	0.1 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
Trichlorofluoromethane	--	0.5 U	--	--	--	--	10 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Semi-Volatiles **(mg/l)**															
Bis(2-chloroethyl)Ether	--	13	0.0095 J	0.019 J	0.099	0.018 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 U
Bis(2-ethylhexyl)phthalate	--	5 U	--	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 UJ
2,2'-oxybis (1-Chloropropane)	--	5 UJ	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 U
2,4-Dimethylphenol	--	5 U	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 U
2-Methylnaphthalene	--	5 U	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 U
2-Methylphenol	--	5 U	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 U
4-Methylphenol	--	5 U	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 U
Acetophenone	--	5 U	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 U
Caprolactam	--	5 U	--	5 U	5 U	5 U	5 U	5 UL	5 UL	5 U	5 U	5 U	5 U	5.3 UJ	5.6 U
Diethylphthalate	--	5 U	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 U
N-Nitrosodiphenylamine	--	5 U	--	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 U
Naphthalene	--	5 U	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.6 U
Phenol	--	5 U	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	5.36 U
Inorganics **(mg/l)**															
Dissolved Manganese	--	1.00	0.021	0.0218	0.324	0.400	0.276	0.491	0.585	0.504	0.566	0.914	1.22	0.792	0.865
Dissolved Iron	--	16.9	0.376	0.170	7.47	9.37	5.64	14.5	16.0	12.4	12.1	15.6	23.0	20.0	38.4
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)	--	--	--	0.0	1.2	< 1	1.3	< 2	< 2	< 2	--	--	--	--	--
Field Parameters															
Temperature (Degrees Celcius)	--	14.20	13.00	13.47	14.13	13.31	14.2	14.5	14.6	14.4	14.0	14.3	14.5	14.2	13.9
Conductivity (ms/cm)	--	281	140	144	236	262	298	383	365	382	216	287	212	326	542
pH (standard units)	--	6.46	5.74	5.48	5.56	5.91	5.73	6.08	5.90	6.04	5.90	6.01	6.58	6.88	7.17
Dissolved Oxygen (mg/l)	--	--	2.95	3.16	0.84	1.26	0.36	0.00	0.00	0.88	0.77	0.00	0.00	0.96	0.00
ORP (mV)	--	14	140	177	62.5	77.0	51	25	-29	-40	3	-62	-33	-30	-170
Water-Level Elevation (ft, MSL)	-23.72	-12.60	-8.26	0.75	-3.50	-7.54	-0.21	-2.07	-4.40	-6.15	-3.40	-3.27	-8.08	-7.04	-6.51

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected

Table 2 (continued)

Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Grav

Parameter	MW-31							
	10/10	10/11	10/12	10/15	3/16	10/16	10/17	10/18
***Non-Halogenated VOCs* (mg/l)**								
Benzene	1 U	0.26 J	1 U	--	--	--	--	--
Toluene	1 U	1 U	1 U	--	--	--	--	--
Ethylbenzene	1 U	1 U	1 U	--	--	--	--	--
Xylene (total)	3 U	3 U	3 U	--	--	--	--	--
2-Butanone	5 U	5 U	5 U	--	--	--	--	--
Acetone	14 U	5 U	5 U	--	--	--	--	--
Carbon Disulfide	1 U	0.36 J	1 U	--	--	--	--	--
Cyclohexane	1 U	1 U	1 U	--	--	--	--	--
Isopropylbenzene	1 U	1 U	1 U	--	--	--	--	--
Methy-tert-butyl ether	1 U	1 U	0.21 J	--	--	--	--	--
Methylcyclohexane	1 U	1 U	1 U	--	--	--	--	--
4-Methyl-2-pentanone	5 U	5 U	5 U	--	--	--	--	--
***Halogenated VOCs* (mg/l)**								
Bromoform	1 U	1 U	1 U	--	--	--	--	--
Bromodichloromethane	1 U	1 U	1 U	--	--	--	--	--
Carbon Tetrachloride	1 U	1 UJ	1 UJ	--	--	--	--	--
Chlorobenzene	1.2	6.0	0.81 J	--	--	--	--	--
Chloroform	1 U	1 U	1 U	--	--	--	--	--
Dibromochloromethane	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethane	1 U	1 U	1 U	--	--	--	--	--
1,3 Chlorobenzene	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	1 U	1 U	--	--	--	--	--
cis-1,2-Dichloroethene	1 U	1 U	1 U	--	--	--	--	--
trans-1,2-Dichloroethene	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethene	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	1 U	1 U	--	--	--	--	--
1,3-Dichlorobenzene	1 U	1 U	1 U	--	--	--	--	--
1,4-Dichlorobenzene	0.33 J	1.0	0.24 J	--	--	--	--	--
Chloroethane	1 U	1 U	1 U	--	--	--	--	--
Tetrachloroethene	1 U	1 U	1.5	--	--	--	--	--
1,1,1-Trichloroethane	1 U	1 U	1 U	--	--	--	--	--
Trichloroethene	1 U	1 U	1 U	--	--	--	--	--
Vinyl Chloride	1 U	1 U	1 U	--	--	--	--	--
1,2,4-Trichlorobenzene	1 U	1 U	1 U	--	--	--	--	--
cis-1,3-Dichloropropene	1 U	1 U	1 U	--	--	--	--	--
Methylene Chloride	1 U	1 U	1 U	--	--	--	--	--
Trichlorofluoromethane	1 U	1 U	1 U	--	--	--	--	--
***Semi-Volatiles* (mg/l)**								
Bis(2-chloroethyl)Ether	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2,4-Dimethylphenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2-Methylnaphthalene	5.0 U	5.0 U	5.0 U	--	--	--	--	--
2-Methylphenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
4-Methylphenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Acetophenone	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Caprolactam	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Diethylphthalate	5.0 U	5.0 U	5.0 U	--	--	--	--	--
N-Nitrosodiphenylamine	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Naphthalene	5.0 U	5.0 U	5.0 U	--	--	--	--	--
Phenol	5.0 U	5.0 U	5.0 U	--	--	--	--	--
***Inorganics* (mg/l)**								
Dissolved Manganese	0.854	1.04	0.72	0.0862	0.18	0.712	0.225	0.191
Dissolved Iron	31.7	43.0	45.4	0.0285 J	30.9	27.3	0.785	0.191
Dissolved Cobalt	--	--	--	0.0500 U	0.0050 U	0.0016 J	0.0013 J	0.0027 J
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--
Field Parameters								
Temperature (Degrees Celcius)	15.4	15.8	14.0	14.8	12.2	12.2	13.8	13.4
Conductivity (ms/cm)	345	495	404	252	283	822	341	235
pH (standard units)	6.85	6.99	6.62	6.07	6.16	7.01	6.51	6.24
Dissolved Oxygen (mg/l)	0.00	0.00	0.00	3.02	0.00	0.00	0.00	0.00
ORP (mV)	-145	-99	-167	146	52	-155	69	133
Water-Level Elevation (ft, MSL)	-1.83	-3.59	-1.66	-3.24	-0.90	-5.36	-4.83	-2.67

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-1																				
		6/94	10/94	1/95	3/95	6/95	10/95	1/96	3/96	6/96	9/96	12/96	3/97	6/97	9/97	12/97	3/98	6/98	10/98	12/98	3/99	6/99
Non-Halogenated VOCs (mg/l)																						
Benzene	5	0.5 U	0.5 U	0.7	0.7	1.0 B	1.4 B	1.0	0.5	0.5 U	0.5 U	0.2 J	0.2 J	0.2 J	0.8	0.3 J	0.8 J	1.3	0.8	0.7	0.8	1.0 B
Toluene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Halogenated VOCs (mg/l)																						
Bromoform	100*	--	--	--	2 U	2 U	0.2 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromodichloromethane	100*	--	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	100*	--	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	100*	--	--	--	1 U	1 U	0.11 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	0.5 U	0.5 U	0.7	0.7	0.7	0.6	0.5 J	0.5 J	0.4 J	0.3 J	0.2 J	0.5 U	0.5 U	0.7	0.3 J	0.5 U	0.5 J	0.6	1.0	1.8	2.1
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.5 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	75	--	0.5 U	0.1 J	0.1 JB	0.1 J	0.4 J	0.5	0.4 J	0.4 J	0.4 J	0.3 J	0.4 J	0.6	1.2	1.6	1.6	2.0	1.1	0.9	1.1	1.0
Chloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5	0.5 U	0.5 U	0.2 J	0.3 J	0.2 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.1 J	0.5 U	0.5 U	0.5 U
Vinyl Chloride	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi-Volatiles (mg/l)																						
Bis(2-chloroethyl)Ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Inorganics (mg/l)																						
Dissolved Manganese (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Iron (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																						
Temperature (Degrees Celcius)		13.9	13.5	12.3	13.4	13.8	13.3	12.0	12.8	13.6	13.0	13.2	12.2	13.1	11.0	12.9	13.4	14.1	13.5	13.4	13.4	13.6
Conductivity (ms/cm)		120	115	148	154	139	160	190	168	167	178	144	118	172	235	179	218	240	231	185	197	224
pH (standard units)		6.12	5.71	7.94	6.37	5.99	5.93	6.66	6.05	7.49	6.24	6.27	5.80	5.98	5.97	6.24	6.10	6.28	6.02	6.26	6.21	6.21
Dissolved Oxygen (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ORP (mV)		-118	88	96	140	119	72	110	84	8	107	--	-91	82	--	-44	50	--	-291	6	146.1	187.9
Water-Level Elevation (ft, MSL)		--	--	--	--	-23.79	--	--	--	-23.88	--	--	--	-20.15	--	--	--	-20.36	--	--	--	-23.50

-- Not analyzed or data not available to RAI as of December 14, 2018
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
UL - Not detected, quantitation limit is probably higher
Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-1																			
		9/99	12/99	3/00	7/00	10/00	12/00	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03	7/03	10/03	1/04	4/04	7/04
***Non-Halogenated VOCs* (mg/l)**																					
Benzene	5	1.0	4.3	2.8	8.2	14.0	68	12	2	9.2	5.4	2.4	4.4	3.1	2.7	2 J	2.8 B	4.6	4.6	3.7	6.2
Toluene		--	--	--	--	--	--	--	0.5 U	--	0.5 U	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.5 U
Ethylbenzene		--	--	--	--	--	--	--	--	--	0.1 J	--	--	--	--	5 U	0.078 J	--	0.7	--	0.5 U
Xylene (total)		--	--	--	--	--	--	--	--	--	1 U	--	--	--	--	5 U	0.17 J	--	1.0 U	--	1.0 U
2-Butanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Halogenated VOCs* (mg/l)**																					
Bromoform	100*	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	5 U	0.5 U	2 U	0.5 U	2 U	0.5 U
Bromodichloromethane	100*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene		--	--	--	--	--	--	--	--	--	31	--	--	--	--	19	22	--	29	--	21 D
Chloroform	100*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	0.5 U	1 U	0.5 U	1 U	0.5 U
1,2-Dichloroethane	5	2.3	5.0	4.8	3.9	3.4	5.4	5.8	12 J	11 J	11	11.0	16.0	16.0	12.0	7	9.1	17.0	13	7.0	14
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--	--	--	--	--	1.6	--	--	--	--	0.7 J	1	--	1.7	--	1.4
cis-1,2-Dichloroethene		--	--	--	--	--	--	--	0.5 U	--	2.1	--	--	--	--	1 J	1.7	--	2.5	--	2.0
trans-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	7	0.5 U	0.5 U	0.2 J	0.5 U	0.5 U	0.5 U	0.5 U	0.1 B	0.2 J	0.1 J	0.1 J	0.5 U	0.1 J	0.5 U	5 U	0.5 U	0.1 J	0.1 J	0.5 U	0.5 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	2.2 J	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--	--	--	--	--	1.7	--	--	--	--	5 U	1.2	--	1.9	--	1.2
1,3-Dichlorobenzene		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	0.3 J	0.63	--	0.9	--	0.7
1,4-Dichlorobenzene	75	1.2	3.8	3.7	2.0	3.4	4.9	3.0	4.8	4.9	3.8	4.0	3.9	4.9	3.2	5 U	2.3	3.7	3.3	1.8	2.0
Chloroethane		--	--	--	--	--	--	--	--	--	0.8	--	--	--	--	5 U	0.85	--	0.9	--	1.0
Tetrachloroethene		0.5 U	0.2 J	0.3 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5	0.2 J	0.7	0.7	0.3 J	0.3 J	0.6	0.4 J	0.7	0.7	0.6	0.7	0.7	0.8	0.6	5 U	0.5 U	0.6	0.4 J	0.2 J	0.3 J
Vinyl Chloride	2	0.5 U	0.5 U	0.5 U	0.2 J	0.3 J	0.5 J	0.2 J	0.3 J	0.3 J	0.3 J	0.3 J	0.2 J	0.3 J	0.3 J	5 U	0.19 J	0.4 J	0.3 J	0.2 J	0.3 J
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Semi-Volatiles* (mg/l)**																					
Bis(2-chloroethyl)Ether		--	--	--	23.47 D	23 D	46 D	32	22	37	28	21	40	31	30 D	31	60 D	--	--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Inorganics* (mg/l)**																					
Dissolved Manganese		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.30	--	--	--	--
Dissolved Iron		--	--	--	--	--	--	0.270	0.264	--	--	--	--	--	--	0.609	0.357	--	--	--	--
Biological Oxygen Demand (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																					
Temperature (Degrees Celcius)		13.5	13.3	14.2	13.8	14.0	13.6	13.7	13.6	--	13.8	13.8	14.8	15.0	13.6	14.42	15.0	14.5	13.7	13.71	14.63
Conductivity (ms/cm)		178	190	290	211	254	38	251	322	--	306	322	318	311	343	241.3	320.2	393	346	258	--
pH (standard units)		6.21	7.63	6.11	6.23	7.65	6.09	6.42	6.22	--	6.15	6.08	6.82	6.26	6.29	5.43	6.0	5.73	6.90	6.39	6.87
Dissolved Oxygen (mg/l)		--	--	--	--	0.3	0.22	0.16	--	--	--	0.09	0.01	0.17	0.05	0.05	0.04	--	--	--	--
ORP (mV)		33.6	286.4	86	124.3	129.2	107	346.9	229.6	--	349.3	256.1	223.1	94.2	79.5	93.4	8.1	80.5	47.8	79.3	107.6
Water-Level Elevation (ft, MSL)		--	--	--	-26.28	--	-18.03	-21.02	-28.09	-31.86	-29.00	-25.42	-32.66	-28.73	-31.54	-26.4	-30.63	-30.81	-28.72	-24.08	-26.89

-- Not analyzed or data not available to RAI as of December 14, 2018
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes
Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

UL - Not detected, quantitation limit is probably higher
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected

Table 2 (continued)

istorical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfil

Parameter	Criteria	BW-1										
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07
***Non-Halogenated VOCs* (mg/l)**												
Benzene	5	7.6	12	20	24	4 J	1.9 J	1.2	0.47 J	0.25 J	0.22 J	0.23 J
Toluene		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene		0.12 J	4 J	13	15	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Xylene (total)		0.5 U	5 U	5 U	5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U
2-Butanone		5 U	10 U	10 R	10 R	10 U	10 U	5 U	5 U	5 U	5 U	5 U
Acetone		5 UJ	20 R	20 R	20 R	20 R	10 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ
Isopropylbenzene		1.5	--	--	--	--	10 U	0.32 J	1 U	1 U	1 U	1 U
Methy-tert-butyl ether		1.1	--	--	--	--	10 U	0.68 J	0.75 J	0.37 J	1 U	1 U
Methylcyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ
4-Methyl-2-pentanone		5 U	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U
***Halogenated VOCs* (mg/l)**												
Bromoform	100*	0.17 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 UJ	1 U	1 U
Bromodichloromethane	100*	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	0.5 U	5 UJ	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene		24 D	30	32	32	18	13	10	5.2	3.1	2.8	2.0
Chloroform	100*	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	100*	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	6.5	5 U	7	2 J	5 U	10 U	0.49 J	0.36 J	0.22 J	0.12 J	1 U
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		1.2 L	2 J	3 J	3 J	5 U	10 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene		1.4	3 J	2 J	2 J	5 U	10 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene		0.22 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	7	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		1.2	--	--	--	--	10 U	0.67 J	0.40 J	1 U	1 U	0.12 J
1,3-Dichlorobenzene		0.79	--	--	--	--	10 U	0.28 J	0.22 J	1 U	1 U	1 U
1,4-Dichlorobenzene	75	2.3	--	--	--	--	1.1 J	1.0	0.59 J	0.27 J	0.25 J	0.17 J
Chloroethane		0.89	5 U	1 J	5 U	5 U	10 UJ	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene		0.13 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	200	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	0.24 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	0.18 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene		0.17 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride		0.5 U	5 U	5 U	5 U	5 U	10 U	1 UJ	1 UJ	1 U	1 U	1 U
Trichlorofluoromethane		0.26 J	--	--	--	--	10 UJ	1 U	1 U	1 U	1 U	1 UJ
***Semi-Volatiles* (mg/l)**												
Bis(2-chloroethyl)Ether		31	43	58	77	17	15	11	5.1	3.8 J	4.4 J	2.9 J
Bis(2-ethylhexyl)phthalate		5 U	5 U	5 U	5.1 U	4.6 J	5 U	5 UL	5 U	5 U	5 U	5 U
2,2'-oxybis (1-Chloropropane)		5 UJ	5 U	5 U	5.1 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 U
2,4-Dimethylphenol		5 U	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylnaphthalene		5 U	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylphenol		5 U	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methylphenol		5 U	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetophenone		5 U	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Caprolactam		5 U	5 U	5 U	5.1 UL	5 U	5 U	5 UL	11 L	5 U	5 U	5 U
Diethylphthalate		5 U	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
N-Nitrosodiphenylamine		5 U	5 U	5 UJ	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene		5 U	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Phenol		5 U	5 U	5 U	1.8 J	5 U	5 UL	5 U	5 U	5 U	5 U	5 U
***Inorganics* (mg/l)**												
Dissolved Manganese		1.03	2.12	2.67 J	2.65	2.53	2.58	2.3	1.98	1.65	1.33	1.17
Dissolved Iron		1.01	0.775	1.09 J	4.83	20.3	16.6	19.4	18.1	18.3	20.5	18.5
Biological Oxygen Demand (mg/l)		--	--	10.2	5.2	< 1	3.2	< 2	< 2	< 2	--	--
Field Parameters												
Temperature (Degrees Celcius)		13.65	13.26	13.35	13.88	14.0	13.1	13.7	16.4	15.0	12.7	14.0
Conductivity (ms/cm)		285	332	408	575	468	411	467	409	380	194	202
pH (standard units)		6.08	6.46	6.33	6.10	6.62	6.61	6.65	6.57	6.55	6.51	6.64
Dissolved Oxygen (mg/l)		0.35	--	0.25	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ORP (mV)		44.9	-3.5	13.4	25.9	-148	-101	-99	-165	-152	-156	-197
Water-Level Elevation (ft, MSL)		-22.22	--	-2.26	-14.17	-19.33	-3.21	-9.38	-15.07	-14.21	-11.94	-11.87

-- Not analyzed or data not available to RAI as of December 14, 2018
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes

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P - Discrepency in GC analysis. Lower value reported
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Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-1											
		10/07	4/08	10/08	4/09	10/09	4/10	10/10	4/11	10/11	4/12	10/12	4/13
Non-Halogenated VOCs **(mg/l)**													
Benzene	5	0.3 J	0.84 J	0.89 J	0.61 J	0.59 J	0.50 J	0.22 J	0.26 J	0.16 J	0.17 J	0.16 J	1 U
Toluene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (total)		3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
2-Butanone		5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
Acetone		4 J	5 U	5 U	5 UJ	2.9 U	6.1 U	5 U	5 U	5 U	5 UJ	5 U	5 UJ
Carbon Disulfide		1 U	1 U	0.35 J	1 U	1 U	1 U	0.28 J	0.24 J	1 U	1 U	1 U	1 U
Cyclohexane		1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methy-tert-butyl ether		0.2 J	0.34 J	0.47 J	0.41 J	0.77 J	0.77 J	0.83 J	1.0	1.2	0.76 J	0.64 J	0.69 J
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone		5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
Halogenated VOCs **(mg/l)**													
Bromoform	100*	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Chlorobenzene		2.4	6.2	6.8	5.8	8.6	6.8	3.4	4.2	2.7	3.6	3.8	3.3
Chloroform	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		0.17 J	0.26 J	0.26 J	0.22 J	0.37 J	0.25 J	1 U	0.15 J	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene		1 U	1 U	1 U	1 U	0.13 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	75	0.36 J	1.1	1.1	1.4	1.9	1.7	0.95 J	0.96 J	0.76 J	0.83 J	0.87 J	0.69 J
Chloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride		1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Trichlorofluoromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Semi-Volatiles **(mg/l)**													
Bis(2-chloroethyl)Ether		3.7 J	5.3	8.7	4.4 J	4.8 J	2.4 J	5.0 U	2.9 J	1.6 J	1.8 J	1.4 J	5.0 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate		5 U	5 UL	8.3 J	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)		5 U	5 U	5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dimethylphenol		5 U	5 U	5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene		5 U	5 U	5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol		5 U	5 U	5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methylphenol		5 U	5 U	5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Acetophenone		5 U	5 U	5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Caprolactam		2.4 J	5 UL	5 UJ	5.3 R	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 J
Diethylphthalate		5 U	5 UL	5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine		5 U	5 U	5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene		5 U	5 U	5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Phenol		5 U	5 U	5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Inorganics **(mg/l)**													
Dissolved Manganese		1.15	1.76	1.85	2.12	2.05	2.19	2.19	1.91	1.86	1.59	1.78	1.87
Dissolved Iron		16.8	24.5	20.9	22.1	20.2	21.0	20.1	15.9	14.4	12.4	14.5	15.0
Dissolved Cobalt		--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters													
Temperature (Degrees Celcius)		15.5	14.4	12.3	12.6	12.8	12.4	13.4	16.2	14.9	16.1	14.0	15.8
Conductivity (ms/cm)		747	328	328	468	514	534	293	382	346	373	394	402
pH (standard units)		6.38	6.44	7.15	6.39	6.70	6.49	6.40	6.50	6.62	6.21	6.03	6.04
Dissolved Oxygen (mg/l)		5.16	0.11	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00
ORP (mV)		-182	-129	-58	-59	-63	-51	-72	-66	-84	-81	-58	53
Water-Level Elevation (ft, MSL)		-19.36	-14.32	-15.85	-10.66	-15.27	-7.63	-10.27	-8.44	-13.43	-5.99	-6.79	-7.97

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes

UL - Not detected, quantitation limit is probably higher
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected

Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-1						
		10/13	10/14	10/15	3/16	10/16	10/17	10/18
Non-Halogenated VOCs **(mg/l)**								
Benzene	5	0.13 J	0.50 U	0.14 J	--	0.50 U	0.50 U	0.50 U
Toluene		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Ethylbenzene		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Xylene (total)		3 U	1.5 U	3.0 U	--	0.50 U	0.50 U	0.50 U
2-Butanone		5 U	50 UJ	5.0 U	--	10 U	10 U	10 U
Acetone		5 U	5.0 UJ	3.5 J	--	10 U	2.6 J	10 U
Carbon Disulfide		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Cyclohexane		1 U	1.0 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Isopropylbenzene		1 U	1.0 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Methy-tert-butyl ether		0.79 J	0.95	0.77 J	--	0.46 J	0.50 U	0.50 U
Methylcyclohexane		1 U	0.50 U	1.0 U	--	5.0 U	5.0 U	5.0 U
4-Methyl-2-pentanone		5 U	5.0 U	5.0 U	--	10 U	10 U	10 U
Halogenated VOCs **(mg/l)**								
Bromoform	100*	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Bromodichloromethane	100*	1 U	0.31 J	1.0 U	--	0.50 U	0.50 U	0.50 U
Carbon Tetrachloride	5	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Chlorobenzene		4.6	6.4	5.9	--	6.4	6.6	6.1
Chloroform	100*	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Dibromochloromethane	100*	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane	5	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,3 Chlorobenzene		--	--	--	--	--	--	--
1,1-Dichloroethane		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
cis-1,2-Dichloroethene		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
trans-1,2-Dichloroethene		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,1-Dichloroethene	7	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--
1,2-Dichlorobenzene		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,3-Dichlorobenzene		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,4-Dichlorobenzene	75	1.1	1.7	1.4	--	0.50 U	1.7	1.5
Chloroethane		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Tetrachloroethene		1 U	0.31 J	1.0 U	--	0.50 U	0.50 U	0.50 U
1,1,1-Trichloroethane	200	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Trichloroethene	5	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Vinyl Chloride	2	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,2,4-Trichlorobenzene		1 U	0.50 UJ	1.0 U	--	0.50 U	0.50 U	0.50 U
cis-1,3-Dichloropropene		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Methylene Chloride		1 U	5.0 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Trichlorofluoromethane		1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Semi-Volatiles **(mg/l)**								
Bis(2-chloroethyl)Ether		5.0 U	5.0 U	0.54	--	0.40	0.27	0.30 J
1,4-Dioxane		--	--	--	--	2.3	1.8 J	2.4
Bis(2-ethylhexyl)phthalate		5.0 U	5.0 U	5.0 U	--	0.61 J	4.8 U	5.0 U
2,2'-oxybis (1-Chloropropane)		5.0 U	5.0 U	5.0 U	--	10 U	9.5 U	10 U
2,4-Dimethylphenol		5.0 U	5.0 U	5.0 U	--	5.0 U	4.8 U	5.0 U
2-Methylnaphthalene		5.0 U	5.0 U	5.0 U	--	5.0 U	4.8 U	5.0 U
2-Methylphenol		5.0 U	5.0 U	5.0 U	--	10 U	9.5 U	10 U
4-Methylphenol		5.0 U	5.0 U	5.0 U	--	10 U	9.5 U	10 U
Acetophenone		5.0 U	5.0 U	5.0 U	--	10 U	9.5 U	10 U
Caprolactam		2.5 J	1.5 J	5.0 U	--	10 U	9.5 U	10 U
Diethylphthalate		5.0 U	5.0 U	5.0 U	--	5.0 U	4.8 U	5.0 U
N-Nitrosodiphenylamine		5.0 U	5.0 U	5.0 U	--	5.0 U	4.8 U	5.0 U
Naphthalene		5.0 U	5.0 U	5.0 U	--	5.0 U	4.8 U	5.0 U
Phenol		5.0 U	5.0 U	5.0 U	--	10 U	9.5 U	10 U
Inorganics **(mg/l)**								
Dissolved Manganese		1.91	1.93 J	2.32	1.9	2.57	3.52	3.55
Dissolved Iron		15.4	14.3	11.7	11.3	12.9	14.2	12.5
Dissolved Cobalt		--	--	0.0305 J	0.026	0.0274 J	0.0290 J	0.0294 J
Biological Oxygen Demand (mg/l)		--	--	--	--	--	--	--
Field Parameters								
Temperature (Degrees Celcius)		13.4	13.3	13.4	10.0	14.1	15.0	12.3
Conductivity (ms/cm)		444	419	523	426	534	503	452
pH (standard units)		5.89	6.76	6.80	6.35	6.54	6.71	6.72
Dissolved Oxygen (mg/l)		0.00	0.00	0.00	0.00	0.00	0.00	0.00
ORP (mV)		-69	-100	-45	-47	-63	-47	-34
Water-Level Elevation (ft, MSL)		-9.19	-8.69	-12.07	-9.13	-16.45	-14.80	-11.43

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes

UL - Not detected, quantitation limit is probably higher
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected
H - Analysis performed outside of Holding Time

Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-2																				
		6/94	10/94	1/95	3/95	6/95	10/95	1/96	3/96	6/96	9/96	12/96	3/97	6/97	9/97	12/97	3/98	6/98	10/98	12/98	3/99	6/99
Non-Halogenated VOCs **(mg/l)**																						
Benzene	5	0.5 U	0.5 U	0.3 J	0.2 J	0.5 B	0.2 JB	0.4 J	0.6	0.5 U	0.5 U	0.6	0.7	1.1	0.9	2.8	1.4	1.9	1.3	2.2	3.8	3.0
Toluene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Halogenated VOCs **(mg/l)**																						
Bromoform	100*	--	--	--	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromodichloromethane	100*	--	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	100*	--	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	100*	--	--	--	1 U	1 U	0.10 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	0.5 U	0.7	0.9	0.5 U	0.9	0.8	0.5 U	0.6	0.8	0.9	0.8	0.8	1.0	0.4 J	1.0	3.2	2.4	3.7	3.2	4.7	5.3
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	75	--	0.5 U	0.1 J	0.2 JB	0.2 J	0.4 J	0.6	0.6	1.0	0.9	0.9	1.0	1.3	0.9	1.4	1.7	2.1	2.1	2.1	2.7	2.4
Chloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.5 U	0.1 J	0.5 J	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J
1,1,1-Trichloroethane	200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5	0.5 U	0.5 U	0.5 U	0.2 J	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.5 U	0.5 U	0.4 J	0.3 J	0.3 J	0.3 J	0.4 J	0.5
Vinyl Chloride	2	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi-Volatiles **(mg/l)**																						
Bis(2-chloroethyl)Ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Inorganics **(mg/l)**																						
Dissolved Manganese		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Iron		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																						
Temperature (Degrees Celcius)		14.5	13.9	13.3	14.0	14.6	13.8	12.5	13.7	14.2	13.4	13.4	12.6	13.4	12.0	13.2	13.5	14.5	13.6	13.4	13.4	13.8
Conductivity (ms/cm)		127	126	163	169	141	150	171	198	203	189	229	181	245	228	183	173	219	232	218	226	277
pH (standard units)		6.07	5.82	6.66	6.33	6.28	6.55	6.73	6.43	6.91	5.90	6.26	6.55	6.18	5.89	6.17	6.19	6.19	6.12	6.08	6.03	6.08
Dissolved Oxygen (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ORP (mV)		-76	58	61	140	70	33	146	81	49	32	--	-109	-75	--	-39	24	--	-333	3	81.3	64
Water-Level Elevation (ft, MSL)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

-- Not analyzed or data not available to RAI as of December 14, 2018
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
UL - Not detected, quantitation limit is probably higher
Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-2 (continued)																						
		11/99	12/99	3/00	7/00	10/00	12/00	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03	7/03	10/03	1/04	4/04	7/04	10/04	1/05	4/05
***Non-Halogenated VOCs* (mg/l)**																								
Benzene	5	0.9	4.3	1.1	1.4	4.9	2.4	2.1	2.2	3.3	5.2	3.5	7.1	6	5.7	7	18	6.3	2.8	2.8	4.3	2.9	1 J	0.8 J
Toluene		--	--	--	--	--	--	--	0.5 U	--	0.5 U	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.5 U	1.3 U	5 U	5 U
Ethylbenzene		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	5 U	0.56	--	0.5 U	--	0.1 J	1.3 U	5 U	5 U
Xylene (total)		--	--	--	--	--	--	--	--	--	1 U	--	--	--	--	5 U	0.24 J	--	1.0 U	--	1.0 U	1.3 U	5 U	5 U
2-Butanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	13 U	10 U	10 R
Acetone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12.5 R	20 U	20 R
Carbon Disulfide		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.3 U	5 U	5 U
Cyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.3 UJ	--	--
Isopropylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.32 J	--	--
Methy-tert-butyl ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.74 J	--	--
Methylcyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.3 U	--	--
4-Methyl-2-pentanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	13 U	10 U	10 U
***Halogenated VOCs* (mg/l)**																								
Bromoform	100*	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U	2 U	2 U	2 U	2 U	5 UJ	0.5 U	2 U	0.5 U	2 U	0.5 U	1.3 U	5 U	5 U
Bromodichloromethane	100*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	5 U	5 U
Carbon Tetrachloride	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	5 UJ	5 U
Chlorobenzene		--	--	--	--	--	--	--	--	--	31	--	--	--	--	28	30 D	--	22	--	21 D	24	17	11
Chloroform	100*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	5 U	5 U
Dibromochloromethane	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	0.5 U	1 U	0.5 U	1 U	0.5 U	1.3 U	5 U	5 U
1,2-Dichloroethane	5	4.9	5.0	3.1	2.6	1.8	2.2	2.8	2.2	1.6	2.0	1.4	1.6	1.3	1.3	5 U	1.3	1.3	0.9	1.1	1.2	1.3	5 U	5 U
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--	--	--	--	--	1	--	--	--	--	5 U	0.92	--	0.6	--	0.7	0.93 J	5 U	5 U
cis-1,2-Dichloroethene		--	--	--	--	--	--	--	1 U	--	0.6	--	--	--	--	0.5 J	0.82	--	0.5 U	--	0.6	0.82 J	5 U	5 U
trans-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.27 J	5 U	5 U
1,1-Dichloroethene	7	0.1 J	0.5 U	0.2 JB	0.7	0.5 U	0.5 U	0.1 J	0.1 B	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	5 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	0.7 J	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--	--	--	--	--	2.5	--	--	--	--	1 J	1.8	--	1.3	--	1.5	1.6	--	--
1,3-Dichlorobenzene		--	--	--	--	--	--	--	--	--	0.9	--	--	--	--	0.6 J	0.92	--	0.5	--	0.6	0.75 J	--	--
1,4-Dichlorobenzene	75	3.1	3.8	1.7	2.5	2.6	2.4	2.9	3.2	2.8	3.0	2.8	3.1	2.4	2.5	5 U	3.2	2.5	1.9	1.8	2.1	2.5	--	--
Chloroethane		--	--	--	--	--	--	--	--	--	0.6	--	--	--	--	5 U	1.5	--	0.3 J	--	0.4 J	0.37 J	5 U	5 U
Tetrachloroethene		0.2 J	0.2 J	0.2 J	0.3 J	0.2 J	0.2 J	0.3 J	0.3 J	0.1 J	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J	5 U	0.5 U	0.2 J	0.2 J	0.2 J	0.2 J	0.41 J	5 U	5 U
1,1,1-Trichloroethane	200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	5 U	5 U
Trichloroethene	5	0.6	0.7	0.3 J	0.3 J	0.3J	0.3 J	0.45	0.3 J	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J	5 U	0.5 U	0.2 J	0.2 J	0.2 J	0.2 J	0.35 J	5 U	5 U
Vinyl Chloride	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	5 U	0.17 J	0.5 U	0.5 U	0.5 U	0.5 U	1.3 U	5 U	5 U
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.3 U	--	--
cis-1,3-Dichloropropene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.3 U	5 U	5 U
Methylene Chloride		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.6 U	5 U	5 U
Trichlorofluoromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.3 U	--	--
***Semi-Volatiles* (mg/l)**																								
Bis(2-chloroethyl)Ether		--	--	--	30.82 D	37 D	47 D	36	25	43	25	30	34	38	54 D	43	42 D	--	--	--	--	25	24	20
Bis(2-ethylhexyl)phthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
2,4-Dimethylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
2-Methylnaphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
2-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
4-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
Acetophenone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
Caprolactam		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
Diethylphthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
N-Nitrosodiphenylamine		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 UJ
Naphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
Phenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U
***Inorganics* (mg/l)**																								
Dissolved Manganese		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.21	--	--	--	--	0.969	0.972	1.02 J
Dissolved Iron		--	--	--	--	--	--	0.779	1.05	--	--	--	--	--	--	1.10	2.40	--	--	--	--	1.21	2.33	1.87 J
Dissolved Cobalt		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																								
Temperature (Degrees Celcius)		13.2	13.3	14.0	13.5	13.8	14.1	13.7	--	--	13.6	14.1	14.3	15.1	13.1	13.59	14.34	14.2	13.2	13.65	14.4	13.75	12.90	13.28
Conductivity (ms/cm)		255	272	410	271	370	45	290	--	--	376	361	341	312	414	316	361.4	424	168.0	324	105	389	262	258
pH (standard units)		6.37	8.02	6.10	6.20	7.81	6.06	6.35	--	--	6.14	5.75	6.25	6.17	6.28	5.66	6.26	5.73	6.5	6.51	6.93	6.23	6.46	6.41
Dissolved Oxygen (mg/l)		--	--	--	--	--	1.41	0.40	--	--	--	0.03	0.02	0.16	0.07	0.01	0.01	--	--	--	--	0.14	0.17	0.49
ORP (mV)		116.7	178.3	41	95.4	54.4	79	309	--	--	302.4	353.2	271.7	42.6	40.3	77.6	27.6	53.3	41.6	41.2	78.2	31.6	22.9	14.5
Water-Level Elevation (ft, MSL)		--	--	--	--	--	-18.98	21.93	-26.11	-32.05	-29.91	-29.51	-32.52	-29.66	-31.23	-26.9	-30.62	-30.76	-28.48	-24.61	-27.13	-21.56	-16.00	-2.18

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
UL - Not detected, quantitation limit is probably higher
Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-2 (continued)											
		7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/07	10/08	4/15	10/15
***Non-Halogenated VOCs* (mg/l)**													
Benzene	5	0.5 J	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	0.28 J	--	--
Toluene		5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	0.36 J	--	--
Ethylbenzene		5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Xylene (total)		5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	--	--
2-Butanone		10 R	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	--	--
Acetone		20 R	20 R	10 U	4.3 J	5.0 U	5 U	5 U	5 U	5.2 J	5 U	--	--
Carbon Disulfide		5 U	5 U	10 U	1 U	1 U	0.27 J	0.33 J	1 U	1 U	0.50 J	--	--
Cyclohexane		--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	--	--
Isopropylbenzene		--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Methy-tert-butyl ether		--	--	10 U	1 U	1 U	1 U	1 U	1 U	0.25 J	0.44 J	--	--
Methylcyclohexane		--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	--	--
4-Methyl-2-pentanone		10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	--	--
***Halogenated VOCs* (mg/l)**													
Bromoform	100*	5 U	5 U	10 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	--	--
Bromodichloromethane	100*	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Carbon Tetrachloride	5	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Chlorobenzene		9	3 J	2.0 J	1.6	1.4	1.1	1.2	1.3	1.7	2.5	--	--
Chloroform	100*	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Dibromochloromethane	100*	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,2-Dichloroethane	5	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
cis-1,2-Dichloroethene		5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
trans-1,2-Dichloroethene		5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,1-Dichloroethene	7	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,3-Dichlorobenzene		--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,4-Dichlorobenzene	75	--	--	10 U	0.28 J	0.34 J	0.27 J	0.30 J	0.32 J	0.43 J	0.81 J	--	--
Chloroethane		5 U	5 U	10 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Tetrachloroethene		5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,1,1-Trichloroethane	200	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Trichloroethene	5	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Vinyl Chloride	2	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,2,4-Trichlorobenzene		--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
cis-1,3-Dichloropropene		5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Methylene Chloride		5 U	5 U	10 U	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	--	--
Trichlorofluoromethane		--	--	10 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	--	--
***Semi-Volatiles* (mg/l)**													
Bis(2-chloroethyl)Ether		21	7.4	5.6	4.9 J	4.8 J	3.3 J	3.6 J	3.1 J	2.3 J	1.7 J	--	--
Bis(2-ethylhexyl)phthalate		5 U	7.9	5 U	5 UL	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
2,2'-oxybis (1-Chloropropane)		5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
2,4-Dimethylphenol		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
2-Methylnaphthalene		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
2-Methylphenol		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
4-Methylphenol		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
Acetophenone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
Caprolactam		5 UL	5 U	5 U	5 UL	5 UL	5 U	5 U	5 U	5.5	5.3 UJ	--	--
Diethylphthalate		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
N-Nitrosodiphenylamine		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
Naphthalene		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
Phenol		5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U	--	--
***Inorganics* (mg/l)**													
Dissolved Manganese		1.2	1.17	1.13	1.04	1.19	1.34	1.40	1.47	1.43	1.82	1.45	1.36
Dissolved Iron		2.1	1.81	1.87	1.60	2.05	1.34	1.79	1.07	0.428	1.62	0.0243 U	1.65
Dissolved Cobalt		--	--	--	--	--	--	--	--	--	--	0.0122 J	0.0149 J
Field Parameters													
Temperature (Degrees Celcius)		13.84	15.0	14.5	16.4	18.0	16.0	14.2	14.6	17.0	14.7	15.6	14.4
Conductivity (ms/cm)		318	302	280	395	351	313	217	270	163	312	386	378
pH (standard units)		5.12	6.36	6.49	6.44	6.53	6.33	6.93	6.79	6.81	6.81	6.67	6.88
Dissolved Oxygen (mg/l)		0.04	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.28	0.00
ORP (mV)		51.3	-44	-60	-68	-74	-40	-43	-46	4	-15	100	-7
Water-Level Elevation (ft, MSL)		-13.27	-18.06	-3.07	-8.83	-14.11	-13.78	-11.28	-12.89	-18.30	-15.20	-9.30	-11.65

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K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
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Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-2 (continued)						
		3/16	4/16	10/16	4/17	10/17	4/18	10/18
Non-Halogenated VOCs **(mg/l)**								
Benzene	5	--	--	--	--	--	--	--
Toluene		--	--	--	--	--	--	--
Ethylbenzene		--	--	--	--	--	--	--
Xylene (total)		--	--	--	--	--	--	--
2-Butanone		--	--	--	--	--	--	--
Acetone		--	--	--	--	--	--	--
Carbon Disulfide		--	--	--	--	--	--	--
Cyclohexane		--	--	--	--	--	--	--
Isopropylbenzene		--	--	--	--	--	--	--
Methy-tert-butyl ether		--	--	--	--	--	--	--
Methylcyclohexane		--	--	--	--	--	--	--
4-Methyl-2-pentanone		--	--	--	--	--	--	--
Halogenated VOCs **(mg/l)**								
Bromoform	100*	--	--	--	--	--	--	--
Bromodichloromethane	100*	--	--	--	--	--	--	--
Carbon Tetrachloride	5	--	--	--	--	--	--	--
Chlorobenzene		--	--	--	--	--	--	--
Chloroform	100*	--	--	--	--	--	--	--
Dibromochloromethane	100*	--	--	--	--	--	--	--
1,2-Dichloroethane	5	--	--	--	--	--	--	--
1,3 Chlorobenzene		--	--	--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--	--	--
cis-1,2-Dichloroethene		--	--	--	--	--	--	--
trans-1,2-Dichloroethene		--	--	--	--	--	--	--
1,1-Dichloroethene	7	--	--	--	--	--	--	--
1,2-Dichloroethene (total)		--	--	--	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--	--	--
1,3-Dichlorobenzene		--	--	--	--	--	--	--
1,4-Dichlorobenzene	75	--	--	--	--	--	--	--
Chloroethane		--	--	--	--	--	--	--
Tetrachloroethene		--	--	--	--	--	--	--
1,1,1-Trichloroethane	200	--	--	--	--	--	--	--
Trichloroethene	5	--	--	--	--	--	--	--
Vinyl Chloride	2	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--
cis-1,3-Dichloropropene		--	--	--	--	--	--	--
Methylene Chloride		--	--	--	--	--	--	--
Trichlorofluoromethane		--	--	--	--	--	--	--
Semi-Volatiles **(mg/l)**								
Bis(2-chloroethyl)Ether		--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--	--	--
2,4-Dimethylphenol		--	--	--	--	--	--	--
2-Methylnaphthalene		--	--	--	--	--	--	--
2-Methylphenol		--	--	--	--	--	--	--
4-Methylphenol		--	--	--	--	--	--	--
Acetophenone		--	--	--	--	--	--	--
Caprolactam		--	--	--	--	--	--	--
Diethylphthalate		--	--	--	--	--	--	--
N-Nitrosodiphenylamine		--	--	--	--	--	--	--
Naphthalene		--	--	--	--	--	--	--
Phenol		--	--	--	--	--	--	--
Inorganics **(mg/l)**								
Dissolved Manganese		1.4	1.2	1.45	1.57	1.58	1.62	1.41
Dissolved Iron		4.0	2.94	3.92	3.92	3.87	4.10	1.85
Dissolved Cobalt		0.017	0.0137 J	0.0164 J	0.0168 J	0.0169 J	0.0191 J	0.0160 J
Field Parameters								
Temperature (Degrees Celcius)		13.3	16.4	15.2	16.6	15.2	14.4	12.9
Conductivity (ms/cm)		325	336	392	401	325	370	334
pH (standard units)		6.46	6.59	6.46	6.45	6.64	6.40	6.80
Dissolved Oxygen (mg/l)		0.00	0.00	0.00	0.11	0.00	0.00	0.00
ORP (mV)		-37	-32	-43	-60	-1	-10	19
Water-Level Elevation (ft, MSL)		-8.82	-8.71	-15.95	-10.58	-14.46	-7.92	-10.95

-- Not analyzed or data not available to RAI as of December 14, 2018

U - Analyte was not detected above the reporting limit

J - Estimated concentration.

K - Analyte present, reported value may be biased high.

L - Analyte present, reported value may be biased low.

* - 100 mg/l is the Criteria for Total trihalomethanes

D - Sample diluted in the lab for analysis.

NP - Well not pumping

P - Discrepency in GC analysis. Lower value reported

B - Analyte Detected in Method Blank

UL - Not detected, quantitation limit is probably higher

Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-3																				
		6/94	10/94	1/95	3/95	6/95	10/95	1/96	3/96	6/96	9/96	12/96	3/97	6/97	9/97	12/97	3/98	6/98	10/98	12/98	3/99	6/99
Non-Halogenated VOCs (mg/l)																						
Benzene	5	0.5 U	0.5 U	0.4 J	0.5 U	0.1 JB	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.6	0.5 U	0.5 U	0.5 U	0.3 J	0.5 U	0.5 U	0.5 U	0.5 U
Toluene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Halogenated VOCs (mg/l)																						
Bromoform	100*	--	--	--	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromodichloromethane	100*	--	--	--	0.5 U	0.5 U	0.05 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	100*	--	--	--	0.9 J	0.06 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	100*	--	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	0.5 U	0.5 U	0.3 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.4 J	0.5 U	0.5 U	0.5 J	0.5 U	0.5 U	0.5 U	9.1	2.1	0.5 U	0.5 U	0.5 U
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	75	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.2 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.1 J
1,1,1-Trichloroethane	200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.7	0.3 J	0.1 J	0.5 U	0.5 U
Vinyl Chloride	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi-Volatiles (mg/l)																						
Bis(2-chloroethyl)Ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Inorganics (mg/l)																						
Dissolved Manganese (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Iron (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																						
Temperature (Degrees Celcius)		14.0	13.3	13.4	13.7	13.4	13.4	13.0	13.0	12.7	13.0	13.0	12.9	13.0	11.0	13.2	13.1	14.6	13.2	13.2	13.1	13.3
Conductivity (ms/cm)		190	113	161	119	107	113	102	97	108	183	104	82	157	83	71	62	165	153	105	99	144
pH (standard units)		9.91	9.11	6.51	7.79	6.86	6.11	7.57	6.20	6.48	6.32	7.01	6.18	5.85	7.10	6.08	6.72	6.22	6.00	5.99	6.07	5.99
Dissolved Oxygen (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ORP (mV)		-12	49	105	180	74	58	297	176	108	96	--	105	159	--	163	114	--	-92	102	269.3	189.1
Water-Level Elevation (ft, MSL)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

-- Not analyzed or data not available to RAI as of December 14, 2018
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
UL - Not detected, quantitation limit is probably higher
Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-3 (continued)																			
		9/99	12/99	3/00	7/00	10/00	12/00	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03	7/03	10/03	1/04	4/04	7/04
***Non-Halogenated VOCs* (mg/l)**																					
Benzene	5	0.5 U	0.7	0.3 J	0.5 U	1.5	1.2	0.3 J	0.6	0.1 J	0.5 U	4.4	2.6	0.5 J	1.7	0.8 J	0.5 U	0.3 J	0.2 J	0.6	0.6
Toluene		--	--	--	--	--	--	--	0.5 U	--	0.5 U	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.5 U
Ethylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.5 U
Xylene (total)		--	--	--	--	--	--	--	--	--	1 U	--	--	--	--	5 U	0.11 JB	--	1.0 U	--	1.0 U
2-Butanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Halogenated VOCs* (mg/l)**																					
Bromoform	100*	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.5 U	2 U	2 U	2 U	2 U	5 U	0.5 U	2 U	0.5 U	2 U	0.5 U
Bromodichloromethane	100*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene		--	--	--	--	--	--	--	--	--	0.4 J	--	--	--	--	6	4 B	--	1	--	7.6
Chloroform	100*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	5 U	0.5 U	1 U	0.5 U	1 U	0.5 U
1,2-Dichloroethane	5	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.5 U	0.3 J	0.5	0.1 J	0.5 U	1.3	0.8	0.2 J	0.7	5 U	0.32 J	0.2 J	0.2 J	0.5 J	0.5
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	0.3 J	0.26 J	--	0.2 J	--	0.4 J
cis-1,2-Dichloroethene		--	--	--	--	--	--	--	1 U	--	0.5 U	--	--	--	--	5 U	0.14 J	--	0.1 J	--	0.2 J
trans-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	7	0.5 U	0.1 J	0.3 JB	0.5 U	0.5 U	0.5 U	0.5 U	0.2 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	5 U	0.21 J	--	0.5 U	--	0.4 J
1,3-Dichlorobenzene		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	5 U	0.087 J	--	0.5 U	--	0.1 J
1,4-Dichlorobenzene	75	0.5 U	0.5 U	0.5 J	0.5 U	2.1	1.4	0.5 U	0.2 J	0.5 J	0.2 J	0.7	0.5	0.2 J	0.4 J	0.5 J	0.37 J	0.2 J	0.2 J	0.5 J	0.6
Chloroethane		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	5 U	0.17 J	--	0.5 U	--	0.3 J
Tetrachloroethene		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.1 J	0.2 J	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U
1,1,1-Trichloroethane	200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Semi-Volatiles* (mg/l)**																					
Bis(2-chloroethyl)Ether		--	--	--	1.135	3.3 D	3 D	2 J	5	1	0.58	22	78	4.5	19	26	16 D	--	--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Inorganics* (mg/l)**																					
Dissolved Manganese		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0432	--	--	--	--
Dissolved Iron		--	--	--	--	--	--	0.0263 B	0.011 U	--	--	--	--	--	--	0.0192 U	0.0234 U	--	--	--	--
Dissolved Cobalt		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																					
Temperature (Degrees Celcius)		13.4	13.1	13.8	13.5	13.8	13.6	12.8	13.5	--	13.3	13.3	13.4	13.5	13.2	13.18	13.48	13.5	13.2	13.3	13.2
Conductivity (ms/cm)		218	240	350	271	321	370	280	140	--	179	199	184	110	172	146.9	139.1	167	130.0	182	--
pH (standard units)		6.51	8.16	6.26	6.20	7.96	6.31	6.41	6.34	--	6.29	--	6.30	6.48	6.52	5.4	6.06	5.72	6.13	6.07	6.98
Dissolved Oxygen (mg/l)		--	--	--	--	0.30	2.57	--	0.11	--	2.39	--	0.05	1.6	0.24	1.01	0.19	--	--	--	--
ORP (mV)		185.5	286.9	153	95.4	157.4	124	154.9	155.6	--	299.8	620	181.1	153.6	153.2	189.1	76	86.6	165.8	126.5	135.3
Water-Level Elevation (ft, MSL)		--	--	--	--	--	-18.88	-22.12	-23.95	-28.57	-28.73	--	-30.62	-30.98	-30.64	-26.96	-28.65	-28.95	-27.69	-24.52	-26.03

-- Not analyzed or data not available to RAI as of December 14, 2018
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* - 100 mg/l is the Criteria for Total trihalomethanes

UL - Not detected, quantitation limit is probably higher
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
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Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-3 (continued)												
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/07	10/08
Non-Halogenated VOCs **(mg/l)**														
Benzene	5	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene		0.5 U	5 U	5 U	5 U	5 U	10 U	0.64 J	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (total)		0.5 U	5 U	5 U	5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
2-Butanone		5 U	10 U	10 U	10 R	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
Acetone		5 U	20 R	20 U	20 R	20 R	10 U	4.6 J	14 U	5 U	5 U	5 U	5 UJ	3.8 J
Carbon Disulfide		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U
Isopropylbenzene		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methy-tert-butyl ether		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
4-Methyl-2-pentanone		5 U	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ
Halogenated VOCs **(mg/l)**														
Bromoform	100*	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Bromodichloromethane	100*	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	0.5 U	5 UJ	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene		0.82	0.9 J	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	100*	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	100*	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	7	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	75	0.13 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane		0.5 U	5 U	5 U	5 U	5 U	10 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	200	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride		0.5 U	5 U	5 U	5 U	5 U	10 U	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U
Chloromethane		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	0.19 J	1 U	1 UJ	1 U
Trichlorofluoromethane		0.5 U	--	--	--	--	10 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
Semi-Volatiles **(mg/l)**														
Bis(2-chloroethyl)Ether		2.7 J	3.7 J	2.3 J	0.14	0.02 U	5 U	0.099	0.020 U	0.053	0.048	0.019 U	5 U	5.3 U
Bis(2-ethylhexyl)phthalate		5 U	4.7 J	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 UJ	5 U	5 UL	5.3 UL
2,2'-oxybis (1-Chloropropane)		5 U	5.3 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 UJ	5 U	5 U	5.3 U
2,4-Dimethylphenol		5 U	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 UL	5.3 UL
2-Methylnaphthalene		5 U	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5.3 UL
2-Methylphenol		5 U	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 UL	5.3 UL
4-Methylphenol		5 U	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 UL	5.3 UL
Acetophenone		5 U	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5.3 U
Caprolactam		5 UJ	5.3 UL	5 U	5 U	5 U	5 U	5 UL	5 UL	5 U	5 UJ	5 U	5 UL	5.3 UL
Diethylphthalate		5 U	5.3 UL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 UL	5.3 UL
N-Nitrosodiphenylamine		5 U	5.3 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5.3 U
Naphthalene		5 U	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5.3 UL
Phenol		5 U	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5.3 U
Inorganics **(mg/l)**														
Dissolved Manganese		0.0197	0.28	0.223	0.0216	0.0238	0.0277	0.0370	0.0405	0.0460	0.0994	0.109	0.104	0.133
Dissolved Iron		0.011 U	0.021 B	0.0273 U	0.028 U	0.0122 U	0.0153 U	0.0101 U	0.0124 U	0.0075 U	0.0091 U	0.010 U	0.009 U	0.0177 U
Dissolved Cobalt		--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)		--	--	0.0	< 1	1.2	2.0	< 2	< 2	< 2	--	--	--	--
Field Parameters														
Temperature (Degrees Celcius)		13.05	13.33	13.37	13.66	13.9	12.8	15.2	16.1	14.9	13.0	14.5	15.2	13.6
Conductivity (ms/cm)		115	107	125	290	112	146	152	194	126	99	90	79	144
pH (standard units)		5.94	5.89	6.57	5.36	5.65	5.85	5.99	5.72	5.59	6.18	6.23	6.02	5.79
Dissolved Oxygen (mg/l)		5.93	0.50	0.28	0.79	0.00	0.00	0.04	0.50	2.49	1.92	2.20	0.90	0.07
ORP (mV)		166	172.6	114.4	183.8	197	146	115	125	242	188	154	202	137
Water-Level Elevation (ft, MSL)		-18.90	-13.58	-1.06	-9.88	-14.96	-1.95	-6.55	-10.97	-11.88	-8.92	-9.85	-15.34	-12.74

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Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	BW-3 (continued)				
		10/15	3/16	10/16	10/17	10/18
***Non-Halogenated VOCs* (mg/l)**						
Benzene	5	--	--	--	--	--
Toluene		--	--	--	--	--
Ethylbenzene		--	--	--	--	--
Xylene (total)		--	--	--	--	--
2-Butanone		--	--	--	--	--
Acetone		--	--	--	--	--
Carbon Disulfide		--	--	--	--	--
Cyclohexane		--	--	--	--	--
Isopropylbenzene		--	--	--	--	--
Methy-tert-butyl ether		--	--	--	--	--
Methylcyclohexane		--	--	--	--	--
4-Methyl-2-pentanone		--	--	--	--	--
***Halogenated VOCs* (mg/l)**						
Bromoform	100*	--	--	--	--	--
Bromodichloromethane	100*	--	--	--	--	--
Carbon Tetrachloride	5	--	--	--	--	--
Chlorobenzene		--	--	--	--	--
Chloroform	100*	--	--	--	--	--
Dibromochloromethane	100*	--	--	--	--	--
1,2-Dichloroethane	5	--	--	--	--	--
1,3 Chlorobenzene		--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--
cis-1,2-Dichloroethene		--	--	--	--	--
trans-1,2-Dichloroethene		--	--	--	--	--
1,1-Dichloroethene	7	--	--	--	--	--
1,2-Dichloroethene (total)		--	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--
1,3-Dichlorobenzene		--	--	--	--	--
1,4-Dichlorobenzene	75	--	--	--	--	--
Chloroethane		--	--	--	--	--
Tetrachloroethene		--	--	--	--	--
1,1,1-Trichloroethane	200	--	--	--	--	--
Trichloroethene	5	--	--	--	--	--
Vinyl Chloride	2	--	--	--	--	--
1,2,4-Trichlorobenzene		--	--	--	--	--
cis-1,3-Dichloropropene		--	--	--	--	--
Methylene Chloride		--	--	--	--	--
Chloromethane		--	--	--	--	--
Trichlorofluoromethane		--	--	--	--	--
***Semi-Volatiles* (mg/l)**						
Bis(2-chloroethyl)Ether		--	--	--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--	--	--
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--
2,4-Dimethylphenol		--	--	--	--	--
2-Methylnaphthalene		--	--	--	--	--
2-Methylphenol		--	--	--	--	--
4-Methylphenol		--	--	--	--	--
Acetophenone		--	--	--	--	--
Caprolactam		--	--	--	--	--
Diethylphthalate		--	--	--	--	--
N-Nitrosodiphenylamine		--	--	--	--	--
Naphthalene		--	--	--	--	--
Phenol		--	--	--	--	--
***Inorganics* (mg/l)**						
Dissolved Manganese		0.103	0.13	0.243	0.518	1.84
Dissolved Iron		0.100 U	0.050 U	0.100 U	0.100 U	0.100 U
Dissolved Cobalt		0.0033 J	0.0050 U	0.0026 J	0.0031 J	0.0045 J
Biological Oxygen Demand (mg/l)		--	--	--	--	--
Field Parameters						
Temperature (Degrees Celcius)		13.9	10.4	14.4	15.1	12.6
Conductivity (ms/cm)		253	305	300	284	152
pH (standard units)		6.69	6.55	6.40	6.47	6.65
Dissolved Oxygen (mg/l)		0.00	0.00	0.00	0.00	0.00
ORP (mV)		169	153	180	239	152
Water-Level Elevation (ft, MSL)		-8.12	-5.53	-12.32	-11.02	-7.39

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Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	MW-40																				
		6/94	10/94	1/95	3/95	6/95	10/95	1/96	3/96	6/96	9/96	12/96	3/97	6/97	9/97	12/97	3/98	6/98	10/98	12/98	3/99	6/99
Non-Halogenated VOCs (mg/l)																						
Benzene	5	0.5 U	0.5 U	0.4 J	1.0	1.2 B	0.8 B	0.5	0.2 J	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Halogenated VOCs (mg/l)																						
Bromoform	100*	--	--	--	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromodichloromethane	100*	--	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	100*	--	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.07 J	0.1 J	0.5 U	0.2 J	0.2 J	0.2 J	0.2 J
Chloromethane		--	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	100*	--	--	--	1 U	1 U	0.15 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	120	40	48	69	98	30	14	1.9	0.7	0.3 J	0.5 U	0.5 U	0.5 U	0.3 J	0.5 U	0.5 U	0.5 U	0.5 U	1.1	0.3 J	0.5 U
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	75	--	0.5 U	0.2 J	0.2 JB	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J	0.3 J	0.3 J	0.1 J	0.1 J	0.5 U	0.1 J	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U
Chloroethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene		0.5 U	0.5 U	0.2 J	0.3 J	0.4 J	0.2 J	0.5 U	0.5 U	0.1 J	0.5 U	0.2 J	0.4 J	1.7	0.9	0.6	0.7	0.9	0.8	0.7	0.8	0.7
1,1,1-Trichloroethane	200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5	0.5 U	0.6	1.7	2.4	2.6	1.1	0.4 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	2	0.5 U	0.5 U	0.2 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi-Volatiles (mg/l)																						
Bis(2-chloroethyl)Ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Inorganics (mg/l)																						
Dissolved Manganese (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Iron (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																						
Temperature (Degrees Celcius)		15.5	13.2	13.1	13.5	13.6	15.4	12.2	13.3	12.8	12.9	12.9	12.9	13.0	11.0	12.9	13.3	14.4	13.3	13.3	13.3	13.8
Conductivity (ms/cm)		200	192	219	243	243	601	188	163	158	145	131	136	177	173	128	138	146	149	135	133	151
pH (standard units)		6.04	6.03	6.61	6.35	6.40	6.59	6.64	6.17	6.69	5.73	6.97	5.95	6.13	5.61	5.66	5.71	5.42	5.25	5.21	5.23	5.27
Dissolved Oxygen (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ORP (mV)		-94	-55	-34	5	-36	-54	9	90	13	26	--	-21	-52	--	74	122	--	-56	96	258.9	262.4
Water-Level Elevation (ft, MSL)		-18.94	--	--	--	-24.77	--	--	--	-23.68	--	--	--	-19.27	--	--	--	-21.18	--	--	--	-23.60

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
UL - Not detected, quantitation limit is probably higher
Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	MW-40																		
		9/99	12/99	3/00	7/00	10/00	12/00	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03	7/03	10/03	1/04	4/04	7/04
***Non-Halogenated VOCs* (mg/l)**																					
Benzene	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.5 U	0.5 U	1 U	0.5 U	0.3 J	0.1 J	0.5 U	0.2 J	0.3 J	0.5 U	0.5 U	0.5 U	0.6	0.5
Toluene		--	--	--	--	--	--	--	0.5 U	--	0.5 U	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.5 U
Ethylbenzene		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.5 U
Xylene (total)		--	--	--	--	--	--	--	--	--	1 U	--	--	--	--	5 U	0.075 J	--	1.0 U	--	1.0 U
2-Butanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methy-tert-butyl ether		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylcyclohexane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Halogenated VOCs* (mg/l)**																					
Bromoform	100*	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	5 U	0.5 U	2 U	0.5 U	2 U	0.5 U
Bromodichloromethane	100*	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.1 J
Chloroform	100*	0.5 U	0.2 J	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.1 B	0.1 J	0.2 J	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.074 J	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U	0.5 U	1 U	0.5 U	1 U	0.5 U
1,2-Dichloroethane	5	0.5 U	0.5 U	5.0	0.1 J	0.5 U	0.5 U	0.2 J	0.1 J	0.5 U	0.5 U	37.0	13.0	0.5 U	24.0	19	0.5 U	1.8	0.5 U	73	68 D
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.3 J
cis-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	0.4 J	0.5 U	--	0.5 U	--	0.7
trans-1,2-Dichloroethene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	7	0.5 U	0.5 U	0.2 JB	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.5 U
1,3-Dichlorobenzene		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.5 U
1,4-Dichlorobenzene	75	0.2 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.1 J
Chloroethane		--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	5 U	0.5 U	--	0.5 U	--	0.5 U
Tetrachloroethene		0.5	0.3 J	0.4 J	0.3 J	0.3 J	0.5	0.6	0.6	0.6	0.6	0.6	0.4 J	0.6	0.6	0.7 J	0.82 B	1	1.1	0.6	0.5 J
1,1,1-Trichloroethane	200	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5	0.5 U	0.5 U	0.3 J	0.1 J	0.5 U	0.6	0.1 J	0.5 U	0.5 U	0.5 U	1.1	0.4 J	0.5 U	0.7	1 J	0.5 U	0.3 J	0.1 J	2	1.9
Vinyl Chloride	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.1 J
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Semi-Volatiles* (mg/l)**																					
Bis(2-chloroethyl)Ether		--	--	--	0.06892	0.022 J	0.67	0.1	0.077	0.024 U	0.024 U	0.97	1.1	0.041 J	0.7	0.8	0.2	--	--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Caprolactam		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-octyl phthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
***Inorganics* (mg/l)**																					
Dissolved Manganese		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.1	--	--	--	--
Dissolved Iron		--	--	--	--	--	--	0.106 B	0.075 B	--	--	--	--	--	--	0.0633 B	0.135	--	--	--	--
Dissolved Lead	0.05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																					
Temperature (Degrees Celcius)		13.4	13.3	14.0	13.5	13.8	13.8	13.9	13.6	--	13.5	13.7	14.0	14.4	14.2	14.65	14.66	14.1	13.6	13.6	14.4
Conductivity (ms/cm)		119	125	180	271	129	18	94	149	--	149	140	140	135	148	144	165.2	171	147	126	--
pH (standard units)		5.65	7.56	5.21	6.2	6.35	5.22	5.29	5.53	--	4.53	5.27	5.25	5.51	5.35	4.56	5.62	5.24	6.00	5.99	6.87
Dissolved Oxygen (mg/l)		--	--	--	--	0.83	0.9	0.57	0.38	--	--	0.3	0.05	0.42	0.16	0.15	0.10	--	--	--	--
ORP (mV)		152.1	334.5	236	95.4	210.4	260	346.2	196.8	--	401.2	297.2	281.6	190.7	189.1	221.8	65.8	127.8	123.4	148.1	128
Water-Level Elevation (ft, MSL)		--	--	--	-24.55	--	-19.76	-22.17	-25.09	-29.62	-26.43	-26.95	-32.1	-31.29	-30.4	-26.77	-28.44	-28.80	-27.34	-24.46	-26.14

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
* - 100 mg/l is the Criteria for Total trihalomethanes
UL - Not detected, quantitation limit is probably higher
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected
Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

storical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfi

Parameter	Criteria	MW-40										
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07
***Non-Halogenated VOCs* (mg/l)**												
Benzene	5	0.23 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Toluene		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	0.46 J	0.49 J	0.65 J
Ethylbenzene		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Xylene (total)		0.5 U	5 U	5 U	5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U
2-Butanone		5 U	10 R	10 U	10 R	10 U	10 U	5 U	5 U	5 U	5 U	5 U
Acetone		5 UJ	20 R	20 U	20 R	20 R	10 U	5 U	5 U	4.1 J	3.6 U	5 U
Carbon Disulfide		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ
Isopropylbenzene		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U
Methy-tert-butyl ether		3.7	--	--	--	--	2.3 J	1.7	0.98 J	0.98 J	0.45 J	0.52 J
Methylcyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ
4-Methyl-2-pentanone		5 U	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U
***Halogenated VOCs* (mg/l)**												
Bromoform	100*	0.16 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 UJ	1 U	1 U
Bromodichloromethane	100*	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene		0.34 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Chloroform	100*	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		0.14 J	5 U	5 U	5 U	5 U	10 U	0.43 J	1 U	1 U	0.20 J	1 U
Dibromochloromethane	100*	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	32 D	7	5 J	5 U	5 UJ	10 U	1 U	1 U	0.21 J	0.12 J	1 U
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		0.32 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene		0.58	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene		0.18 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	7	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		0.13 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	75	0.2 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U
Chloroethane		0.5 U	5 U	5 U	5 U	5 U	10 UJ	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene		0.78	0.8 J	1 J	1 J	1 J	10 U	0.31 J	0.60 J	0.69 J	0.72 J	0.70 J
1,1,1-Trichloroethane	200	0.21 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1.7	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	0.16 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene		0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride		0.5 U	5 U	5 U	5 U	5 U	10 U	1 UJ	1 UJ	1 U	1 U	1 U
Trichlorofluoromethane		1.6	--	--	--	--	1.2 J	1 U	1 U	1 U	1 U	1 UJ
***Semi-Volatiles* (mg/l)**												
Bis(2-chloroethyl)Ether		2.5 J	0.26 B	0.14	0.083	0.019 U	0.67	0.46	0.33	0.24	0.043	0.018 U
Bis(2-ethylhexyl)phthalate		5 U	5 U	64	5 U	6.2	16 J	5 UL	5 U	5 U	5 UJ	5 U
2,2'-oxybis (1-Chloropropane)		5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 UJ	5 U
2,4-Dimethylphenol		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
2-Methylnaphthalene		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
2-Methylphenol		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
4-Methylphenol		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
Acetophenone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
Caprolactam		5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 UL	5 U	5 UJ	5 U
Diethylphthalate		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
Di-n-octyl phthalate		5 U	5 U	60	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
N-Nitrosodiphenylamine		5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
Naphthalene		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
Phenol		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U
***Inorganics* (mg/l)**												
Dissolved Manganese		0.242	0.248	0.323	0.341	0.0947	0.0447	0.131	0.157	0.0726	0.0329	0.0287
Dissolved Iron		0.295	0.164	0.0637	0.0569	0.127	0.171	0.0959	0.823	0.730	0.226	0.313
Dissolved Lead	0.05	--	--	--	0.0138	0.026	0.0128	0.0093	0.0163	0.0154	0.0241	0.0258
Biological Oxygen Demand (mg/l)		--	--	0	< 1	< 1	1.1	< 2	< 2	< 2	--	--
Field Parameters												
Temperature (Degrees Celcius)		13.44	12.87	12.95	13.32	13.74	14.2	15.9	15.7	14.1	12.9	13.8
Conductivity (ms/cm)		146	124	130	364	182	206	208	229	350	171	197
pH (standard units)		5.39	5.62	5.36	4.82	5.55	5.51	5.67	5.58	5.81	5.35	5.42
Dissolved Oxygen (mg/l)		0.17	0.10	0.05	0.82	0.77	0.00	0.00	2.41	0.15	0.00	0.00
ORP (mV)		109.8	184.1	192.0	218.3	215.1	104	118	36	9	147	72
Water-Level Elevation (ft, MSL)		-17.90	-12.84	-0.73	-8.76	-13.90	-1.50	-5.97	-10.23	-11.23	-7.97	-8.86

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Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

cal Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel La

Parameter	Criteria	MW-40									
		10/07	10/08	10/09	4/10	10/10	4/11	10/11	4/12	10/12	4/13
***Non-Halogenated VOCs* (mg/l)**											
Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene		1 U	0.55 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (total)		3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
2-Butanone		5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
Acetone		6.5 J	5 U	5 U	5 U	8.8 U	5 U	5 U	5 UJ	5 U	5 U
Carbon Disulfide		1 U	0.24 J	0.32 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methy-tert-butyl ether		0.53 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone		5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
***Halogenated VOCs* (mg/l)**											
Bromoform	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Chlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3 Chlorobenzene		--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	75	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene		0.59 J	0.31 J	0.45 J	0.61 J	0.28 J	1.4	0.44 J	0.87 J	1.4	1.3
1,1,1-Trichloroethane	200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	0.23 J	0.35 J	0.24 J	0.29 J	0.29 J	0.35 J	0.30 J	0.32 J
Vinyl Chloride	2	1 U	1 U	0.40 J	0.53 J	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride		1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Trichlorofluoromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
***Semi-Volatiles* (mg/l)**											
Bis(2-chloroethyl)Ether		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Bis(2-ethylhexyl)phthalate		5 U	5.3 U	210 JD	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.4 J
2,2'-oxybis (1-Chloropropane)		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dimethylphenol		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methylphenol		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Acetophenone		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Caprolactam		4.4 J	5.3 U	5.0 U	5.0 U	1.7 J	5.0 U	5.0 U	5.0 U	7.2	5.0 UJ
Diethylphthalate		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-octyl phthalate		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 U	5.0 U
N-Nitrosodiphenylamine		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Phenol		5 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
***Inorganics* (mg/l)**											
Dissolved Manganese		0.0779	0.0036	0.177	0.107	0.0744	0.0526	0.0086 J	0.0411	0.0203	0.0319
Dissolved Iron		2.1	0.0177 U	13.2	7.7	0.1 U	1.06	0.100 U	0.0407 J	0.0535 J	0.108
Dissolved Lead	0.05	--	--	0.010 U	0.010 U	0.010 U	0.0099 J	0.010 U	0.005 J	0.0069 J	0.0114
Dissolved Cobalt		--	--	--	--	--	--	--	--	--	--
Field Parameters											
Temperature (Degrees Celcius)		14.6	13.2	13.4	13.5	13.9	14.1	14.2	14.5	13.2	13.8
Conductivity (ms/cm)		195	105	373	424	220	306	284	295	275	274
pH (standard units)		5.64	6.13	6.74	6.57	5.87	6.03	6.07	5.65	5.55	5.43
Dissolved Oxygen (mg/l)		0.00	0.58	0.00	0.00	0.00	1.51	0.00	0.00	2.11	0.06
ORP (mV)		-20	105	-106	-76	80	11	82	50	102	202
Water-Level Elevation (ft, MSL)		-13.94	-11.78	-11.85	-4.14	-6.42	-5.25	-9.39	-3.91	-4.97	-5.48

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Criteria are Groundwater concentrations specified in the Consent Decree for compliance at the Boundary Wells - exceedances shaded

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	Criteria	MW-40				
		10/15	3/16	10/16	10/17	10/18
Non-Halogenated VOCs **(mg/l)**						
Benzene	5	--	--	--	--	--
Toluene		--	--	--	--	--
Ethylbenzene		--	--	--	--	--
Xylene (total)		--	--	--	--	--
2-Butanone		--	--	--	--	--
Acetone		--	--	--	--	--
Carbon Disulfide		--	--	--	--	--
Cyclohexane		--	--	--	--	--
Isopropylbenzene		--	--	--	--	--
Methy-tert-butyl ether		--	--	--	--	--
Methylcyclohexane		--	--	--	--	--
4-Methyl-2-pentanone		--	--	--	--	--
Halogenated VOCs **(mg/l)**						
Bromoform	100*	--	--	--	--	--
Bromodichloromethane	100*	--	--	--	--	--
Carbon Tetrachloride	5	--	--	--	--	--
Chlorobenzene		--	--	--	--	--
Chloroform	100*	--	--	--	--	--
Chloromethane		--	--	--	--	--
Dibromochloromethane	100*	--	--	--	--	--
1,2-Dichloroethane	5	--	--	--	--	--
1,3 Chlorobenzene		--	--	--	--	--
1,1-Dichloroethane		--	--	--	--	--
cis-1,2-Dichloroethene		--	--	--	--	--
trans-1,2-Dichloroethene		--	--	--	--	--
1,1-Dichloroethene	7	--	--	--	--	--
1,2-Dichloroethene (total)		--	--	--	--	--
1,2-Dichlorobenzene		--	--	--	--	--
1,3-Dichlorobenzene		--	--	--	--	--
1,4-Dichlorobenzene	75	--	--	--	--	--
Chloroethane		--	--	--	--	--
Tetrachloroethene		--	--	--	--	--
1,1,1-Trichloroethane	200	--	--	--	--	--
Trichloroethene	5	--	--	--	--	--
Vinyl Chloride	2	--	--	--	--	--
1,2,4-Trichlorobenzene		--	--	--	--	--
cis-1,3-Dichloropropene		--	--	--	--	--
Methylene Chloride		--	--	--	--	--
Trichlorofluoromethane		--	--	--	--	--
Semi-Volatiles **(mg/l)**						
Bis(2-chloroethyl)Ether		--	--	--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--	--	--
2,2'-oxybis (1-Chloropropane)		--	--	--	--	--
2,4-Dimethylphenol		--	--	--	--	--
2-Methylnaphthalene		--	--	--	--	--
2-Methylphenol		--	--	--	--	--
4-Methylphenol		--	--	--	--	--
Acetophenone		--	--	--	--	--
Caprolactam		--	--	--	--	--
Diethylphthalate		--	--	--	--	--
Di-n-octyl phthalate		--	--	--	--	--
N-Nitrosodiphenylamine		--	--	--	--	--
Naphthalene		--	--	--	--	--
Phenol		--	--	--	--	--
Inorganics **(mg/l)**						
Dissolved Manganese		0.0091 J	0.0050 U	0.0054 J	0.0018 J	0.0168 J
Dissolved Iron		0.100 U	0.050 U	1.68	0.100 U	0.100 U
Dissolved Lead	0.05	--	--	--	--	--
Dissolved Cobalt		0.0500 U	0.0050 U	0.050 U	0.050 U	0.050 U
Field Parameters						
Temperature (Degrees Celcius)		13.5	11.1	12.6	13.3	11.5
Conductivity (ms/cm)		244	232	283	240	221
pH (standard units)		6.35	5.62	5.43	5.71	5.70
Dissolved Oxygen (mg/l)		0.00	1.50	2.22	2.65	2.25
ORP (mV)		101	179	283	292	277
Water-Level Elevation (ft, MSL)		-8.75	-6.21	-12.75	-11.45	-7.85

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Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	P-4															
	2/02	4/02	7/02	10/02	1/03	4/03	7/03	10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06
***Non-Halogenated VOCs* (mg/l)**																
Benzene	1 U	1 U	--	--	--	0.5 U	0.065 J	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
Toluene	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	0.22 J	1.0	1.3
Ethylbenzene	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
Xylene (total)	1 U	1 U	--	--	--	0.5 U	0.14 J	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
2-Butanone	--	--	--	--	--	--	--	5 U	10 R	10 R	10 R	10 U	10 U	5.0 U	2.3 J	5.0 U
Acetone	--	--	--	--	--	--	--	5 U	20 R	20 R	20 R	20 R	10 U	5.0 UJ	17 U	6.2 J
Carbon Disulfide	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
Cyclohexane	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1.0 U	1.0 U	1.0 U
Methy-tert-butyl ether	--	--	--	--	--	--	--	0.59	--	--	--	--	3.1 J	1.0 U	0.89 J	0.86 J
Methylcyclohexane	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-pentanone	--	--	--	--	--	--	--	5 U	10 U	10 U	10 U	10 U	10 U	5.0 U	5.0 U	5.0 U
***Halogenated VOCs* (mg/l)**																
Bromoform	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 UJ	1.0 U	1.0 UJ	1.0 U
Bromodichloromethane	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
Carbon Tetrachloride	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 UJ	1.0 U	1.0 U	1.0 U
Chlorobenzene	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	0.9 J	0.8 J	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
Chloroform	0.3 J	0.2 J	--	--	--	0.2 J	0.12 J	0.36 J	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	1 U	1 U	--	--	--	0.5	2.7	0.5 U	30	15	21	13	9.1 J	1.0	1.4	1.0 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.1
cis-1,2-Dichloroethene	1 U	1 U	--	--	--	0.1 J	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	2 U	2 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	--	--	--	--	10 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	--	--	--	--	10 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	--	--	--	--	10 U	1.0 U	1.0 U	1.0 U
Chloroethane	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 R	1.0 U	1.0 U
Chloromethane	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	1 U	1 U	--	--	--	0.08 J	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
Trichloroethene	1 U	1 U	--	--	--	0.1 J	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
Vinyl Chloride	1 U	1 U	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1.0 U	1.0 UJ	1.0 U
Trichlorofluoromethane	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1.0 UJ	1.0 U	1.0 U
***Semi-Volatiles* (mg/l)**																
Bis(2-chloroethyl)Ether	0.03 U	0.025 U	0.04 U	0.05 U	0.05 U	0.05 U	0.05 U	0.02 U	0.034 B	0.059	0.021 U	0.019 UL	5 U	5 U	5 U	5 U
Bis(2-ethylhexyl)phthalate	5 U	--	--	--	--	--	--	5 U	5 U	5.3 U	4.6 J	4.3 J	5 U	5 UL	5 U	5 U
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	5 U	5 U	5.3 U	5.3 U	5 U	5 UL	5 U	5 U	5 U
2,4-Dimethylphenol	--	--	--	--	--	--	--	5 U	5 U	5.3 U	5.3 U	5 U	5 U	5 U	5 U	5 U
2-Methylnaphthalene	--	--	--	--	--	--	--	5 U	5 U	5.3 U	5.3 U	5 U	5 U	5 U	5 U	5 U
2-Methylphenol	--	--	--	--	--	--	--	5 U	5 U	5.3 U	5.3 U	5 U	5 U	5 U	5 U	5 U
4-Methylphenol	--	--	--	--	--	--	--	5 U	5 U	5.3 U	5.3 U	5 U	5 U	5 U	5 U	5 U
Acetophenone	--	--	--	--	--	--	--	5 U	5 U	5.3 U	5.3 U	5 U	5 U	5 U	5 U	5 U
Caprolactam	--	--	--	--	--	--	--	5 UJ	5 U	5.3 U	5.3 U	5 U	5 UL	5 UL	5 U	5 U
Diethylphthalate	--	--	--	--	--	--	--	5 U	5 U	5.3 U	5.3 U	5 U	5 U	5 U	5 U	5 U
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	5 U	5 U	5.3 UJ	5.3 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	--	--	--	--	--	--	--	5 U	5 U	5.3 U	5.3 U	5 U	5 U	5 U	5 U	5 U
Phenol	--	--	--	--	--	--	--	5 U	5 U	5.3 U	5.3 U	5 U	5 U	5 U	5 U	5 U
***Inorganics* (mg/l)**																
Dissolved Manganese	--	--	--	--	--	--	0.315	0.0429	2.97	1.69	2.57	2.39	1.37	2.85	0.255	0.251
Dissolved Iron	0.403	0.047 B	--	--	--	0.0142 U	0.101 B	0.011 U	5.35	20.1	34.8	25.7	42.6	0.596	0.0135 U	0.0263 U
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	0	< 1	3.2	4.3	3	4	3
Field Parameters																
Temperature (Degrees Celcius)	14.1	14.36	--	15.5	13.8	13.78	15.46	13.56	13.42	13.77	13.92	13.50	14.3	15.5	15.9	15.6
Conductivity (ms/cm)	85.4	87.4	--	97.40	81	92.64	286.7	86	326	480	609	640	640	252	291	516
pH (standard units)	5.18	4.42	--	5.04	4.99	4.12	6.99	4.8	5.98	6.27	5.91	6.43	6.34	6.22	6.29	6.44
Dissolved Oxygen (mg/l)	4.48	1.08	--	0.72	3.96	2.5	0.08	3.9	0.06	0.18	0.06	0.10	0.00	0.00	0.00	0.00
ORP (mV)	334.3	408.2	--	303.5	312.8	272.7	63.7	232.8	71.4	-18.5	-17.5	-13.9	-97	-8	19	31
Water-Level Elevation (ft, MSL)	-27.11	-27.11	-34.41	-31.42	-30.97	-27.73	-19.39	-19.53	-15.63	-2.53	-11.38	-15.90	-2.84	-8.25	-13.00	-13.69

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	P-4															
	1/07	4/07	7/07	10/07	1/08	4/08	7/08	10/08	1/09	4/09	10/09	4/10	10/10	4/11	10/11	4/12
***Non-Halogenated VOCs* (mg/l)**																
Benzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.32 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	1.2	0.92 J	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylene (total)	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ
Acetone	5.0 U	5.0 U	4.1 J	5 UJ	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 UJ	5.0 U	5.0 U	7.3 U	5.0 U	5.0 U	5.0 UJ
Carbon Disulfide	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Cyclohexane	1.0 U	1.0 UJ	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methy-tert-butyl ether	0.63 J	1.0 U	1.0 U	1.0 U	1.0 U	3.3	0.65 J	7.0	5.2	9.7	0.54 J	0.22 J	1.0 U	1.0 U	1.0 U	1.0 U
Methylcyclohexane	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Methyl-2-pentanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ
***Halogenated VOCs* (mg/l)**																
Bromoform	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon Tetrachloride	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U
Chlorobenzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.37 J	1.0 U	0.59 J	0.46 J	1.3	0.16 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroform	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	0.91 J	0.21 J	1.0 U	0.3 J	0.28 JB	18	3.6	19	19	28	2.2	0.57 J	1.0 U	1.0 U	1.0 U	1.0 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.22 J	1.0 U	0.21 J	1.0 U	0.43 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.56 J	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl Chloride	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	1.0 U	1.0 U	1.0 UJ	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichlorofluoromethane	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
***Semi-Volatiles* (mg/l)**																
Bis(2-chloroethyl)Ether	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
Bis(2-ethylhexyl)phthalate	5 U	5 U	5 U	5 UL	5 U	5 UL	5 U	5.3 U	5.1 UJ	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
2,2'-oxybis (1-Chloropropane)	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
2,4-Dimethylphenol	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
2-Methylnaphthalene	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
2-Methylphenol	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
4-Methylphenol	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
Acetophenone	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
Caprolactam	5 U	2.9 R	5 UJ	5 UL	5 UJ	5 UL	5 U	5.3 UJ	5.1 U	5.0 R	4.9 U	5 U	5 U	5 U	5 U	5 U
Diethylphthalate	5 U	5 U	5 U	5 UL	5 U	5 UL	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
N-Nitrosodiphenylamine	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
Phenol	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5.3 U	5.1 U	5.0 U	4.9 U	5 U	5 U	5 U	5 U	5 U
***Inorganics* (mg/l)**																
Dissolved Manganese	0.234	0.0511	0.0606	0.0437	0.0532	0.997	0.593	1.11	1.01	1.50	0.136	0.0399	0.0052 J	0.015 U	0.015 U	0.0031 J
Dissolved Iron	0.102	0.924	1.61	0.18	0.160 U	28.9	12.7	36.4	35.6	60.6	0.157	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)	--	--	--	--	2	--	--	--	--	--	--	--	--	--	--	--
Field Parameters																
Temperature (Degrees Celcius)	13.6	14.8	18.3	15.1	13.4	14.8	15.0	14.4	13.2	14.3	14.7	13.9	14.7	16.0	15.0	14.5
Conductivity (ms/cm)	156	92	305	257	309	306	172	433	307	716	242	246	120	125	122	132
pH (standard units)	6.40	6.18	6.55	6.46	6.47	6.38	5.69	7.37	6.30	6.58	6.66	6.90	6.59	6.34	6.98	6.91
Dissolved Oxygen (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.23	0.00	0.00	0.00	0.85	3.89	3.74	3.07
ORP (mV)	-45	-75	6	19	145	-93	159	-93	-93	-99	275	128	123	163	168	111
Water-Level Elevation (ft, MSL)	-10.41	-11.95	-14.15	-15.12	-11.49	-12.36	-15.97	-13.69	-12.05	-9.81	-13.71	-7.05	-9.02	-8.24	-12.56	-6.95

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	P-4								
	10/12	4/13	10/13	10/14	10/15	2/16	10/16	10/17	10/18
***Non-Halogenated VOCs* (mg/l)**									
Benzene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Toluene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Ethylbenzene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Xylene (total)	1.0 U	1.0 U	1.0 U	1.5 U	1.0 U	--	0.50 U	0.50 U	0.50 U
2-Butanone	5.0 U	5.0 U	5.0 U	50 UJ	5.0 U	--	10 U	10 U	10 U
Acetone	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 U	--	10 U	10 UJ	2.1 U
Carbon Disulfide	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Cyclohexane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Isopropylbenzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Methy-tert-butyl ether	1.0 U	1.4	1.8	1.5	0.96 J	--	1.9	1.5	1.3
Methylcyclohexane	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	5.0 U	5.0 U	5.0 U
4-Methyl-2-pentanone	5.0 U	5.0 U	5.0 UJ	5.0 UJ	5.0 U	--	10 U	10 U	10 U
***Halogenated VOCs* (mg/l)**									
Bromoform	1.0 U	1.0 U	1.0 UJ	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Bromodichloromethane	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Carbon Tetrachloride	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Chlorobenzene	1.0 U	0.42 J	0.64 J	0.50 U	0.26 J	--	0.50 U	0.63	0.62
Chloroform	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Dibromochloromethane	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane	1.0 U	1.0 U	8.1	14	6.7	--	15	16	13
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
cis-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
trans-1,2-Dichloroethene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,1-Dichloroethene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,3-Dichlorobenzene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,4-Dichlorobenzene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Chloroethane	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Chloromethane	1.0 U	1.0 U	1.0 U	0.50 UJ	1.0 U	--	0.50 U	0.50 U	0.50 U
Tetrachloroethene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,1,1-Trichloroethane	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Trichloroethene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Vinyl Chloride	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,2,4-Trichlorobenzene	1.0 U	1.0 U	1.0 U	0.50 UJ	1.0 U	--	0.50 U	0.50 U	0.50 U
cis-1,3-Dichloropropene	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Methylene Chloride	1.0 U	1.0 UJ	1.0 U	5.0 U	1.0 U	--	0.68	0.50 U	1.1
Trichlorofluoromethane	1.0 U	1.0 U	1.0 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
***Semi-Volatiles* (mg/l)**									
Bis(2-chloroethyl)Ether	5 U	5 U	5 U	5 U	0.10 U	--	0.10 U	0.10 U	0.10 UJ
1,4-Dioxane	--	--	--	--	--	--	--	2.0 U	2.0 UJ
Bis(2-ethylhexyl)phthalate	5 U	4.7 J	7.2 U	5 U	5 U	--	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)	5 U	5 U	5 U	5 U	5 U	--	10 U	10 U	10 U
2,4-Dimethylphenol	5 U	5 U	5 U	5 U	5 U	--	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	5 U	5 U	5 U	5 U	5 U	--	5.0 U	5.0 U	5.0 U
2-Methylphenol	5 U	5 U	5 U	5 U	5 U	--	10 U	10 U	10 U
4-Methylphenol	5 U	5 U	5 U	5 U	5 U	--	10 U	10 U	10 U
Acetophenone	5 U	5 U	5 U	5 U	5 U	--	10 U	10 U	10 U
Caprolactam	5 U	5 UJ	5 U	5 UJ	1.6 J	--	10 U	10 U	0.72 J
Diethylphthalate	5 U	5 U	5 U	5 U	5 U	--	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	5 U	5 U	5 U	5 U	5 U	--	5.0 U	5.0 U	5.0 U
Naphthalene	5 U	5 U	5 U	5 U	5 U	--	5.0 U	5.0 U	5.0 U
Phenol	5 U	5 U	5 U	5 U	5 U	--	10 U	10 U	10 U
***Inorganics* (mg/l)**									
Dissolved Manganese	0.0150 U	0.975	1.19	2.1 J	1.36	3.2	3.44	3.81	3.56
Dissolved Iron	0.1 U	29.9	34.6	45.8	33.5	77.6	81.5	81.2	73.5
Dissolved Cobalt	--	--	--	--	0.108	0.24	0.223	0.246	0.267
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--
Field Parameters									
Temperature (Degrees Celcius)	13.6	14.6	15.9	13.3	14.1	14.5	13.3	12.9	14.7
Conductivity (ms/cm)	146	895	1120	1710	2410	5470	7010	8710	7400
pH (standard units)	6.88	5.57	6.37	6.50	6.74	6.70	6.60	6.57	6.65
Dissolved Oxygen (mg/l)	4.30	1.47	0.00	0.39	0.00	0.22	0.00	0.00	0.00
ORP (mV)	206	-18	-61	-116	-46	-75	-109	-57	-45
Water-Level Elevation (ft, MSL)	-7.88	-8.68	-8.12	-10.08	-11.81	-10.18	-16.00	-14.73	-10.99

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected
H - Analysis performed outside of Holding Time

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	P-5U																			
	2/02	4/02	7/02	10/02	1/03	4/03	7/03	10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/15	3/16
***Non-Halogenated VOCs* (mg/l)**																				
Benzene	3	3	--	--	--	23	58	1.9	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Toluene	1 U	1 U	--	--	--	5 U	3 U	0.5 U	5 U	5 U	5 U	0.8 J	10 U	0.67 J	0.37 J	1.2	1.6	0.97 J	--	--
Ethylbenzene	1 U	1 U	--	--	--	5	4.5 B	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Xylene (total)	1 U	1 U	--	--	--	5 U	1.4 JB	0.5 U	5 U	5 U	5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U	--	--
2-Butanone	--	--	--	--	--	--	--	5 U	10 U	10 R	10 R	10 U	10 U	1.8 J	5 U	5 U	1.3 J	5 U	--	--
Acetone	--	--	--	--	--	--	--	5 U	20 R	20 R	20 R	20 R	10 U	15	5.6 U	8.0 J	6.7 U	13 U	--	--
Carbon Disulfide	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Cyclohexane	--	--	--	--	--	--	--	0.5 UL	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--
Isopropylbenzene	--	--	--	--	--	--	--	0.89	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Methy-tert-butyl ether	--	--	--	--	--	--	--	0.73	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Methylcyclohexane	--	--	--	--	--	--	--	0.5 UL	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	5 U	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	--	--
***Halogenated VOCs* (mg/l)**																				
Bromoform	1 U	1 U	--	--	--	5 U	3 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 UJ	1 U	1 UJ	--	--
Bromodichloromethane	1 U	1 U	--	--	--	5 U	3 U	0.5 UL	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Carbon Tetrachloride	1 U	1 U	--	--	--	5 U	3 U	0.5 U	5 UJ	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Chlorobenzene	9	16	--	--	--	58	100	43 D	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Chloroform	1 U	1 U	--	--	--	5 U	3 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Dibromochloromethane	1 U	1 U	--	--	--	5 U	3 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
1,2-Dichloroethane	7	8	--	--	--	10	12	2.9	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	0.4 J	0.6 J	--	--	--	2 J	3 U	0.56	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
cis-1,2-Dichloroethene	0.6 J	0.7 J	--	--	--	2 J	2.9 J	3	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
1,1-Dichloroethene	1 U	1 U	--	--	--	5 U	2.5 J	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
1,2-Dichloroethene (total)	0.6 J	0.7 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	0.4 J	0.7 J	--	--	--	3 JB	5.8 B	2.4	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--
1,3-Dichlorobenzene	0.3 J	0.5 J	--	--	--	1 J	2.0 J	1.1	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--
1,4-Dichlorobenzene	2	2	--	--	--	7	11 B	4.1	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Chloroethane	0.3 J	0.3 J	--	--	--	1 J	0.81 J	0.5 U	5 U	5 U	5 U	5 U	10 UJ	1 U	1 U	1 U	1 U	1 U	--	--
Tetrachloroethene	1 U	1 U	--	--	--	5 U	3 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
1,1,1-Trichloroethane	1 U	1 U	--	--	--	5 U	3 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Trichloroethene	0.2 J	0.2 J	--	--	--	0.6 J	0.78 J	7.6	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Vinyl Chloride	1 U	1 U	--	--	--	5 U	3 U	0.29 J	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	--	--
Methylene Chloride	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 UJ	1 UJ	1 U	1 UJ	1 U	--	--
Trichlorofluoromethane	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 UJ	1 U	1 U	1 U	1 U	1 U	--	--
***Semi-Volatiles* (mg/l)**																				
Bis(2-chloroethyl)Ether	16	19	13	18	41 D	35	51 D	11	0.093	0.017 U	0.02 UJ	0.018 U	5 U	5 U	5 U	5 U	5 U	5 UL	--	--
Bis(2-ethylhexyl)phthalate	5 U	--	--	--	--	--	--	5.1 U	5 U	5 U	5 UJ	6.8	5 U	3.9 L	5 U	5 U	5 UL	5 UL	--	--
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	5.1 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--	5.1 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--	5.1 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	--	--
2-Methylphenol	--	--	--	--	--	--	--	5.1 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	--	--
4-Methylphenol	--	--	--	--	--	--	--	5.1 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	--	--
Acetophenone	--	--	--	--	--	--	--	5.1 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	--	--
Caprolactam	--	--	--	--	--	--	--	5.1 UJ	5 UL	5 U	5 UJ	5 UJ	5 U	5 UL	5 UL	5 U	5 UL	5 UL	--	--
Diethylphthalate	--	--	--	--	--	--	--	5.1 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 UL	5 UL	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	5.1 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	--	--
Naphthalene	--	--	--	--	--	--	--	5.1 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	--	--
Phenol	--	--	--	--	--	--	--	5.1 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	--	--
***Inorganics* (mg/l)**																				
Dissolved Manganese	--	--	--	--	--	--	6.53	4.7	2.04	0.0011J	1.56 J	0.899	1.71	2.65	1.82	0.570	0.451	0.658	0.0226	0.21
Dissolved Iron	2.24	2.42	--	--	--	5.87	10.4	8.36	3.16	0.045 J	0.0375 J	0.0122 U	0.0153 U	0.0380 U	0.0124 U	0.0701 U	0.0091 U	0.010 U	0.100 U	0.050
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0500 U	0.014
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	1.0	7.5	< 1	1.2	< 2	6	< 2	--	--	--	--
Field Parameters																				
Temperature (Degrees Celcius)	153.2	14.6	14.94	15.35	14.1	14.48	16.87	14.42	13.96	14.31	16.38	14.5	14.2	14.6	15.6	15.2	14.6	16.2	14.2	11.8
Conductivity (ms/cm)	346.1	314.1	334.1	346.9	485	396.3	639.7	392	77	57	56	88	113	179	177	138	84	105	349	317
pH (standard units)	6.42	6.04	6.9	5.96	6.25	5.58	5.34	6.17	5.93	5.55	5.29	5.44	5.47	5.69	5.36	5.38	5.31	5.27	5.76	5.73
Dissolved Oxygen (mg/l)	0.23	0.22	0.01	0	0.11	0	0.00	0.06	1.89	3.71	8.59	4.96	4.70	3.62	3.47	4.45	0.81	4.70	1.40	0.00
ORP (mV)	235.7	304.2	200	56.3	40.4	31.7	30.3	29.4	102.6	154.9	184	224	166	165	127	161	43	178	251	171
Water-Level Elevation (ft, MSL)	-25.29	-24.29	-30.19	-28.47	-30.07	-25.54	-27.88	-18.84	-13.75	-1.31	-10.36	-15.53	-2.33	-6.88	-11.38	-11.86	-9.12	-10.13	-9.39	-6.49

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J - Estimated concentration.
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Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	P-5L																					
	2/02	4/02	7/02	10/02	1/03	4/03	7/03	10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/07	10/08	10/15	3/16
***Non-Halogenated VOCs* (mg/l)**																						
Benzene	0.2 J	0.8 J	--	--	--	1 J	0.78 B	1.3	5 U	5 U	5 U	5 U	10 U	0.35 J	0.24 J	0.16 J	0.19 J	0.25 J	0.31 J	1 U	--	--
Toluene	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	1.1 J	0.20 J	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Ethylbenzene	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Xylene (total)	1 U	1 U	--	--	--	5 U	0.18 JB	0.5 U	5 U	5 U	5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	--	--
2-Butanone	--	--	--	--	--	--	--	5 U	10 U	10 R	10 R	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UL	--	--
Acetone	--	--	--	--	--	--	--	5 U	20 R	20 R	20 R	20 R	10 U	5 U	5 U	5 U	5 U	5 U	2.7 J	6.2 UJ	--	--
Carbon Disulfide	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Cyclohexane	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	--	--
Isopropylbenzene	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Methy-tert-butyl ether	--	--	--	--	--	--	--	0.48 J	--	--	--	--	10 U	0.40 J	0.29 J	1 U	1 U	0.17 J	0.36 J	1 U	--	--
Methylcyclohexane	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	5 U	10 U	10 U	10 U	10 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	--	--
***Halogenated VOCs* (mg/l)**																						
Bromoform	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U	1 U	--	--
Bromodichloromethane	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Carbon Tetrachloride	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 UJ	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Chlorobenzene	0.8 J	4	--	--	--	5	4.9	4.1	3 J	4 J	5 U	3 J	6.8 J	6.1	4.8	3.4	3.8	4.2	3.9	1 U	--	--
Chloroform	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Dibromochloromethane	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,2-Dichloroethane	1 U	1 U	--	--	--	0.4 J	0.27 J	0.5 U	5 U	5 U	5 U	5 U	10 U	0.21 J	0.29 J	0.20 J	0.15 J	0.22 J	1 U	1 U	--	--
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	0.2 J	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
cis-1,2-Dichloroethene	1 U	1 U	--	--	--	5 U	0.1 J	0.17 J	5 U	5 U	5 U	5 U	10 U	1 U	0.35 J	1 U	1 U	0.19 J	0.26 J	1 U	--	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,1-Dichloroethene	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,2-Dichloroethene (total)	2 U	2 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	0.2 J	--	--	--	5 U	0.5 U	0.21 J	--	--	--	--	10 U	0.32 J	0.40 J	1 U	0.27 J	0.27 J	0.35 J	1 U	--	--
1,3-Dichlorobenzene	1 U	1 U	--	--	--	5 U	0.12 J	0.5 U	--	--	--	--	10 U	0.13 J	1 U	0.10 J	1 U	0.11 J	0.17 J	1 U	--	--
1,4-Dichlorobenzene	0.6 J	0.6 J	--	--	--	5 U	0.5 U	0.44 J	--	--	--	--	10 U	0.50 J	0.66 J	0.51 J	0.56 J	0.62 J	0.66 J	1 U	--	--
Chloroethane	1 U	1 U	--	--	--	5 U	0.5 U	0.5 UJ	5 U	5 U	5 U	5 U	10 U	1 U	1 U	0.29 J	1 U	1 U	1 U	1 U	--	--
Chloromethane	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	0.18 J	1 U	1 UJ	1 U	--	--
Tetrachloroethene	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	0.29 J	0.27 J	1 U	--	--
1,1,1-Trichloroethane	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Trichloroethene	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Vinyl Chloride	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
Methylene Chloride	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 UJ	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	--	--
Trichlorofluoromethane	--	--	--	--	--	--	--	0.5 UJ	--	--	--	--	10 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
***Semi-Volatiles* (mg/l)**																						
Bis(2-chloroethyl)Ether	11	4.5	6.3	3.2 J	9	6	8 D	9.8	5.1	5.6	0.57 UJ	10	10	11	6.6	3.3 J	3.8 J	5.7 L	3.7 J	5 U	--	--
Bis(2-ethylhexyl)phthalate	5 U	--	--	--	--	--	--	5 U	5 U	5 U	5 UJ	4.4 J	5 UL	5.8 L	5 UL	5 U	5 UL	5 UL	5 U	5 U	--	--
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	--	--
2-Methylphenol	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	--	--
4-Methylphenol	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	--	--
Acetophenone	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	--	--
Caprolactam	--	--	--	--	--	--	--	5 UJ	5 UL	5 U	5 UJ	5 UJ	5 UL	5 U	5 UL	5 U	5 UL	5 UL	5 U	5 UJ	--	--
Diethylphthalate	--	--	--	--	--	--	--	5 U	5 UL	5 U	5 UJ	5 U	5 UL	5 U	5 UL	5 U	5 UL	5 UL	5 U	5 U	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	--	--
Naphthalene	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5UL	5 U	5 U	--	--
Phenol	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	--	--
***Inorganics* (mg/l)**																						
Dissolved Manganese	--	--	--	--	--	--	0.979	0.766	0.965	1.43 J	0.829 J	0.575	1.33	1.15	1.13	1.02	0.977	0.937	0.78	0.00028 U	0.156	1.2
Dissolved Iron	0.236	1.27	--	--	--	4.30	5.07	3.63	2.58	5.55 J	2.04 J	0.789	4.55	3.11	2.04	1.07	2.12	2.22	1.57	0.0177 U	0.100 U	3.3
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0043 J	0.034
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	0.2	1.8	2.2	1.9	< 2	5	2	--	--	--	--	--	--
Field Parameters																						
Temperature (Degrees Celcius)	13.7	15.1	16	15.7	13.4	15.9	15.86	15.44	13.59	14.43	16.18	14.45	14.2	14.5	17.6	15.2	14.0	16.8	15.9	14.8	15.5	12.4
Conductivity (ms/cm)	279.6	244.2	239.2	222.2	230	201.3	224.7	191	132	162	176	192	294	340	290	279	178	178	367	181	219	216
pH (standard units)	7.21	6.19	4.87	6.18	6.41	5.62	6.18	6.13	6.16	6.26	5.96	6.35	6.03	6.19	6.01	6.11	5.95	5.96	5.91	6.56	7.03	6.09
Dissolved Oxygen (mg/l)	0.59	0.32	0.05	0.45	0.04	0.45	0.23	0.33	0.14	0.05	3.62	1.07	0.00	0.00	0.00	0.02	0.00	0.00	4.41	3.86	2.24	0.00
ORP (mV)	267.5	177.1	231.3	16.4	62.1	50.9	91.7	59.4	-59.8	-20.8	106	174.8	-25	-75	-50	3	-33	-145	-80	177	173	31
Water-Level Elevation (ft, MSL)	-25.66	-24.66	-31.66	-28.98	-31.78	-27.46	-30.83	-19.48	-16.58	-1.98	-13.20	-18.23	-3.04	-8.61	-14.03	-13.45	-11.06	-12.76	-18.17	-14.98	-11.11	-8.17

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	P-6															
	2/02	4/02	7/02	10/02	1/03	4/03	7/03	10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06
Non-Halogenated VOCs **(mg/l)**																
Benzene	76 J	55 J	--	--	--	32	12 B	24	91	150	170	290	340 D	380	450	600
Toluene	0.9 J	0.6 J	--	--	--	5 U	1.2 B	0.5 U	3 J	11	17	20	20	22	47	240
Ethylbenzene	19	11	--	--	--	5 U	5.9 B	0.34 J	55	74	140	270	300 D	340	390	520
Xylene (total)	6	4	--	--	--	5 U	10 B	0.35 J	110	160	250	530	510	690	770	980
2-Butanone	--	--	--	--	--	--	--	5 U	10 U	10 R	10 R	10 U	10 U	100 U	100 U	100 U
Acetone	--	--	--	--	--	--	--	5 UJR	20 U	20 R	20 R	20 R	8.5 J	100 U	100 U	100 U
Carbon Disulfide	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
Cyclohexane	--	--	--	--	--	--	--	0.36 J	--	--	--	--	3.5 J	20 U	20 U	20 U
Isopropylbenzene	--	--	--	--	--	--	--	1.3	--	--	--	--	7.5 J	7.0 J	9.5 J	11 J
Methy-tert-butyl ether	--	--	--	--	--	--	--	0.5	--	--	--	--	10 U	20 U	20 U	20 U
Methylcyclohexane	--	--	--	--	--	--	--	0.5 U	--	--	--	--	2.5 J	4.5 J	5.5 J	6.9 J
4-Methyl-2-pentanone	--	--	--	--	--	--	--	5 U	10 UJ	10 U	10 U	10 U	2.0 J	100 U	100 U	100 U
Halogenated VOCs **(mg/l)**																
Bromoform	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 UJ
Bromodichloromethane	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
Carbon Tetrachloride	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
Chlorobenzene	1	1	--	--	--	5 U	0.5 U	0.74	1 J	2 J	2 J	4 J	3.7 J	4.8 J	6.6 J	6.3 J
Chloroform	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
Dibromochloromethane	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
1,2-Dichloroethane	1 U	1 U	--	--	--	5 U	0.5 U	0.22 J	5 U	5 U	5 U	5 U	7.3 J	20 U	20 U	20 U
1,3 Chlorobenzene	--	1 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1	1	--	--	--	0.8 J	0.5 U	0.77	5 U	5 U	1 J	2 J	2.1 J	20 U	20 U	20 U
cis-1,2-Dichloroethene	2	2	--	--	--	0.7 J	0.15 J	0.59	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
1,1-Dichloroethene	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
1,2-Dichloroethene (total)	2 J	2 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	0.4 JB	0.4 J	--	--	--	5 U	0.073 J	0.29 J	--	--	--	--	1.3 J	20 U	20 U	20 U
1,3-Dichlorobenzene	1 U	1 U	--	--	--	5 U	0.051 J	0.5 U	--	--	--	--	10 U	20 U	20 U	20 U
1,4-Dichlorobenzene	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	--	--	--	--	10 U	20 U	20 U	20 U
Chloroethane	1 U	0.2 J	--	--	--	5 U	0.5 U	0.32 J	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
Chloromethane	1U	1 U	--	--	--	--	--	--	--	--	--	--	10 U	20 U	20 U	20 U
Tetrachloroethene	1 U	1 U	--	--	--	5 U	0.007 J	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
1,1,1-Trichloroethane	1 U	1 U	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
Trichloroethene	0.2 J	1 U	--	--	--	5 U	0.043 J	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
Vinyl Chloride	1	0.9 J	--	--	--	5 U	0.5 U	0.14 J	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	20 U	20 U	20 U
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	20 U	20 U	20 U
Methylene Chloride	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	20 UJ	20 UJ	20 U
Trichlorofluoromethane	--	--	--	--	--	--	--	0.16 J	--	--	--	--	10 UJ	20 U	20 U	20 U
Semi-Volatiles **(mg/l)**																
Bis(2-chloroethyl)Ether	5 U	45	97	59	45	22	82 D	18	47	56	41	130 D	150 D	140 D	250 D	220 D
Bis(2-ethylhexyl)phthalate	5 U	--	--	--	--	--	--	5 U	5 U	5 U	19	5.7	6.2 U	30 L	19 L	5.7 J
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U
2,4-Dimethylphenol	--	--	--	--	--	--	--	5 U	5 U	1 J	5 U	6.2	5 U	4.5 J	6.3	6.6
2-Methylnaphthalene	--	--	--	--	--	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylphenol	--	--	--	--	--	--	--	5 U	5 U	17	13	31	5 U	11	27	73
4-Methylphenol	--	--	--	--	--	--	--	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetophenone	--	--	--	--	--	--	--	5 U	5 U	5 U	5 U	5	5 U	3.9 J	5.2	7.2
Caprolactam	--	--	--	--	--	--	--	5 UJ	5.6	7.2	5.4 L	30 J	33	25 L	31 L	46
Diethylphthalate	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UL	5 U	5 U	5 UL	5 UL	5 U
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	--	--	--	--	--	--	--	5 U	5 U	5 U	5 U	2.2 J	2.0 J	5 U	2.0 J	5 U
Phenol	--	--	--	--	--	--	--	5 U	5 U	1.8 J	5 U	5 U	5 UL	5 U	7.0	5 U
Inorganics **(mg/l)**																
Dissolved Manganese	--	--	--	--	--	--	0.656	0.943	0.367	0.394	0.294	0.264	0.244	0.253	0.277	0.307
Dissolved Iron	11	14.8	--	--	--	13.6	9.89	14.5	11.6	12.4	10.7	12.5	12.9	12.4	12.5	15.8
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	11.1	12.4	18.7	14.4	20	< 2	31
Field Parameters																
Temperature (Degrees Celcius)	15.57	15.28	15.44	15.94	14.47	14.92	--	14.67	14.59	14.03	15.21	15.5	15.6	17.0	17.2	18.4
Conductivity (ms/cm)	235	238.4	253.1	218.1	256	206.1	--	263	251	269	517	393	421	611	591	674
pH (standard units)	6.67	5.97	6.74	6.18	6.88	6.28	--	6.97	6.85	7.09	6.97	6.86	7.12	6.82	7.06	6.86
Dissolved Oxygen (mg/l)	0.88	0.19	0.19	0.81	0.22	0.06	--	0.13	0.18	0.27	0.47	0.00	0.00	0.00	0.00	0.00
ORP (mV)	26.6	240.2	258.9	7.5	81.6	-70.9	--	-118.6	-110.4	-175.9	-108.1	-231	-220	-224	-187	-221
Water-Level Elevation (ft, MSL)	-23.61	-22.61	-25.73	-26.29	-27.16	-23.49	-25.58	-15.95	-10.73	-0.53	-6.59	-11.02	-1.39	-4.37	-7.54	-8.74

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Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	P-6										
	1/07	4/07	7/07	10/07	1/08	4/08	7/08	10/08	1/09	4/09	10/09
***Non-Halogenated VOCs* (mg/l)**											
Benzene	520	700	570	710	420	730	590	330	560	170	140
Toluene	270	410	390	260	220	480	570	24	330	5.7 U	10 U
Ethylbenzene	570	590	430	510	320	720	520	290	500	110	31
Xylene (total)	1100	1200	860	1000	650	1400	1100	590	930	240	24 J
2-Butanone	100 U	100 U	75 U	200 U	100 U	100 U	250 U	100 U	100 UJ	50 U	50 U
Acetone	100 U	100 U	75 U	200 U	100 U	100 U	250 U	100 U	100 UJ	50 UJ	50 U
Carbon Disulfide	20 U	20 U	15 UJ	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
Cyclohexane	20 U	9.5 J	8.8 J	9.1 J	8.6 J	13 J	9.1 J	6.8 J	19 J	3.6 J	10 U
Isopropylbenzene	13 J	9.6 J	8.9 J	40 U	8.5 J	15 J	50 U	9.2 J	12 J	2.6 J	2.6 J
Methy-tert-butyl ether	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
Methylcyclohexane	9.2 J	8.8 J	6.7 J	40 U	7.2 J	12 J	9.4 J	7.4 J	13 J	10 U	10 U
4-Methyl-2-pentanone	100 U	100 U	75 U	200 U	100 U	100 U	250 U	100 U	100 UJ	50 U	50 U
***Halogenated VOCs* (mg/l)**											
Bromoform	20 U	20 U	15 U	40 U	20 UJ	20 U	50 U	20 U	20 U	10 UJ	10 UJ
Bromodichloromethane	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
Carbon Tetrachloride	20 U	20 U	15 U	40 U	20 UJ	20 UJ	50 U	20 U	20 U	10 U	10 UJ
Chlorobenzene	6.4 J	7.4 J	5.7 J	40 U	20 U	8.5 J	50 U	4.5 J	6.1 J	10 U	2.3 J
Chloroform	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
Dibromochloromethane	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 UJ
1,2-Dichloroethane	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
cis-1,2-Dichloroethene	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
trans-1,2-Dichloroethene	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
1,1-Dichloroethene	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	20 U	2.2 J	2.1 J	40 U	1.7 J	3.2 J	50 U	20 U	20 U	10 U	10 U
1,3-Dichlorobenzene	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
1,4-Dichlorobenzene	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
Chloroethane	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 UJ
Chloromethane	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
Tetrachloroethene	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
1,1,1-Trichloroethane	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
Trichloroethene	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
Vinyl Chloride	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
1,2,4-Trichlorobenzene	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
cis-1,3-Dichloropropene	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
Methylene Chloride	20 U	20 U	15 UJ	40 UJ	8.6 J	20 U	50 U	20 U	8.6 J	10 U	3.4 J
Trichlorofluoromethane	20 U	20 U	15 U	40 U	20 U	20 U	50 U	20 U	20 U	10 U	10 U
***Semi-Volatiles* (mg/l)**											
Bis(2-chloroethyl)Ether	260 D	320	320 D	340 D	170	210	290 D	210 D	210 D	52 J	66
Bis(2-ethylhexyl)phthalate	7.3 J	36 U	5 U	5 U	14 U	5.0 U	5.0 U	5.1 U	5.0 UJ	5.3 U	5.0 U
2,2'-oxybis (1-Chloropropane)	5 U	36 U	5 U	5 U	14 U	5.0 U	5.0 U	5.1 U	5.0 U	5.3 U	5.0 U
2,4-Dimethylphenol	12	13 J	14	15	17	7.6	10	9.2	13 UL	6.5 J	5.0 U
2-Methylnaphthalene	5 U	36 U	5 U	5 U	14 U	5.0 U	5.0 U	5.1 U	5.0 U	5.3 U	5.0 U
2-Methylphenol	110 D	92	64	32	33	5.0 U	28	5.1 U	5.0 UL	5.3 U	5.0 U
4-Methylphenol	5 U	36 U	5 U	5 U	14 U	5.0 U	5.0 U	5.1 U	5.0 UL	5.3 U	5.0 U
Acetophenone	5 U	36 U	5 U	5 U	5.8 J	5.0 U	5.0 U	5.1 U	5.0 U	5.3 J	1.6 J
Caprolactam	64 D	75	73 J	65	110 J	44 J	150 D	210 DJ	120 D	16 J	25
Diethylphthalate	5 U	36 U	5 U	5 U	14 U	5.0 U	5.0 U	5.1 U	5.0 U	5.3 U	5.0 U
N-Nitrosodiphenylamine	5 U	36 U	5 U	5 U	14 U	5.0 U	5.0 U	5.1 U	5.0 U	5.3 U	5.0 U
Nitrobenzene	5 U	36 U	5 U	5 U	14 U	5.0 U	5.0 U	5.1 U	5.0 U	5.3 U	5.0 U
Naphthalene	3.0 K	36 U	5 U	4.0 J	4.1 J	3.1 J	5.3	5.1 U	3.2 J	5.3 U	5.0 U
Phenol	5 U	36 U	4.6 J	5 U	14 U	2.2 J	5.0 U	5.1 U	4.5 L	5.3 U	5.0 U
***Inorganics* (mg/l)**											
Dissolved Manganese	0.312	0.301	0.313	0.269	0.237	0.297	0.263	0.189	0.231	0.057	0.0667
Dissolved Iron	16.1	14.1	15.1	14.9	12.4	15.5	13.7	10.6	12.3	3.56	3.42
Biological Oxygen Demand (mg/l)	--	--	--	--	37	--	--	--	--	--	--
Field Parameters											
Temperature (Degrees Celcius)	14.2	14.6	15.1	15.4	14.7	15.0	14.8	14.5	13.8	14.4	15.4
Conductivity (ms/cm)	248	468	467	997	405	459	318	356	411	589	269
pH (standard units)	7.46	6.64	6.71	6.96	6.79	6.97	6.35	8.17	7.08	7.56	7.15
Dissolved Oxygen (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.94	0.00	0.00	0.00	0.00
ORP (mV)	-176	-214	-220	-249	-227	-215	-180	-170	-137	-116	-156
Water-Level Elevation (ft, MSL)	-6.01	-6.25	-9.71	-11.30	-7.59	-7.50	-10.63	-9.76	-8.18	-6.19	-9.62

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Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	P-6											
	4/10	10/10	4/11	10/11	4/12	10/12	4/13	10/13	4/14	10/14	4/15	10/15
Non-Halogenated VOCs **(mg/l)**												
Benzene	16	120	27	5.4	200	460	210	220	110	96 J	130 D	140 D
Toluene	1 U	1 U	1 U	1 U	13 U	25 U	280	28	10 UJ	1.8	1.8	1.1 JD
Ethylbenzene	0.61 J	2.1 J	0.53 J	1 U	66	140	160	120	52	52 J	62 D	56 D
Xylene (total)	3 U	3 U	3 U	0.60 J	290	400	390	380	160	39 J	120	73 D
2-Butanone	5 U	5 U	5 U	5 U	63 UJ	130 U	63 U	50 U	50 U	50 UJ	5.0 U	25 U
Acetone	5 U	15 U	15 U	5 U	63 UJ	130 U	63 UJ	50 U	50 UJ	5.0 UJ	6.5 UJ	25 U
Carbon Disulfide	1 U	1 U	0.51 J	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
Cyclohexane	0.38 J	1.9 J	0.59 J	1 U	13 U	25 U	4.2 J	4.6 J	10 U	2.3	3.4	1.9 JD
Isopropylbenzene	0.35 J	2.2 J	0.64 J	1 U	3.8 J	5.4 J	5.0 J	5.4 J	3.6 J	3.2	3.9	4.0 JD
Methy-tert-butyl ether	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
Methylcyclohexane	0.33 J	2.0 J	0.59 J	1 U	13 U	25 U	3.8 J	5.4 J	2.6 J	2.0	3.3	2.3 JD
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	63 UJ	130 U	63 U	50 U	50 U	5.0 UJ	5.0 U	25 U
Halogenated VOCs **(mg/l)**												
Bromoform	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
Bromodichloromethane	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
Carbon Tetrachloride	1 U	1 U	1 U	1 UJ	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 UJ	5.0 U
Chlorobenzene	0.20 J	1.4 J	0.35 J	1 U	3.0 J	5.9 J	2.8 J	3.7 J	3.0 J	2.1	3.4	3.3 JD
Chloroform	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 UJ	1.0 U	5.0 U
Dibromochloromethane	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	0.39 J	5.0 U
cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.48 J	0.88 J	5.0 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
1,4-Dichlorobenzene	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	0.21 J	5.0 U
Chloroethane	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.46 J	0.62 J	5.0 U
Chloromethane	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 UJ	1.0 U	5.0 U
Tetrachloroethene	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
Trichloroethene	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
Vinyl Chloride	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 UJ	1.0 U	5.0 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 U	5.0 U
Methylene Chloride	1 U	1 U	1 U	1 U	13 U	20 JB	13 UJ	10 U	2.9 J	0.50 U	0.28 U	5.0 U
Trichlorofluoromethane	1 U	1 U	1 U	1 U	13 U	25 U	13 U	10 U	10 U	0.50 U	1.0 UJ	5.0 U
Semi-Volatiles **(mg/l)**												
Bis(2-chloroethyl)Ether	13	51	10	3.3 J	73	160	90 D	70	48	36 L	66	62
1,4-Dioxane	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	25 UJ	5 U	5 U	4.5 U	2.6 J	5 U	5.0 U
2,2'-oxybis (1-Chloropropane)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ	25 UJ	5 U	5 U	4.5 U	5 U	5 U	5.0 U
2,4-Dimethylphenol	5.0 U	5.0 U	5.0 U	5.0 U	4.8 J	25 U	5.4	2.6 J	2.1 J	5 U	2.1 J	1.2 J
2-Methylnaphthalene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	25 U	5 U	5 U	4.5 U	5 U	5 U	5.0 U
2-Methylphenol	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	25 U	12	5 U	4.5 U	5 U	5 U	5.0 U
4-Methylphenol	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	25 U	6.4	5 U	4.5 U	5 U	5 U	5.0 U
Acetophenone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ	25 U	5 U	5 U	4.5 U	5 U	5 U	5.0 U
Caprolactam	5.0 U	5.0 U	3.1 J	1.8 J	23 J	44 J	18 J	24	13	3.4 L	14	10
Diethylphthalate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	25 U	5 U	5 U	4.5 U	5 U	5 U	5.0 U
N-Nitrosodiphenylamine	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	25 UJ	5 U	5 U	4.5 U	5 U	5 U	5.0 U
Nitrobenzene	5.0 U	5.0 U	5.0 U	5.0 U	14	27	5 U	5 U	4.5 U	5 U	5 U	5.0 U
Naphthalene	5.0 U	5.0 U	5.0 U	5.0 U	1.6 J	25 U	1.8 J	1.5 J	4.5 U	5 U	1.0 J	0.80 J
Phenol	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	25 U	5 R	5 U	4.5 U	5 U	5.7	3.1 J
Inorganics **(mg/l)**												
Dissolved Manganese	0.0332	0.0968	0.0569	0.0218	0.218	0.573	0.228	0.240	0.238	0.307 J	0.360	0.468
Dissolved Iron	2.42	2.95	2.95	0.372	8.20	16.4	8.99	7.24	5.38	8.66	7.74	9.62
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	0.0055 J	0.0062 J
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--
Field Parameters												
Temperature (Degrees Celcius)	13.9	15.6	15.6	15.7	15.7	13.9	14.2	13.9	13.0	13.5	13.7	14.0
Conductivity (ms/cm)	441	276	338	253	427	614	404	317	376	268	311	403
pH (standard units)	7.21	7.22	7.14	7.02	6.61	6.47	6.31	6.99	7.17	8.27	7.13	7.34
Dissolved Oxygen (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.92	0.00
ORP (mV)	-135	-151	-141	-38	-184	-132	-119	-159	-141	-129	-148	-143
Water-Level Elevation (ft, MSL)	-2.59	-4.50	-3.41	-6.63	-2.23	-3.47	-3.65	-3.47	-1.77	-4.37	-3.98	-5.99

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Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	P-6						
	3/16	4/16	10/16	4/17	10/17	4/18	10/18
***Non-Halogenated VOCs* (mg/l)**							
Benzene	--	290 D	280 D	190 D	190	180	230 D
Toluene	--	1.5 JD	2.5 U	1.2	0.73	1.0	1.0
Ethylbenzene	--	49 D	58 D	8.8	3.1	5.4	11
Xylene (total)	--	96 D	60 D	41	20	20	28
2-Butanone	--	50 U	50 U	10 U	10 U	10 U	10 U
Acetone	--	50 U	50 U	3.3 J	10 UJ	2.9 J	3.0 U
Carbon Disulfide	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
Cyclohexane	--	2.5 U	2.5 UJ	5.1 J	6.4	3.5	5.5
Isopropylbenzene	--	7.6 D	6.6 D	6.6	5.7	4.6	6.9
Methy-tert-butyl ether	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
Methylcyclohexane	--	4.7 JD	4.6 JD	4.3 J	3.8	2.7 J	4.1 J
4-Methyl-2-pentanone	--	50 U	50 U	10 U	10 U	10 U	10 U
***Halogenated VOCs* (mg/l)**							
Bromoform	--	2.5 U	2.5 U	0.50 UJ	0.50 U	0.50 U	0.50 U
Bromodichloromethane	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
Carbon Tetrachloride	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	--	7.1 D	2.5 UJ	6.3	6.4	5.0	7.2
Chloroform	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
Dibromochloromethane	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane	--	2.5 U	6.2 JD	0.50 U	0.50 U	0.50 U	0.50 U
1,3 Chlorobenzene	--	--	--	--	--	--	--
1,1-Dichloroethane	--	2.5 U	2.5 U	0.65	0.52	0.49 J	0.70
cis-1,2-Dichloroethene	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
trans-1,2-Dichloroethene	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethene	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	1.5 JD	2.5 U	0.96	1.0	0.73	1.1
1,3-Dichlorobenzene	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
1,4-Dichlorobenzene	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroethane	--	2.5 U	3.0 D	1.2	1.0	0.50 U	1.2
Chloromethane	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1,1-Trichloroethane	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
Trichloroethene	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
Vinyl Chloride	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 UJ	0.50 U
1,2,4-Trichlorobenzene	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
cis-1,3-Dichloropropene	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.50 U
Methylene Chloride	--	2.5 U	2.5 U	0.50 U	0.50 U	0.50 U	0.55
Trichlorofluoromethane	--	2.5 U	2.5 U	0.50 UJ	0.50 U	0.50 U	0.50 U
***Semi-Volatiles* (mg/l)**							
Bis(2-chloroethyl)Ether	--	80	60	54	72	58 J	46
1,4-Dioxane	--	87 JD	91 JD	110 D	110 D	110 D	82 J-D
Bis(2-ethylhexyl)phthalate	--	5.0 U	5.0 U	5.0 U	4.8 U	5.0 U	8.5 J
2,2'-oxybis (1-Chloropropane)	--	--	10 U	10 U	9.5 U	10 U	10 U
2,4-Dimethylphenol	--	5.0 U	5.0 U	5.0 U	4.8 U	5.0 U	5.0 U
2-Methylnaphthalene	--	5.0 U	5.0 U	5.0 U	4.8 U	5.0 U	5.0 U
2-Methylphenol	--	10 U	10 U	10 U	9.5 U	10 U	10 U
4-Methylphenol	--	10 U	10 U	10 U	9.5 U	10 U	10 U
Acetophenone	--	10 U	10 U	10 U	9.5 U	10 U	10 U
Caprolactam	--	9.9 J	5.7 J	7.6 J	9.5 U	4.8 J	4.7 J
Diethylphthalate	--	5.0 U	5.0 U	5.0 U	4.8 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	--	5.0 U	5.0 U	5.0 U	4.8 U	5.0 U	5.0 U
Nitrobenzene	--	5.0 U	5.0 U	5.0 U	4.8 U	5.0 UJ	5.0 U
Naphthalene	--	0.79 J	0.60 J	0.49 J	4.8 U	5.0 U	5.0 U
Phenol	--	10 U	10 U	10 U	9.5 U	2.7 J	1.8 J
***Inorganics* (mg/l)**							
Dissolved Manganese	0.99	0.895	3.67 J	0.89	1.05	0.655	0.715
Dissolved Iron	16.9	15.9	46.9 J	16.5	17.4	12.8	13.7
Dissolved Cobalt	0.0084	0.0080 J	0.0329 J	0.0106 J	0.0117 J	0.0108 J	0.0121 J
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--
Field Parameters							
Temperature (Degrees Celcius)	13.1	13.9	14.0	14.1	13.1	13.2	10.8
Conductivity (ms/cm)	598	578	600	638	466	554	487
pH (standard units)	7.41	7.31	7.36	7.27	7.48	7.11	7.59
Dissolved Oxygen (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ORP (mV)	-188	-194	-195	-194	-161	-145	-150
Water-Level Elevation (ft, MSL)	-3.46	-3.37	-8.79	-4.96	-7.83	-3.15	-5.41

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
J+/K - Analyte present, reported value may be biased high.
J-/L - Analyte present, reported value may be biased low.
R - Data rejected

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
UL - Not detected, quantitation limit is probably higher
H - Analysis performed outside of Holding Time

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-18														
	1/01	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03	7/03	10/04	1/05	4/05	7/05
***Non-Halogenated VOCs* (mg/l)**															
Benzene	--	8	15 D	--	--	--	--	--	--	10	2.4 B	6.1	4 J	16	4 J
Toluene	--	0.5 B	3.1 U	--	--	--	--	--	--	5 U	0.5 U	2.9	5 U	5 U	5 U
Ethylbenzene	--	2	0.8 JD	--	--	--	--	--	--	5 U	0.27 JB	0.32 J	2 J	2 J	1 J
Xylene (total)	--	0.1 J	3.1 U	--	--	--	--	--	--	5 U	1.7 B	0.46 J	5 U	3 J	5 U
2-Butanone	--	--	--	--	--	--	--	--	--	--	--	19	10 U	10 R	10 R
Acetone	--	--	--	--	--	--	--	--	--	--	--	6.4 U	20 U	20 R	20 R
Carbon Disulfide	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U
Cyclohexane	--	--	--	--	--	--	--	--	--	--	--	0.62 L	--	--	--
Isopropylbenzene	--	--	--	--	--	--	--	--	--	--	--	4.2	--	--	--
Methy-tert-butyl ether	--	--	--	--	--	--	--	--	--	--	--	0.93	--	--	--
Methylcyclohexane	--	--	--	--	--	--	--	--	--	--	--	0.27 L	--	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	5 U	10 U	10 U	10 UJ
***Halogenated VOCs* (mg/l)**															
Bromoform	--	1 U	3.1 U	--	--	--	--	--	--	5 UJ	0.5 U	0.5 U	5 U	5 U	5 U
Bromodichloromethane	--	1 U	3.1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U
Carbon Tetrachloride	--	1 U	3.1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U
Chlorobenzene	--	50	33	--	--	--	--	--	--	28	19 B	37	34	48	22
Chloroform	--	1 U	3.1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U
Dibromochloromethane	--	1 U	3.1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 UJ	5 U	5 U
1,2-Dichloroethane	--	49	69	--	--	--	--	--	--	20	52 D	10	8	4 J	5 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	3	3 JD	--	--	--	--	--	--	1 J	2.4	2.7	4 J	4 J	1 J
cis-1,2-Dichloroethene	--	5	7 J	--	--	--	--	--	--	2 J	7.6	2.3 L	3 J	2 J	5 U
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	0.33 L	5 U	5 U	5 U
1,1-Dichloroethene	--	0.2 J	0.4 JD	--	--	--	--	--	--	5 U	0.25 J	0.5 U	5 U	5 U	5 U
1,2-Dichloroethene (total)	--	5.3 J	7 D	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	3	2 JD	--	--	--	--	--	--	0.9 J	1.7	1.4	--	--	--
1,3-Dichlorobenzene	--	2	0.9 B	--	--	--	--	--	--	0.6 J	0.48 J	0.96	--	--	--
1,4-Dichlorobenzene	--	7	5 D	--	--	--	--	--	--	2 J	3 R	2.8	--	--	--
Chloroethane	--	2	2 JD	--	--	--	--	--	--	5 U	2.3	1.7	3 J	2 J	5 U
Chloromethane	--	1 U	3.1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U
Tetrachloroethene	--	1 U	3.1 U	--	--	--	--	--	--	5 U	0.12 J	0.5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	--	1 U	3.1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U
Trichloroethene	--	2	2 JD	--	--	--	--	--	--	5 U	1	0.5 U	5 U	5 U	5 U
Vinyl Chloride	--	1	1 L	--	--	--	--	--	--	5 U	1.1	0.46 J	5 U	5 U	5 U
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	0.19 J	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U
Methylene Chloride	--	--	--	--	--	--	--	--	--	--	--	0.54 U	5 U	5 U	5 U
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--
***Semi-Volatiles* (mg/l)**															
Bis(2-chloroethyl)Ether	39 D	72	46	30 D	39	70	70	60	97 D	100 D	180 D	120	90 D	120 D	41 J
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--	--	--	10 U	5 U	5 U	27 J
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	--	--	--	--	10 UJ	5 U	5 U	5 UJ
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--	--	10 U	5 U	5 U	5 UJ
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	10 U	5 U	5 U	5 UJ
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	10 U	5 U	5 U	5 UJ
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	10 U	5 U	5 U	5 UJ
Acetophenone	--	--	--	--	--	--	--	--	--	--	--	10 U	5 U	5 U	5 UJ
Caprolactam	--	--	--	--	--	--	--	--	--	--	--	10 UJ	5 U	5 U	5 UJ
Diethylphthalate	--	--	--	--	--	--	--	--	--	--	--	10 U	5 U	5 U	5 UJ
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--	--	10 U	5 U	5 U	5 UJ
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	10 U	5 U	5 U	5 UJ
Phenol	--	--	--	--	--	--	--	--	--	--	--	10 U	5 U	5 U	5 UJ
***Inorganics* (mg/l)**															
Dissolved Manganese	--	--	--	--	--	--	--	--	--	--	11.7	4.4	11.3	0.211	9.74 J
Dissolved Iron	--	194	156	--	--	--	--	--	--	2.20	4.18	5.53	8.36	0.0273 U	4.57 J
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	2.1	< 1
Field Parameters															
Temperature (Degrees Celcius)	12.49	13.43	15.97	--	12.2	13.51	14.35	14.52	12.87	13.76	14.28	13.82	11.30	13.28	14.50
Conductivity (ms/cm)	0.562	535.1	310	--	490.9	358.1	344.3	389	468	299.4	476	411	350	435	497
pH (standard units)	7.42	6.93	6.18	--	6.24	6.32	7.35	6.3	6.3	5.67	6.42	6.26	6.69	6.21	6.00
Dissolved Oxygen (mg/l)	4.39	0	0.24	--	0	0.07	0	0	5.3	0.12	0.00	1.08	--	0.44	7.79
ORP (mV)	21.8	377.1	134.2	--	318	280.1	196.2	19.9	60.7	49.5	9.4	8.1	46.8	-19.2	37.3
Water-Level Elevation (ft, MSL)	-23.00	-19.63	-22.96	-28.91	-26.55	--	-28.98	-26.7	-29.05	-24.42	-27.88	-18.82	-21.30	-0.88	-10.43

-- Not analyzed or data not available to RAI as of December 14, 2018
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

R - Data Rejected
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-18													
	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/07	4/08	10/08	4/09	10/09	10/10	10/11
***Non-Halogenated VOCs* (mg/l)**														
Benzene	0.8 J	10 U	3.8	3.9	5.8	2.9	2.5	1.5 J	1.3 J	0.65 J	0.54 J	0.51 J	0.28 J	0.30 J
Toluene	5 U	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
Ethylbenzene	2	10 U	0.74 J	8.6	1.4 J	0.34 J	0.71 J	5 U	5 U	2 U	1 U	1 U	1 U	1 U
Xylene (total)	5 U	10 U	3 U	6 U	6 U	3 U	6 U	15 U	15 U	6 U	3 U	3 U	3 U	3 U
2-Butanone	10 U	10 U	5 U	10 U	10 U	5 U	10 U	25 UJ	25 U	10 U	5 U	5 U	5 U	5 U
Acetone	20 R	10 U	5 U	9.9 U	10 U	5 UJ	10 UJ	25 UJ	25 U	10 U	5 UJ	3.9 U	14 U	5 U
Carbon Disulfide	5 U	10 U	1 U	2 U	2 U	1 U	2 UJ	5 U	5 U	0.41 J	1 U	1 U	1 U	1 U
Cyclohexane	--	10 U	1 U	2 U	2 U	1 U	2 U	5 UJ	5 U	2 U	1 U	1 U	1 U	1 U
Isopropylbenzene	--	1.2 J	1.4	3.4	2.1	1.6	1.0 J	5 U	5 U	2 U	1 U	1 U	1 U	1 U
Methy-tert-butyl ether	--	10 U	0.88 J	1.0 J	2 U	0.45 J	0.44 J	1.3 J	2.2 J	2.5	3.4	3.0	1.3	0.99 J
Methylcyclohexane	--	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone	10 U	10 U	5 U	10 U	10 U	5 U	10 U	25 U	25 U	10 U	5 U	5 U	5 U	5 U
***Halogenated VOCs* (mg/l)**														
Bromoform	5 U	10 U	1 U	2 U	2 UJ	1 U	2 U	5 U	5 U	2 U	1 UJ	1 UJ	1 U	1 U
Bromodichloromethane	5 U	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5 U	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 UJ	2 U	1 U	1 UJ	1 U	1 UJ
Chlorobenzene	14	10	31	53	57	89 D	120 D	64	50	25	20	1 UJ	6.4	6.5
Chloroform	5 U	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
Dibromochloromethane	5 U	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 UJ	1 U	1 U
1,2-Dichloroethane	9	1.2 J	1.8	5.1 J	3.8	2.8	3.2	2.3 J	1.4 J	2 U	1 U	0.27 J	1 U	1 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	5 U	10 U	0.79 J	2.2	1.9 J	1.7	1.6 J	5 U	5 U	2 U	1 U	0.26 J	1 U	1 U
cis-1,2-Dichloroethene	1 J	10 U	0.57 J	0.97 J	0.96 J	0.97 J	0.94 J	5 U	5 U	2 U	1 U	0.24 J	1 U	1 U
trans-1,2-Dichloroethene	5 U	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5 U	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	10 U	1.9	3.2	1.7 J	1.6	1.5 J	1.2 J	0.97 J	0.58 J	1 U	0.49 J	1 U	1 U
1,3-Dichlorobenzene	--	10 U	0.81 J	1.3 J	1.2 J	1.8	2.0	1.4 J	1.4 J	0.59 J	0.46 J	0.47 J	1 U	1 U
1,4-Dichlorobenzene	--	10 U	3.0	5.3	4.4	6.7	6.9	4.6 J	3.8 J	1.8 J	1.2	1.5	1.2	1.3
Chloroethane	5 U	10 UJ	1 U	2 U	2 U	0.68 J	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
Chloromethane	5 U	10 U	1 U	2 U	2 U	0.18 J	2 U	5 UJ	5 U	2 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5 U	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5 U	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
Trichloroethene	5 U	10 U	0.25 J	0.50 J	2 U	0.41 J	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
Vinyl Chloride	5 U	10 U	0.17 J	2 U	0.47 J	0.51 J	0.51 J	5 U	5 U	2 U	1 U	4.2	0.86J	1.3
1,2,4-Trichlorobenzene	--	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	5 U	10 U	1 U	2 U	2 U	1 U	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
Methylene Chloride	5 U	10 U	1 UJ	2 UJ	2 U	1 UJ	2 U	5 UJ	5 U	2 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	--	10 UJ	1 U	2 U	2 U	0.22 J	2 U	5 U	5 U	2 U	1 U	1 U	1 U	1 U
***Semi-Volatiles* (mg/l)**														
Bis(2-chloroethyl)Ether	15	17	19	46	33	39	34	23	13	24	12	7.7	5.0 U	2.1 J
Bis(2-ethylhexyl)phthalate	6.7	5 U	6.5 L	5 U	5 U	5 U	5 U	5 U	5 U	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)	5 U	5 UL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
2,4-Dimethylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
4-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
Acetophenone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
Caprolactam	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	2.1 J	5 UL	5.4 UJ	5.3 R	5.0 U	5.0 U	5.0 U
Diethylphthalate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
Naphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
Phenol	5 U	5 UL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.4 U	5.3 U	5.0 U	5.0 U	5.0 U
***Inorganics* (mg/l)**														
Dissolved Manganese	8.73	7.54	8.45	10.0	13.0	12.1	8.43	4.53	3.94	2.65	2.80	2.59	3.60	4.17
Dissolved Iron	9.31	13.4	11.6	13.6	30.2	46.7	45.8	36.9	40.0	34.9	40.5	36.8	44.2	45.0
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)	1.1	3.9	< 2	4	6	--	--	--	--	--	--	--	--	--
Field Parameters														
Temperature (Degrees Celcius)	14.0	13.1	14.5	14.5	14.2	13.5	14.5	15.0	14.1	13.4	13.0	13.3	14.4	14.7
Conductivity (ms/cm)	440	810	418	906	417	403	261	425	660	513	720	860	439	606
pH (standard units)	6.28	6.37	6.28	6.04	6.06	6.41	6.93	6.71	6.46	7.33	6.60	6.83	6.45	6.66
Dissolved Oxygen (mg/l)	0.00	1.57	0.00	0.00	0.00	0.25	0.00	0.00	0.22	0.17	0.00	0.00	0.00	0.00
ORP (mV)	-74	-77	-82	-62	-99	-71	-109	-86	-127	-100	-104	-105	-94	-119
Water-Level Elevation (ft, MSL)	-15.48	-1.48	-6.22	-11.06	-10.96	-8.47	-10.32	-15.23	-10.50	-12.46	-7.82	-12.03	-6.82	-9.70

-- Not analyzed or data not available to RAI as of December 14, 2018
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J - Estimated concentration.
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UL - Not detected, quantitation limit is probably higher

R - Data Rejected
D - Sample diluted in the lab for analysis.
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B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-18							
	10/12	10/13	10/14	10/15	3/16	10/16	10/17	10/18
***Non-Halogenated VOCs* (mg/l)**								
Benzene	0.30 J	0.37 J	0.45 J	0.40 J	--	0.50 U	0.50 U	0.50 U
Toluene	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Ethylbenzene	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Xylene (total)	3 U	3 U	1.5 U	3.0 U	--	0.50 U	0.50 U	0.50 U
2-Butanone	5 U	5 U	50 UJ	5.0 U	--	10 U	10 U	10 U
Acetone	5 U	5 U	5.0 UJ	5.7	--	10 U	10 UJ	10 U
Carbon Disulfide	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Cyclohexane	1 U	1 U	1.0 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Isopropylbenzene	1 U	1 U	1.0 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Methy-tert-butyl ether	0.80 J	0.86 J	0.51	0.70 J	--	0.75	0.57	0.52
Methylcyclohexane	1 U	1 U	0.50 U	1.0 U	--	5.0 U	5.0 U	5.0 U
4-Methyl-2-pentanone	5 U	5 U	5.0 UJ	5.0 U	--	10 U	10 U	10 U
***Halogenated VOCs* (mg/l)**								
Bromoform	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Bromodichloromethane	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Carbon Tetrachloride	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Chlorobenzene	6.5	8.0	10	12	--	12	7.5	8.0
Chloroform	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Dibromochloromethane	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
cis-1,2-Dichloroethene	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
trans-1,2-Dichloroethene	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,1-Dichloroethene	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	0.18 J	0.50 U	0.22 J	--	0.50 U	0.50 U	0.50 U
1,3-Dichlorobenzene	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
1,4-Dichlorobenzene	1.4	1.9	2.3	2.5	--	2.9	1.4	1.7
Chloroethane	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Chloromethane	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Tetrachloroethene	1 U	1 U	0.50 U	0.15 J	--	0.50 U	0.50 U	0.50 U
1,1,1-Trichloroethane	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Trichloroethene	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Vinyl Chloride	0.66 J	1 U	0.50 UJ	1.0 U	--	0.50 U	0.50 U	0.50 U
1,2,4-Trichlorobenzene	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
cis-1,3-Dichloropropene	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
Methylene Chloride	1 U	1 U	5.0 U	1.0 U	--	0.50 U	0.50 U	1.1
Trichlorofluoromethane	1 U	1 U	0.50 U	1.0 U	--	0.50 U	0.50 U	0.50 U
***Semi-Volatiles* (mg/l)**								
Bis(2-chloroethyl)Ether	5.0 U	5.0 U	5.0 U	1.4	--	1.3 D	1.3 D	0.79 J
1,4-Dioxane	--	--	--	--	--	5.4 JL	6.3	3.4 J-
Bis(2-ethylhexyl)phthalate	5.0 U	5.0 U	5.0 U	5.0 U	--	0.71 J	4.8 U	5.0 U
2,2'-oxybis (1-Chloropropane)	5.0 U	5.0 U	5.0 U	5.0 U	--	10 U	9.5 U	10 U
2,4-Dimethylphenol	5.0 U	5.0 U	5.0 U	5.0 U	--	5.0 U	4.8 U	5.0 U
2-Methylnaphthalene	5.0 U	5.0 U	5.0 U	5.0 U	--	5.0 U	4.8 U	5.0 U
2-Methylphenol	5.0 U	5.0 U	5.0 U	5.0 U	--	10 U	9.5 U	10 U
4-Methylphenol	5.0 U	5.0 U	5.0 U	5.0 U	--	10 U	9.5 U	10 U
Acetophenone	5.0 U	5.0 U	5.0 U	5.0 U	--	10 U	9.5 U	10 U
Caprolactam	5.0 U	5.0 U	5.0 UJ	5.0 U	--	10 U	9.5 U	10 U
Diethylphthalate	5.0 U	5.0 U	5.0 U	5.0 U	--	5.0 U	4.8 U	5.0 U
N-Nitrosodiphenylamine	5.0 U	5.0 U	5.0 U	5.0 U	--	5.0 U	4.8 U	5.0 U
Naphthalene	5.0 U	5.0 U	5.0 U	5.0 U	--	5.0 U	4.8 U	5.0 U
Phenol	5.0 U	5.0 U	5.0 U	5.0 U	--	10 U	9.5 U	10 U
***Inorganics* (mg/l)**								
Dissolved Manganese	3.87	3.67	3.42 J	3.77	3.7	3.52	3.39	2.84
Dissolved Iron	42.1	39.1	39.4	45.3	42.3	47.5	43.3	36.9
Dissolved Cobalt	--	--	--	0.0376 J	0.036	0.0329 J	0.0335 J	0.0320 J
Field Parameters								
Temperature (Degrees Celcius)	14.4	13.1	12.8	13.5	9.5	13.1	15.3	12.4
Conductivity (ms/cm)	622	688	633	677	619	695	497	494
pH (standard units)	6.31	6.50	6.69	6.93	6.58	6.71	6.74	6.91
Dissolved Oxygen (mg/l)	0.25	0.00	0.00	0.00	0.17	0.00	0.00	0.00
ORP (mV)	-107	-115	-115	-106	-116	-126	-80	-80
Water-Level Elevation (ft, MSL)	-4.40	-5.78	-6.00	-8.55	-5.61	-12.45	-11.07	-7.90

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
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L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

R - Data Rejected
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
H - Analysis performed outside of Holding Time

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-22N																	
	7/00	12/00	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03	7/03	10/04	1/05	4/05	7/05	10/05	1/06
***Non-Halogenated VOCs* (mg/l)**																		
Benzene	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.41 J	5 U	5 U	5 U	5 U	10 U
Toluene	--	--	0.1 B	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U
Ethylbenzene	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U
Xylene (total)	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.24 JB	0.5 U	5 U	5 U	5 U	5 U	10 U
2-Butanone	--	--	--	--	--	--	--	--	--	--	--	--	1.9 J	10 R	10 R	10 R	10 U	10 U
Acetone	--	--	--	--	--	--	--	--	--	--	--	--	5 UJ	20 R	20 R	20 R	20 R	10 U
Carbon Disulfide	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U
Cyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U
Isopropylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U
Methy-tert-butyl ether	--	--	--	--	--	--	--	--	--	--	--	--	0.56	--	--	--	--	10 U
Methylcyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	--	5 U	10 U	10 U	10 U	10 U	10 U
***Halogenated VOCs* (mg/l)**																		
Bromoform	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.14 J	5 U	5 U	5 U	5 U	10 UJ
Bromodichloromethane	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U
Carbon Tetrachloride	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 UJ
Chlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	1.4	0.9 J	5 U	5 U	5 U	10 U
Chloroform	--	--	1 U	0.2 J	--	--	--	--	--	--	0.2 J	6.2 J	0.13 J	5 U	5 U	5 U	5 U	10 U
Dibromochloromethane	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U
1,2-Dichloroethane	--	--	0.8 J	3	--	--	--	--	--	--	0.5	0.16 J	19 D	17	5 U	5 U	5 U	10 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.17 J	5 U	5 U	5 U	5 U	10 U
cis-1,2-Dichloroethene	--	--	1 U	1 U	--	--	--	--	--	--	0.09 J	0.04 J	0.36 J	5 U	5 U	5 U	5 U	10 U
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	0.12 J	5 U	5 U	5 U	5 U	10 U
1,1-Dichloroethene	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U
1,2-Dichloroethene (total)	--	--	2 U	2 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.12 J	--	--	--	--	10 U
1,3-Dichlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	--	--	--	--	10 U
1,4-Dichlorobenzene	--	--	1 U	0.2 B	--	--	--	--	--	--	0.5 U	0.5 U	0.66	--	--	--	--	10 U
Chloroethane	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.16 K	5 U	5 U	5 U	5 U	10 U
Chloromethane	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U
Tetrachloroethene	--	--	1 U	1 U	--	--	--	--	--	--	0.05 J	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U
1,1,1-Trichloroethane	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U
Trichloroethene	--	--	0.2 J	0.3 J	--	--	--	--	--	--	0.2 J	0.5 U	0.32 J	5 U	5 U	5 U	5 U	10 U
Vinyl Chloride	--	--	1 U	1 U	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U
Methylene Chloride	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	10 U
***Semi-Volatiles* (mg/l)**																		
Bis(2-chloroethyl)Ether	0.05 U	0.024 U	0.02 U	0.024 U	0.025 U	0.024 U	0.014 J	0.04 U	0.05 U	0.05 J	0.05 U	0.05 U	0.017 J	0.053 B	0.039	0.02 U	0.018 U	0.018 U
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	17	5 U	23 U
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	--	--	--	--	--	5 UJ	5 U	5 U	5 U	5 U	5 UL
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UL	5 U	5 U
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5 U	5 U	5 U
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UL	5 U	5 U
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UL	5 U	5 U
Acetophenone	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5 U	5 U	5 U
Caprolactam	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5 UL	5 U	5 UL
Diethylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5 U	5 U	5 U
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 UJ	5 U	5 U	5 U
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5 U	5 U	5 U
Phenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5 U	5 U	5 U
***Inorganics* (mg/l)**																		
Dissolved Manganese	--	--	--	--	--	--	--	--	--	--	--	0.799	1.53	1.83	0.852	0.975	0.004 B	0.807
Dissolved Iron	--	--	0.023 B	0.011 U	--	--	--	--	--	--	0.0142 U	0.0234 U	0.132	0.0112 U	0.0273 U	0.028 U	0.027 U	0.0153 U
Dissolved Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	< 1	< 1	< 1
Field Parameters																		
Temperature (Degrees Celcius)	13.4	13.35	13.35	13.47	--	13.13	14.14	--	15.28	14.48	14.4	14.69	13.58	13.99	13.37	14.94	13.80	13.8
Conductivity (ms/cm)	0.081	0.073	82.11	126	--	148.3	146.1	--	129.4	165	145.7	160.4	226	161	158	120	55	171
pH (standard units)	5.28	6.21	5.22	5.62	--	6.12	5.33	--	5.55	5.89	5.1	5.16	6.52	5.88	6.15	4.89	5.19	5.40
Dissolved Oxygen (mg/l)	--	1.3	0.76	0.56	--	2.4	0.72	0.92	0	0.05	0.2	0.33	0.12	0.04	1.15	1.54	3.12	0.01
ORP (mV)	260	223.8	402.9	226.4	--	268.9	307.5	--	283.2	220.5	232.4	8.3	129.8	114.3	146.5	218	279.5	227
Water-Level Elevation (ft, MSL)	-27.66	-18.17	-23.44	-27.05	-31.74	-30.03	-28.29	-35.08	-31.93	-32.62	-29.33	-22.39	-22.20	-17.93	-3.71	-14.10	-21.39	-3.93

-- Not analyzed or data not available to RAI as of December 14, 2018

-- Not analyz U - Analyte was not detected above the reporting limit

J - Estimated concentration.

K - Analyte present, reported value may be biased high.

L - Analyte present, reported value may be biased low.

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D - Sample diluted in the lab for analysis.

NP - Well not pumping

P - Discrepency in GC analysis. Lower value reported

B - Analyte Detected in Method Blank

R - Data Rejected

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-22N																	
	4/06	7/06	10/06	1/07	4/07	7/07	10/07	1/08	4/08	7/08	10/08	1/09	4/09	10/09	10/10	10/11	10/12	10/13
***Non-Halogenated VOCs* (mg/l)**																		
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	0.23 J	1 U	1 U	1 U	0.22 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (total)	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	5 UJ	7.8 U	5 U	5 U	5 U	2.8 J	3.1 J	5 U	5 U	8.9 U	5 U	5 UJ	5 UJ	5 U	15 U	5 U	5 U	5 U
Carbon Disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane	1 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methy-tert-butyl ether	1 U	1 U	1 U	1 U	0.31 J	0.28 J	0.37 J	0.24 J	0.63 J	0.75 J	0.36 J	0.41 J	0.82 J	0.97 J	0.71 J	1.2	0.63 J	0.82 J
Methylcyclohexane	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
***Halogenated VOCs* (mg/l)**																		
Bromoform	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
Chlorobenzene	1 U	1 U	0.22 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	0.11 J	1 U	0.11 J	1 U	1 U	0.11 J	0.18 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	0.28 J	1 U	2.4	4.4	1.5	3.2	5.9	3.4	1 U	1 U	1 U	1 U	1.3	0.63 J	0.48 J	0.46 J	0.53 J
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	0.29 J	0.35 J	0.35 J	1 U	0.27 J	0.44 J	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.14 J	0.14 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U	1 U	1 U	0.12 J	1 U	0.16 J	0.13 J	0.26 J	0.13 J	1 U	0.24 J	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	1 R	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.37 J	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.19 J	0.35 J	1 U	1 U	1 U	2.8	2.2	2.9	5.1	4.9
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.16 J
Vinyl Chloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	1 UJ	1 U	0.65 J	1 U	1 UJ	1 U	1 U	0.62 J	0.39 J	1 U	0.24 J	0.16 J	1 U	1 U	1 U	1 U	0.23 J	0.22 J
***Semi-Volatiles* (mg/l)**																		
Bis(2-chloroethyl)Ether	0.018 U	0.019 U	0.019 U	0.020 U	0.018 U	0.020 U	0.020 U	0.020 U	0.019 U	0.019 U	0.020 U	0.051	0.020 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Bis(2-ethylhexyl)phthalate	8.0 L	70 J	86 DK	6.2 J	120 JD	27 J	15 J	5 U	5 U	14	5 U	5 UJ	5 U	2.6 J	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dimethylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Acetophenone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Caprolactam	5 UL	5 U	5 U	5 U	5 U	5 UJ	5 U	5 UJ	5 U	5 U	5 UJ	5 U	5 R	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Diethylphthalate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Phenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
***Inorganics* (mg/l)**																		
Dissolved Manganese	0.782	0.641	0.498	0.587	0.550	0.136	0.541	0.107	0.380	0.459	0.348	0.255	0.267	0.191	0.015 U	0.183	0.0817	0.0137 J
Dissolved Iron	0.0101 U	0.0124 U	0.011 U	0.0091 U	0.010 U	0.0153 U	0.009 U	0.0212 U	0.100 U	0.0126 U	0.0217 U	0.0246 U	0.0396 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dissolved Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	0.010 U	0.010 U	0.010 U	0.010 U	--
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)	< 2	3	< 2	--	--	--	--	2	--	--	--	--	--	--	--	--	--	--
Field Parameters																		
Temperature (Degrees Celcius)	15.0	17.6	16.6	14.9	20.5	18.2	15.7	14.6	16.8	17.2	15.7	13.6	16.8	15.1	18.8	15.4	15.3	14.9
Conductivity (ms/cm)	229	208	195	194	141	198	181	416	429	313	244	215	353	349	407	333	379	321
pH (standard units)	6.08	6.01	6.02	6.46	6.26	9.47	7.39	9.61	6.43	6.55	6.40	6.44	6.86	6.77	11.37	6.71	6.54	5.43
Dissolved Oxygen (mg/l)	0.55	0.57	1.16	0.00	0.04	0.00	0.19	0.92	1.08	0.83	0.32	0.53	0.28	0.00	1.15	0.62	0.29	0.00
ORP (mV)	225	143	146	147	152	-29	99	21	150	126	120	150	60	76	-103	190	171	221
Water-Level Elevation (ft, MSL)	-10.68	-15.95	-15.60	-11.09	-14.97	-16.99	-18.22	-14.25	-15.35	-19.04	-15.94	-13.98	-11.82	-15.84	-11.86	-15.51	-10.04	-11.03

-- Not analyz -- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-22N									
	10/14	4/15	10/15	3/16	4/16	10/16	4/17	10/17	4/18	10/18
***Non-Halogenated VOCs* (mg/l)**										
Benzene	0.50 U	--	1.0 U	--	--	0.50 U	--	0.50 U	--	0.50 U
Toluene	0.50 U	--	1.0 U	--	--	0.50 U	--	0.50 U	--	0.50 U
Ethylbenzene	0.50 U	--	1.0 U	--	--	0.50 U	--	0.50 U	--	0.50 U
Xylene (total)	1.5 U	--	3.0 U	--	--	0.50 U	--	0.50 U	--	0.50 U
2-Butanone	50 UJ	--	5.0 U	--	--	10 U	--	10 U	--	10 U
Acetone	5.0 UJ	--	5.0 U	--	--	10 U	--	10 UJ	--	10 U
Carbon Disulfide	0.50 U	--	1.0 U	--	--	0.50 U	--	0.50 U	--	0.50 U
Cyclohexane	1.0 U	--	1.0 U	--	--	0.50 U	--	0.50 U	--	0.50 U
Isopropylbenzene	1.0 U	--	1.0 U	--	--	0.50 U	--	0.50 U	--	0.50 U
Methy-tert-butyl ether	0.54	--	0.53 J	--	--	0.50	--	0.50 U	--	0.50 U
Methylcyclohexane	0.50 U	--	1.0 U	--	--	5.0 U	--	5.0 U	--	5.0 U
4-Methyl-2-pentanone	5.0 UJ	--	5.0 U	--	--	10 U	--	10 U	--	10 U
***Halogenated VOCs* (mg/l)**										
Bromoform	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Bromodichloromethane	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Carbon Tetrachloride	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Chlorobenzene	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Chloroform	0.50 U	--	0.25 J	-	-	0.50 U	-	0.50 U	-	0.50 U
Dibromochloromethane	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
1,2-Dichloroethane	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
1,3 Chlorobenzene	--	--	--	-	-	--	-	--	-	--
1,1-Dichloroethane	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
cis-1,2-Dichloroethene	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
trans-1,2-Dichloroethene	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
1,1-Dichloroethene	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
1,3-Dichlorobenzene	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
1,4-Dichlorobenzene	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Chloroethane	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Chloromethane	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Tetrachloroethene	5.4	--	3.6	-	-	2.7	-	2.1	-	1.4
1,1,1-Trichloroethane	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Trichloroethene	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Vinyl Chloride	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
1,2,4-Trichlorobenzene	0.50 UJ	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
cis-1,3-Dichloropropene	0.50 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Methylene Chloride	5.0 U	--	1.0 U	-	-	0.50 U	-	0.50 U	-	0.50 U
Trichlorofluoromethane	0.50 U	--	1.0 U	--	--	0.50 U	--	0.50 U	--	0.50 U
***Semi-Volatiles* (mg/l)**										
Bis(2-chloroethyl)Ether	4.9 U	--	0.10 U	--	--	0.096 U	--	0.10 U	--	0.10 UJ
1,4-Dioxane	--	--	--	--	--	2.0 U	--	2.0 U	--	2.0 UJ
Bis(2-ethylhexyl)phthalate	4.9 U	--	5.0 U	--	--	4.9 U	--	20	--	5.0 U
2,2'-oxybis (1-Chloropropane)	4.9 U	--	5.0 U	--	--	9.8 U	--	9.5 U	--	10 U
2,4-Dimethylphenol	4.9 U	--	5.0 U	--	--	4.9 U	--	4.8 U	--	5.0 U
2-Methylnaphthalene	4.9 U	--	5.0 U	--	--	4.9 U	--	4.8 U	--	5.0 U
2-Methylphenol	4.9 U	--	5.0 U	--	--	9.8 U	--	9.5 U	--	10 U
4-Methylphenol	4.9 U	--	5.0 U	--	--	9.8 U	--	9.5 U	--	10 U
Acetophenone	4.9 U	--	5.0 U	--	--	9.8 U	--	9.5 U	--	10 U
Caprolactam	4.9 UJ	--	5.0 U	--	--	9.8 U	--	9.5 U	--	10 U
Diethylphthalate	4.9 U	--	5.0 U	--	--	4.9 U	--	4.8 U	--	5.0 U
N-Nitrosodiphenylamine	4.9 U	--	5.0 U	--	--	4.9 U	--	4.8 U	--	5.0 U
Naphthalene	4.9 U	--	5.0 U	--	--	4.9 U	--	4.8 U	--	5.0 U
Phenol	4.9 U	--	5.0 U	--	--	9.8 U	--	9.5 U	--	10 U
***Inorganics* (mg/l)**										
Dissolved Manganese	0.0022 J	0.0018 J	0.0016 J	0.0039 J	0.0076 J	0.0089 J	0.0054 J	0.0202	0.0045 J	0.0234
Dissolved Iron	0.1 U	0.100 U	0.100 U	0.026 J	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Dissolved Cobalt	--	0.0500 U	0.0500 U	0.0050 U	0.00034 J	0.050 U	0.050 U	0.0011 J	0.050 U	0.0021 J
Field Parameters										
Temperature (Degrees Celcius)	14.7	15.0	16.2	17.6	15.6	13.6	14.5	14.4	12.9	14.5
Conductivity (ms/cm)	303	323	371	226	229	266	273	214	235	204
pH (standard units)	6.59	7.07	7.00	6.19	5.95	5.74	5.72	5.66	5.70	5.85
Dissolved Oxygen (mg/l)	3.22	3.11	2.68	2.92	3.31	2.65	3.80	2.96	4.23	4.19
ORP (mV)	134	94	206	182	176	224	190	241	234	323
Water-Level Elevation (ft, MSL)	-11.89	-14.02	-14.50	-12.97	-12.75	-19.13	-14.48	-17.84	-11.46	-13.76

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
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K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank
R - Data Rejected

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-26N																		
	10/00	1/01	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03	7/03	10/04	1/05	4/05	7/05	10/05	1/06	4/06
***Non-Halogenated VOCs* (mg/l)**																			
Benzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.11 J	5 U	5 U	5 U	5 U	10 U	0.18 J
Toluene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	1.4 J	0.76 J
Ethylbenzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
Xylene (total)	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.2 JB	0.5 U	5 U	5 U	5 U	5 U	10 U	3 U
2-Butanone	--	--	--	--	--	--	--	--	--	--	--	--	5 U	10 R	10 U	10 U	10 U	10 U	5 U
Acetone	--	--	--	--	--	--	--	--	--	--	--	--	5 UJ	20 R	20 U	20 R	20 R	10 U	5 UJ
Carbon Disulfide	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
Cyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1 U
Isopropylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1 U
Methy-tert-butyl ether	--	--	--	--	--	--	--	--	--	--	--	--	0.34 J	--	--	--	--	10 U	1 U
Methylcyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1 U
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	--	5 U	10 U	10 U	10 U	10 U	10 U	5 U
***Halogenated VOCs* (mg/l)**																			
Bromoform	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.11 J	5 U	5 U	5 U	5 U	10 UJ	1 U
Bromodichloromethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
Carbon Tetrachloride	--	--	1 UJ	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 UJ	1 U
Chlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
Chloroform	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.03 J	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
Dibromochloromethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
1,2-Dichloroethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.055 J	0.15 J	5 U	5 U	5 U	5 U	10 U	1 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.11 J	5 U	5 U	5 U	5 U	10 U	1 U
cis-1,2-Dichloroethene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.11 J	5 U	5 U	5 U	5 U	10 U	1 U
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
1,1-Dichloroethene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	--	--	--	--	10 U	1 U
1,2-Dichloroethene (total)	--	--	2 U	2 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	--	--	--	--	10 U	1 U
1,3-Dichlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	--	--	--	--	10 U	1 U
1,4-Dichlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
Chloroethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	--	--	--	--	10 U	1 UJ
Chloromethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
Tetrachloroethene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	10 U	1 R
1,1,1-Trichloroethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.11 J	5 U	5 U	5 U	5 U	10 U	1 U
Trichloroethene	--	--	1	1	--	--	--	--	--	--	5 U	0.5 U	0.67	5 U	5 U	5 U	5 U	10 U	1 U
Vinyl Chloride	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	--	--	--	--	10 U	1 U
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 U	10 U	1 U
Methylene Chloride	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1 U
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U	1 UJ
***Semi-Volatiles* (mg/l)**																			
Bis(2-chloroethyl)Ether	0.32	0.38	0.4	0.21	0.21	0.098	0.12	0.13	0.1	0.07	0.1	0.07	0.11	0.2 B	0.15	0.2	0.78	0.59	2.8 D
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 UL
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	--	--	--	--	--	5 UJ	5 UL	5 U	5 U	5 U	5 UL	5 U
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 U	5 U	5 U	5 U	5 U
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 U	5 U	5 U	5 U	5 U
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 U	5 U	5 U	5 U	5 U
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 U	5 U	5 U	5 U	5 U
Acetophenone	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 U	5 U	5 U	5 U	5 U
Caprolactam	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 UL
Diethylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 U
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 UJ	5 U	5 U	5 U	5 U
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 U	5 U	5 U	5 U	5 U
Phenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 UL	5 U	5 U	5 U	5 U	5 U
***Inorganics* (mg/l)**																			
Dissolved Manganese	--	--	--	--	--	--	--	--	--	--	--	0.0044 B	0.0029 J	0.0042 B	0.0043	0.0054	0.0054	0.0035	0.0079 U
Dissolved Iron	--	--	0.0157 B	0.011 U	--	--	--	--	--	--	0.0192 U	0.0234 U	0.011 U	0.0112 U	0.0273 U	0.028 U	0.0122 U	0.0153 U	0.0101 U
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	1.1	< 1	< 1	< 2
Field Parameters																			
Temperature (Degrees Celcius)	13.69	13.5	13.23	13.43	--	13.38	14.09	14.23	14.88	13.85	14.02	17.74	13.66	13.96	13.59	14.59	15.7	14.1	15.3
Conductivity (ms/cm)	85.04	0.082	82.81	93.78	--	95.67	96.62	93.68	81.45	103	103.2	115.7	115	78	84	105	130	147	162
pH (standard units)	7.18	7.23	5.62	3.95	--	5.65	4.93	5.44	5.24	5.67	4.75	4.97	5.39	5.63	5.57	5.03	5.62	5.24	5.80
Dissolved Oxygen (mg/l)	0.18	0.17	0.34	--	--	1.6	0.77	0.22	1.66	0.08	0.13	6.70	0.30	2.71	2.40	2.63	0.00	0.44	1.08
ORP (mV)	188.8	194.1	373.3	374	--	377.2	395.1	309.6	332.4	338.6	231.2	121.2	152.5	196.2	227.4	248.4	198	249	254
Water-Level Elevation (ft, MSL)	--	27.96	-21.94	-30.74	-36.42	-31.31	--	-39.04	-28.84	-34.23	-28.56	-35.3	-27.19	-20.74	-4.03	-19.74	-24.97	-4.79	-13.27

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

R - Data Rejected
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank

Table 2 (continued)

istorical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfil

Parameter	MW-26N											
	7/06	10/06	1/07	4/07	7/07	10/07	1/08	4/08	7/08	10/08	1/09	4/09
***Non-Halogenated VOCs* (mg/l)**												
Benzene	0.64 J	0.38 J	0.38 J	5.8	0.97 J	0.46 J	0.85 J	1.5	0.53 J	0.39 J	0.92 J	1 U
Toluene	0.47 J	1 U	1 U	1 U	0.22 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (total)	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 U
Acetone	5.0 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ
Carbon Disulfide	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U
Isopropylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methy-tert-butyl ether	0.30 J	1 U	1 U	0.14 J	1 U	0.23 J	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U
***Halogenated VOCs* (mg/l)**												
Bromoform	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 UJ
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U	1 U	0.64 J	1.3	0.34 J	1 U	1 U	1 U	1 U	1 U
Chloroform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.48 J	1 U	0.16 J	1 U	2.5	2	1.5	1.0	1 U	0.54 J	0.96 J	1 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	0.32 J	0.28 J	1 U	0.27 J	0.43 J	1 U
cis-1,2-Dichloroethene	1 U	1 U	1 U	0.45 J	0.61 J	0.31 J	0.43 J	0.39 J	0.24 J	0.30 J	0.45 J	0.33 J
trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	1 U	1 U	1 U	0.32 J	0.11 J	0.15 J	0.12 J	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	0.19 J	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	1 U	1 U	1 U	1 U	0.15 J	1 UJ	0.15 J	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	1 U	1 U	0.28 J	1 U	1 U	0.76 J	0.69 J	1.7	1.2 U	0.70 J	0.74 J	0.95 J
Vinyl Chloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	1 UJ	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	6.6
***Semi-Volatiles* (mg/l)**												
Bis(2-chloroethyl)Ether	3.6 J	1.5 J	2.0 J	19	42	11	20	9.6	9.4	9.5 L	15	24
Bis(2-ethylhexyl)phthalate	5 U	6.9 L	5.0 J	7.7 J	8.4 J	4.2 L	5 U	12	5 U	5 U	5 UJ	7.3
2,2'-oxybis (1-Chloropropane)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5.3 U
2,4-Dimethylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U
2-Methylnaphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U
2-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U
4-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U
Acetophenone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U
Caprolactam	5 U	5 UL	5 U	5 U	5 UJ	5 UL	5 UJ	5 U	5 U	14 J	5 U	5.3 R
Diethylphthalate	5 U	5 UL	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 U	5.3 U
N-Nitrosodiphenylamine	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U
Naphthalene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U
Phenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.3 U
***Inorganics* (mg/l)**												
Dissolved Manganese	0.0043	0.003	0.0035 U	0.0035	0.004 U	0.0021	0.0013 J	0.0022	0.0022	0.0016 U	0.0564	0.284
Dissolved Iron	0.0124 U	0.0075 U	0.0101 U	0.010 U	0.0153 U	0.009 U	0.0212 U	0.100 U	0.0126 U	0.0177 U	0.0246 U	0.0396 U
Biological Oxygen Demand (mg/l)	8	< 2	--	--	--	--	1	--	--	--	--	--
Field Parameters												
Temperature (Degrees Celcius)	17.5	16.0	15.0	14.6	16.4	15.6	15.3	16.9	16.7	15.9	14.5	14.7
Conductivity (ms/cm)	188	244	124	121	375	511	451	295	203	211	175	254
pH (standard units)	5.75	5.92	5.47	5.39	6.05	6.31	6.51	6.35	5.85	6.90	6.77	6.40
Dissolved Oxygen (mg/l)	1.30	1.03	0.81	0.00	0.00	0.00	1.21	1.94	1.67	1.15	0.06	0.00
ORP (mV)	178	174	199	163	122	96	130	107	183	100	144	180
Water-Level Elevation (ft, MSL)	-20.72	-17.65	-16.17	-19.06	-23.27	-24.91	-18.21	-18.78	-24.79	-19.81	-17.86	-14.03

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
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R - Data Rejected
D - Sample diluted in the lab for analysis.
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Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-26N											
	10/09	4/10	10/10	4/11	10/11	4/12	10/12	4/13	10/13	4/14	10/14	4/15
Non-Halogenated VOCs **(mg/l)**												
Benzene	0.48 J	0.49 J	0.30 J	0.11 J	0.79 J	0.29 J	0.42 J	0.55 J	0.43 J	0.70 J	0.47 J	0.30 J
Toluene	1 U	1 U	1 U	1 U	0.48 J	0.24 J	1 U	1 U	0.16 J	1 U	0.26 J	1.0 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
Xylene (total)	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	1.5 U	3.0 U
2-Butanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	50 UJ	5.0 U
Acetone	5 U	5 U	5 U	5 U	5 U	3.6 J	18	8.1 UJ	5.8	5 UJ	5.0 UJ	6.4 UJ
Carbon Disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
Cyclohexane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	1.0 U
Isopropylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	1.0 U
Methy-tert-butyl ether	1 U	1 U	1 U	1 U	1 U	3.3	4.4	6.1	2.6	3.8	2.9	2.9
Methylcyclohexane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.0 UJ	5.0 U
Halogenated VOCs **(mg/l)**												
Bromoform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
Carbon Tetrachloride	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	0.50 U	1.0 UJ
Chlorobenzene	0.37 J	0.29 J	0.18 J	0.19 J	0.49 J	7.7	12	14	11	18	17	9.3
Chloroform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
Dibromochloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
1,2-Dichloroethane	0.23 J	0.86 J	0.76 J	0.28 J	2.9	1.2	1.5	1.4	1.7	2.4	1.3	2.6
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	0.43 J	0.31 J	0.23 J	0.45 J	0.41 J	0.43 J	0.70 J	0.50 J	1 U	0.51	0.76 J
cis-1,2-Dichloroethene	1 U	0.39 J	0.38 J	1 U	0.74 J	1 U	0.50 J	0.41 J	0.35 J	0.60 J	0.50 U	0.57 J
trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	1 U	1 U	1 U	0.22 J	0.22 J	0.29 J	0.55 J	0.44 J	0.68 J	0.61	0.55 J
1,3-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	0.17 J	0.24 J	0.35 J	0.25 J	0.46 J	0.48 J	0.38 J
1,4-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	0.64 J	0.97 J	1.3	0.94 J	1.6	1.5	1.1
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.23 J	1 U	1 U	0.50 U	1.0 UJ
Chloromethane	1 UJ	1 UJ	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	0.50 U	1.0 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	0.15 J	1 U	1 U	1 U	0.50 U	1.0 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
Trichloroethene	0.57 J	0.87 J	0.52 J	0.43 J	0.25 J	0.16 J	1 U	1 U	0.16 J	0.14 J	0.50 U	1.0 U
Vinyl Chloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	0.50 UJ	1.0 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 U
Methylene Chloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	5.0 U	0.36 U
Trichlorofluoromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.50 U	1.0 UJ
Semi-Volatiles **(mg/l)**												
Bis(2-chloroethyl)Ether	6.3	12	16	6.3	21	10	10	24	13	19	23	29
1,4-Dioxane	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	5.3 U	5 U	5 U	12 U	5 U	5 U	5 U	3.8 J	5 U	4.8	8.2	5 U
2,2'-oxybis (1-Chloropropane)	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.8 U	5 U	5 U
2,4-Dimethylphenol	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.8 U	5 U	5 U
2-Methylnaphthalene	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.8 U	5 U	5 U
2-Methylphenol	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.8 U	5 U	5 U
4-Methylphenol	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.8 U	5 U	5 U
Acetophenone	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.8 U	5 U	5 U
Caprolactam	5.3 U	5 U	5 U	5 U	5 U	8.6	44	3.2 J	19	14	7.8 J	2.7 J
Diethylphthalate	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.8 U	5 U	5 U
N-Nitrosodiphenylamine	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.8 U	5 U	5 U
Naphthalene	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.8 U	5 U	5 U
Phenol	5.3 U	5 UL	5 UL	5 U	5 UL	5 U	5 UL	5 U	5 U	4.8 U	5 U	5 U
Inorganics **(mg/l)**												
Dissolved Manganese	0.128	0.226	0.350	0.222	1.44	0.361	0.972	0.749	0.386	0.925	0.0581 J	1.43
Dissolved Iron	0.100 U	0.100 U	0.100 U	0.0342 J	0.161	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.100 U
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	0.0147 J
Field Parameters												
Temperature (Degrees Celcius)	16.2	14.9	15.9	16.6	16.5	16.1	17.4	16.7	16.3	14.7	15.3	15.5
Conductivity (ms/cm)	254	217	132	192	205	329	420	405	364	446	329	386
pH (standard units)	6.77	6.79	6.29	6.40	6.45	9.29	7.09	5.25	9.70	6.55	9.93	6.79
Dissolved Oxygen (mg/l)	3.95	0.63	0.42	2.56	0.89	1.18	0.70	0.65	0.98	0.00	2.22	0.00
ORP (mV)	156	96	88	118	44	-50	61	166	46	129	11	131
Water-Level Elevation (ft, MSL)	-19.12	-11.43	-13.09	-11.77	-17.88	-8.47	-8.78	-10.85	-13.37	-8.11	-11.21	-14.01

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
R - Data Rejected
D - Sample diluted in the lab for analysis.

Table 2 (continued)

storical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfi

Parameter	MW-26N							
	10/15	3/16	4/16	10/16	4/17	10/17	4/18	10/18
Non-Halogenated VOCs **(mg/l)**								
Benzene	0.74 J	--	0.78	0.86	0.79	0.55	0.85	0.55
Toluene	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Ethylbenzene	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Xylene (total)	3.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
2-Butanone	5.0 U	--	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	5.0 U	--	10 UJ	10 U	10 UJ	10 UJ	10 UJ	2.1 U
Carbon Disulfide	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Cyclohexane	1.0 U	--	0.50 U	0.50 U	0.50 UJ	0.50 U	0.50 U	0.50 U
Isopropylbenzene	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methy-tert-butyl ether	3.2	--	2.6	3.6	2.5	2.1	2.5	2.4
Methylcyclohexane	1.0 U	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 U
4-Methyl-2-pentanone	5.0 U	--	10 U	10 U	10 U	10 U	10 U	10 U
Halogenated VOCs **(mg/l)**								
Bromoform	1.0 U	--	0.50 U	0.50 U	0.50 UJ	0.50 U	0.50 U	0.50 U
Bromodichloromethane	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Carbon Tetrachloride	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chlorobenzene	22	--	19	20	16	8.7	9.6	9.9
Chloroform	0.25 J	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Dibromochloromethane	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane	1.9	--	3.5	1.9	2.5	1.3	1.4	1.3
1,3 Chlorobenzene	--	--	--	--	--	--	--	--
1,1-Dichloroethane	0.81 J	--	0.81	0.74	0.74	0.42 J	0.45 J	
cis-1,2-Dichloroethene	0.88 J	--	1.2	0.84	1.0	0.44 J	0.52	0.53
trans-1,2-Dichloroethene	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloroethene	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	0.53 J	--	0.61	0.55	0.54	0.50 U	0.50 U	0.50 U
1,3-Dichlorobenzene	0.44 J	--	0.50 U	0.40 J	0.50 U	0.50 U	0.50 U	0.50 U
1,4-Dichlorobenzene	1.3	--	1.4	1.2	1.1	0.59	0.50 U	0.67
Chloroethane	0.25 J	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloromethane	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene	0.15 J	--	0.50 U	0.50 U	0.50 U	0.60	0.50 U	0.55
1,1,1-Trichloroethane	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Trichloroethene	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Vinyl Chloride	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ	0.50 U
1,2,4-Trichlorobenzene	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
cis-1,3-Dichloropropene	1.0 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methylene Chloride	0.36 U	--	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Trichlorofluoromethane	1.0 U	--	0.50 U	0.50 U	0.50 UJ	0.50 U	0.50 U	0.50 U
Semi-Volatiles **(mg/l)**								
Bis(2-chloroethyl)Ether	22	--	23	18	24	17	12 J	6.9 J
1,4-Dioxane	--	--	46 D	53 D	56 D	87 D	49 D	26 J-
Bis(2-ethylhexyl)phthalate	5.0 U	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)	5.0 U	--	--	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	5.0 U	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	5.0 U	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	5.0 U	--	10 U	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	5.0 U	--	10 U	10 U	10 U	10 U	10 U	10 U
Acetophenone	5.0 U	--	10 U	10 U	10 U	10 U	10 U	10 U
Caprolactam	5.0 U	--	10 U	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	5.0 U	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	5.0 U	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	5.0 U	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Phenol	5.0 U	--	10 U	10 U	10 U	10 U	10 U	10 U
Inorganics **(mg/l)**								
Dissolved Manganese	1.17	1.8	2.57 J	1.47 J	2.47 J	2.35	1.74	1.67
Dissolved Iron	0.0173 J	0.026 J	0.0259 J	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Dissolved Cobalt	0.0140 J	0.018	0.0206 J	0.0133 J	0.0214 J	0.0197 J	0.0152 J	0.0170 J
Field Parameters								
Temperature (Degrees Celcius)	14.6	12.9	16.5	14.2	13.4	13.3	11.8	13.8
Conductivity (ms/cm)	433	401	376	424	441	293	353	278
pH (standard units)	6.61	6.55	6.23	6.45	6.23	6.35	6.32	6.51
Dissolved Oxygen (mg/l)	0.42	0.22	0.00	0.00	0.00	0.00	0.00	0.00
ORP (mV)	140	139	110	84	91	139	97	224
Water-Level Elevation (ft, MSL)	-15.77	-12.42	-12.30	-19.90	-14.21	-19.42	-10.44	-15.14

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
J+/K - Analyte present, reported value may be biased high.
J-/L - Analyte present, reported value may be biased low.
R - Data Rejected
D - Sample diluted in the lab for analysis.
B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-38N		
	4/10	10/15	3/16
Non-Halogenated VOCs **(mg/l)**			
Benzene	--	--	--
Toluene	--	--	--
Ethylbenzene	--	--	--
Xylene (total)	--	--	--
2-Butanone	--	--	--
Acetone	--	--	--
Carbon Disulfide	--	--	--
Cyclohexane	--	--	--
Isopropylbenzene	--	--	--
Methy-tert-butyl ether	--	--	--
Methylcyclohexane	--	--	--
Styrene	--	--	--
4-Methyl-2-pentanone	--	--	--
Halogenated VOCs **(mg/l)**			
Bromoform	--	--	--
Bromodichloromethane	--	--	--
Carbon Tetrachloride	--	--	--
Chlorobenzene	--	--	--
Chloroform	--	--	--
Dibromochloromethane	--	--	--
1,2-Dichloroethane	--	--	--
1,3 Chlorobenzene	--	--	--
1,1-Dichloroethane	--	--	--
cis-1,2-Dichloroethene	--	--	--
trans-1,2-dischloroethene	--	--	--
1,1-Dichloroethene	--	--	--
1,2-Dichloroethene (total)	--	--	--
1,2-Dichlorobenzene	--	--	--
1,3-Dichlorobenzene	--	--	--
1,4-Dichlorobenzene	--	--	--
Chloroethane	--	--	--
Tetrachloroethene	--	--	--
1,1,1-Trichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--
Trichloroethene	--	--	--
Vinyl Chloride	--	--	--
1,2,4-Trichlorobenzene	--	--	--
cis-1,3-Dichloropropene	--	--	--
Methylene Chloride	--	--	--
Trichlorofluoromethane	--	--	--
Semi-Volatiles **(mg/l)**			
Bis(2-chloroethyl)Ether	--	--	--
Bis(2-ethylhexyl)phthalate	--	--	--
2,2'-oxybis (1-Chloropropane)	--	--	--
2,4-Dimethylphenol	--	--	--
2-Methylnaphthalene	--	--	--
2-Methylphenol	--	--	--
4-Methylphenol	--	--	--
Acetophenone	--	--	--
Caprolactam	--	--	--
Diethylphthalate	--	--	--
Dimethylphthalate	--	--	--
N-Nitrosodiphenylamine	--	--	--
Naphthalene	--	--	--
1,1'- Biphenyl	--	--	--
Di (n-butyl) phthalate	--	--	--
2,4-Dichlorophenol	--	--	--
bis (2-chloroethoxy)methane	--	--	--
Di-n-octylphthalate	--	--	--
Phenol	--	--	--
Inorganics (mg/l)			
Dissolved Manganese	--	0.0381	0.031
Dissolved Iron	--	0.107	0.30
Dissolved Lead	0.010 U	--	--
Dissolved Cobalt	--	0.0021 J	0.0029 J
Biological Oxygen Demand (mg/l)	--	--	--
Field Parameters			
Temperature (Degrees Celcius)	13.7	13.8	13.2
Conductivity (ms/cm)	366	267	284
pH (standard units)	5.63	5.85	5.84
Dissolved Oxygen (mg/l)	0.00	3.22	4.64
ORP (mV)	115	225	252
Water-Level Elevation (ft, MSL)	-5.50	-10.08	-7.71

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-49N																	
	7/00	1/01	4/01	7/01	10/01	1/02	4/02	7/02	10/02	1/03	4/03	7/03	10/04	1/05	4/05	7/05	10/05	1/06
Non-Halogenated VOCs **(mg/l)**																		
Benzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 UJ	10 U
Toluene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 UJ	10 U
Ethylbenzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 UJ	10 U
Xylene (total)	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.27 JB	0.5 U	5 U	5 U	5 U	5 U	10 U
2-Butanone	--	--	--	--	--	--	--	--	--	--	--	--	5 U	10 R	10 U	10 R	10 UJ	10 U
Acetone	--	--	--	--	--	--	--	--	--	--	--	--	5 UJ	20 R	20 U	20 R	20 R	10 U
Carbon Disulfide	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 UJ	10 U
Cyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U
Isopropylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U
Methy tert-butyl ether	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10 U
Methylcyclohexane	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	--	5 U	10 U	10 U	10 U	10 UJ	10 U
Halogenated VOCs **(mg/l)**																		
Bromoform	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.14 J	5 U	5 U	5 U	5 UJ	10 UJ
Bromodichloromethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 UJ	10 U
Carbon Tetrachloride	--	--	1 UJ	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 UJ	10 UJ
Chlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 UJ	10 U
Chloroform	--	--	0.6 J	0.8 J	--	--	--	--	--	--	5 U	0.5 U	0.3 J	5 U	5 U	5 U	5 UJ	10 U
Dibromochloromethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 UJ	10 U
1,2-Dichloroethane	--	--	5	0.8 J	--	--	--	--	--	--	5 U	0.5 U	1.1	5 U	5 U	5 U	5 UJ	10 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.61	5 U	5 U	5 U	5 UJ	10 U
cis-1,2-Dichloroethene	--	--	0.1 J	0.1 J	--	--	--	--	--	--	5 U	0.11 J	0.22 J	5 U	5 U	5 U	5 UJ	10 U
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	0.11 J	5 U	5 U	5 U	5 UJ	10 U
1,1-Dichloroethene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	--	--	--	--	10 U
1,2-Dichloroethene (total)	--	--	2 U	2 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.12 J	--	--	--	--	10 U
1,3-Dichlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	--	--	--	--	10 U
1,4-Dichlorobenzene	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.99	--	--	--	--	10 U
Chloroethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 UJ	10 U
Chloromethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 u	10 U
Tetrachloroethene	--	--	0.2 J	1 U	--	--	--	--	--	--	5 U	0.5 U	0.41 J	5 U	5 U	5 U	5 UJ	10 U
1,1,1-Trichloroethane	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 UJ	10 U
Trichloroethene	--	--	0.3 J	0.3 J	--	--	--	--	--	--	0.7 J	0.5 U	0.41 J	5 U	5 U	5 U	5 UJ	10 U
Vinyl Chloride	--	--	1 U	1 U	--	--	--	--	--	--	5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 UJ	10 U
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	--	--	--	--	10 U
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 UJ	10 U
Methylene Chloride	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	5 U	5 U	5 U	5 UJ	10 U
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--	--	--	--	3	--	--	--	--	18
Semi-Volatiles **(mg/l)**																		
Bis(2-chloroethyl)Ether	0.05 U	0.018 J	0.7 J	0.026 U	0.025 U	0.024 U	1.7	0.032 J	0.05 U	0.04 J	0.037 J	0.05 U	0.87	0.032 B	0.017 U	0.021 U	0.02 UL	0.019 U
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--	--	--	--	17	5 U	5 U	5.1 UL	8.2	5.2 U
Benzo (a) Anthracene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Benzo (a) Pyrene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Benzo (b) Fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Benzo (k) Fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Benzo (g,h,i) Perylene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Chrysene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Indeno (1,2,3-cd) Pyrene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	--	--	--	--	--	5 UJ	5 U	5 U	5.1 U	5 U	5 UL
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 UL	5 U
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 UL	5 U	5 U
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 UL	5 U
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 UL	5 U
Acetophenone	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Caprolactam	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 UL	5 U	5 UL
Diethylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 UL	5 U	5 U
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 UJ	5.1 U	5 U	5 U
Naphthalene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 UL	5 U	5 U
Phenol	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Phenanthrene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Di-n-octylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Pyrene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	5 U	5 U	5 U	5.1 U	5 U	5 U
Inorganics **(mg/l)**																		
Dissolved Manganese	--	--	--	--	--	--	--	--	--	--	--	0.0041 B	0.0973	0.0023 B	0.0026	0.0048	0.942	0.0002 U
Dissolved Iron	--	--	0.0188 B	0.011 U	--	--	--	--	--	--	0.0142 U	0.0244 U	0.011 U	0.0524 B	0.0273 U	0.028 U	0.0131 U	0.0153 U
Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0	2.3	2.3	< 1
Field Parameters																		
Temperature (Degrees Celcius)	13.14	13.48	12.81	13.4	--	13.4	15.01	14.53	16.47	14.57	14.84	17.49	13.66	13.41	13.03	14.73	13.60	13.5
Conductivity (ms/cm)	0.087	0.081	70.57	87.16	--	88	137.1	77.92	46.02	82	71.72	78.05	146	42	57	56	134	68
-- Not analyzed or data not available to RAI	5.59	6.45	5.55	5.05	--	5.26	5.34	4.13	5.31	5.41	4.49	4.98	5.53	5.57	5.13	4.19	5.94	4.75
Dissolved Oxygen (mg/l)	--	1.64	1.18	0.89	--	4.22	0.72	0.75	2.6	2.49	3.12	1.71	0.31	3.84	4.43	2.97	1.37	0.99
ORP (mV)	219.2	241.9	435	281.7	--	347.1	353.2	344.8	309.2	263.8	261.4	73.1	164.3	220.8	249.4	249.4	115.3	249
Water-Level Elevation (ft, MSL)	-30.05	-27.69	-23.20	-29.17	-32.73	-31.32	-28.04	-37.43	-36.04	-33.66	-29.73	-33.83	-24.64	-18.99	-3.46	-16.64	-18.41	-3.69

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

R - Data Rejected
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-49N																
	4/06	7/06	10/06	1/07	4/07	7/07	10/07	1/08	4/08	7/08	10/08	1/09	4/09	10/09	10/10	10/11	10/12
Non-Halogenated VOCs (mg/l)																	
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1.7	1 U	0.64 J	0.78 J	1 U	0.48 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (total)	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
2-Butanone	2.2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
Acetone	10 J	9.3 U	5 U	2.9 U	5 U	5 U	4.4 J	5 U	5 U	5 U	5 U	5 UJ	5 UJ	3.1 U	5 U	5 U	5 U
Carbon Disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methy tert-butyl ether	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.77 J	1 U	1 U	1 U	1 U
Methylcyclohexane	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U
Halogenated VOCs (mg/l)																	
Bromoform	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.43 J	0.42 J	0.34 J	0.74 J	1 U	0.49 J	0.41 J	0.50 J	0.27 J
trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	1 R	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.14 J	1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 U
Tetrachloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.51 J	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	1 U	1 U	1 U	1 U	1 U	0.24 J	0.22 J	1 U	0.86 J	1 U	0.83 J	1.4	1 U	1.6	1.1	0.96 J	0.70 J
Vinyl Chloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	1 UJ	1 U	1 U	1 U	2.8 J	3.1	2.3	1.6	9.3	8.5	7.1	12	1 U	12	11	8.2	6.5
Semi-Volatiles (mg/l)																	
Bis(2-chloroethyl)Ether	0.018 U	0.019 U	0.059	0.018 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.021 U	0.020 U	0.020 U	5.0 U	5.0 U	5.0 U	5.0 U
Bis(2-ethylhexyl)phthalate	5 UL	5 U	5 U	5 U	21 J	5 UL	5 UL	5 U	5 UL	5 U	5.1 U	5.0 UJ	5.3 U	5.0 UJ	5.0 U	13	5.0 U
Benzo (a) Anthracene	5 U	5 U	5 U	5 U	1.3 J	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (a) Pyrene	5 U	5 U	5 U	5 U	2.4 L	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (b) Fluoranthene	5 U	5 U	5 U	5 U	5.3 L	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (k) Fluoranthene	5 U	5 U	5 U	5 U	2.8 L	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (g,h,i) Perylene	5 U	5 U	5 U	5 U	3.5 L	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Chrysene	5 U	5 U	5 U	5 U	4.4 J	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Indeno (1,2,3-cd) Pyrene	5 U	5 U	5 U	5 U	3.3 L	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 UJ	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dimethylphenol	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Acetophenone	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Caprolactam	5 UL	5 U	5 U	5 U	5 U	5 UL	5 UL	5 UJ	5 UL	5 U	5.1 UJ	5.0 U	5.3 R	5.0 U	5.0 U	5.0 U	5.0 U
Diethylphthalate	5 U	5 U	5 U	5 U	5 U	5 UL	5 UL	5 U	5 UL	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Phenol	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Phenanthrene	5 U	5 U	5 U	5 U	1.8 J	5 UL	5 U	5 U	5 UL	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-octylphthalate	5 U	5 U	5 U	2.4 J	5 U	5 UL	5 UL	5 U	5 UL	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Pyrene	5 U	5 U	5 U	5 U	6.0	5 U	5 U	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Fluoranthene	1.4 J	5 U	5 U	5 U	8.5	5 U	1.5 J	5 U	5 U	5 U	5.1 U	5.0 U	5.3 U	5.0 U	5.0 U	5.0 U	5.0 U
Inorganics (mg/l)																	
Dissolved Manganese	0.0082 U	0.00029 U	0.0013 U	0.00051 U	0.0012 U	0.0089	0.0129	0.0009	0.0026	0.0012	0.0016 U	0.0016 J	0.00066 U	0.0021 J	0.015 U	0.0021 J	0.0150 U
Dissolved Iron	0.0101 U	0.0124 U	0.0116 U	0.0458 U	0.0327 U	0.0988	0.009 U	0.155 U	0.0419 U	0.0126 U	0.0207 U	0.0246 U	0.0611 U	0.1 U	0.1 U	0.100 U	0.1 U
Dissolved Cobalt	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	0.010 U	0.010 U	0.010 U	0.0100 U
Biological Oxygen Demand (mg/l)	< 2	< 2	< 2	--	--	--	--	1	--	--	--	--	--	--	--	--	--
Field Parameters																	
Temperature (Degrees Celcius)	15.3	18.2	17.3	15.1	15.7	17.6	16.0	14.0	16.1	16.1	15.9	13.0	15.6	15.3	14.6	16.6	14.7
-- Not analyzed or data not available to RAI	33	12	25	10	48	69	51	63	79	67	58	67	104	98	66	78	101
pH (standard units)	6.19	6.32	6.42	6.52	6.04	5.55	5.98	7.85	5.41	4.64	5.53	6.26	5.45	6.00	5.39	5.63	5.55
Dissolved Oxygen (mg/l)	6.01	5.07	4.73	7.24	6.06	0.95	0.00	2.04	4.38	4.41	3.47	4.31	3.91	4.03	3.64	3.21	4.03
ORP (mV)	202	94	109	77	99	61	102	141	180	239	234	291	218	240	206	224	237
Water-Level Elevation (ft, MSL)	-11.65	-17.96	-16.12	-14.45	-16.69	-19.51	-21.19	-16.06	-16.90	-21.53	-17.32	-15.14	-12.52	-17.00	-12.92	-16.46	-9.96

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

R - Data Rejected
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank

Table 2 (continued)

Historical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Landfills

Parameter	MW-49N								
	4/15	10/15	3/16	4/16	10/16	4/17	10/17	4/18	10/18
***Non-Halogenated VOCs* (mg/l)**									
Benzene	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--
Xylene (total)	--	--	--	--	--	--	--	--	--
2-Butanone	--	--	--	--	--	--	--	--	--
Acetone	--	--	--	--	--	--	--	--	--
Carbon Disulfide	--	--	--	--	--	--	--	--	--
Cyclohexane	--	--	--	--	--	--	--	--	--
Isopropylbenzene	--	--	--	--	--	--	--	--	--
Methy tert-butyl ether	--	--	--	--	--	--	--	--	--
Methylcyclohexane	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--
***Halogenated VOCs* (mg/l)**									
Bromoform	--	--	--	--	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	--	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--	--	--
Dibromochloromethane	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--	--
1,3 Chlorobenzene	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--	--	--	--	--
Chloroethane	--	--	--	--	--	--	--	--	--
Chloromethane	--	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--
Methylene Chloride	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--
***Semi-Volatiles* (mg/l)**									
Bis(2-chloroethyl)Ether	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--
Benzo (a) Anthracene	--	--	--	--	--	--	--	--	--
Benzo (a) Pyrene	--	--	--	--	--	--	--	--	--
Benzo (b) Fluoranthene	--	--	--	--	--	--	--	--	--
Benzo (k) Fluoranthene	--	--	--	--	--	--	--	--	--
Benzo (g,h,i) Perylene	--	--	--	--	--	--	--	--	--
Chrysene	--	--	--	--	--	--	--	--	--
Indeno (1,2,3-cd) Pyrene	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-Chloropropane)	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--
2-Methylphenol	--	--	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	--	--	--	--
Acetophenone	--	--	--	--	--	--	--	--	--
Caprolactam	--	--	--	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	--	--	--
Di-n-octylphthalate	--	--	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	--	--	--	--
***Inorganics* (mg/l)**									
Dissolved Manganese	0.0115 J	0.0150 U	0.0050 U	0.0015 J	0.0051 J	0.0017 J	0.0029 J	0.0019 J	0.163
Dissolved Iron	0.0794 J	0.100 U	0.53	0.100 U	0.100 U	0.100 U	0.16	0.100 U	0.0599 U
Dissolved Cobalt	0.0500 U	0.0500 U	0.0050 U	0.0031 J	0.00020 J	0.0035 J	0.0027 J	0.0029 J	0.0090 J
Dissolved Lead	--	--	--	--	--	--	--	--	--
Biological Oxygen Demand (mg/l)	--	--	--	--	--	--	--	--	--
Field Parameters									
Temperature (Degrees Celcius)	15.7	14.9	17.6	18.5	14.0	14.6	15.3	12.2	14.0
Conductivity (ms/cm)	66	69	97	199	245	119	106	112	116
pH (standard units)	6.37	6.85	6.16	5.77	5.55	5.55	5.66	5.60	5.43
Dissolved Oxygen (mg/l)	4.32	0.51	3.38	4.21	4.14	3.71	3.98	4.68	4.34
ORP (mV)	153	178	202	91	228	200	268	222	241
Water-Level Elevation (ft. MSL)	-14.32	-15.01	-12.83	-12.59	-19.74	-14.67	-18.48	-11.06	-14.34

-- Not analyzed or data not available to RAI as of December 14, 2018
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
K - Analyte present, reported value may be biased high.
L - Analyte present, reported value may be biased low.
UL - Not detected, quantitation limit is probably higher

R - Data Rejected
D - Sample diluted in the lab for analysis.
NP - Well not pumping
P - Discrepency in GC analysis. Lower value reported
B - Analyte Detected in Method Blank

Table K-2: Summary of Surface Water Quality Data for Army Creek and Army Pond.

RUTH ASSOCIATES, INC.

Table 3

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWA 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Non-Halogenated VOCs* (µg/l)**																	
Benzene	370	0.44 J	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Toluene	2	0.25	5 U	5 U	5 UJ	5 UJ	10 U	0.30 J	1 U	1 U	1 U	1 U	--	--	--	--	--
Ethylbenzene	90	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Xylene (total)	13	0.5 U	5 U	5 U	5 UJ	5 U	10 U	3 U	3 U	3 U	3 U	3 U	--	--	--	--	--
2-Butanone	14000	5 U	10 R	10 R	10 R	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
Acetone	1500	5.8 U	20 R	20 R	20 R	20 R	1.5 J	5 UJ	8.7 U	5 U	5 UJ	5 U	--	--	--	--	--
Carbon Disulfide	0.92	0.21 J	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Cyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Isopropylbenzene	2.6	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methy-tert-butyl ether	11070	0.5	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylcyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
4-Methy-2-pentanone	170	5 U	10 U	10 U	10 UJ	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
***Halogenated VOCs* (µg/l)**																	
Bromoform	320	0.5 U	5 U	5 U	5 UJ	5 UJ	10 UJ	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Bromodichloromethane		0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Carbon Tetrachloride	13.3	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chlorobenzene	1.3	1.4	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroform	1.8	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Dibromochloromethane		0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethane	100	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethane	47	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,2-Dichloroethene		0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
trans-1,2-Dichloroethene	970	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethene	25	0.11 J	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichlorobenzene	0.7	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,3-Dichlorobenzene	150	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,4-Dichlorobenzene	26	0.2 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroethane		0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 R	1 U	1 U	1 U	1 U	--	--	--	--	--
Tetrachloroethene	111	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1,1-Trichloroethane	11	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Trichloroethene	21	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Vinyl Chloride	930	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2,4-Trichlorobenzene	24	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,3-Dichloropropene		0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylene Chloride	98.1	0.5 U	5 U	5 U	5 UJ	5 UJ	10 U	1 U	1 UJ	1 UJ	1 U	1 U	--	--	--	--	--
Trichlorofluoromethane		0.5 U	--	--	--	--	10 U	1 UJ	1 U	1 U	1 U	1 U	--	--	--	--	--
***Semi-Volatiles* (µg/l)**																	
1,1'-Biphenyl	14	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)		5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	--
2,4-Dimethylphenol		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dinitrophenol		20 U	20 U	20 J	20 UJ	20 U	20 UL	20 U	20 UL	20 U	20 U	20 UL	10 U	10 U	10 U	10 UJ	10 U
2,6-Dinitrotoluene	81	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	4.7	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	13	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
4,6-Dinitro-2-methylphenol		20 U	20 U	20 U	20 UJ	20 U	20 UL	20 U	20 U	20 U	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	543	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Acetophenone		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Atrazine	1.8	5 UJ	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 UL	5.0 UJ	5.0 U	5.0 U	5.0 U	10 U
Benzaldehyde		5 UJ	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5.0 UJ	5.0 UJ	5.0 U	5.0 UJ	10 U
Benzo (a) pyrene	0.015	5 U	5 U	5 UL	5 UL	5 U	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (b) Fluoranthene		5 U	5 U	5 UL	5 UL	5 U	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (g,h,i) Perylene		5 U	5 U	5 UL	5 UL	5 U	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (k) Fluoranthene		5 U	5 U	5 UL	5 UL	5 U	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Bis(2-chloroethyl)Ether		1.8 J	0.04 B	0.081	0.02 UJ	0.02 UL	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Bis(2-ethylhexyl)phthalate	16	5 U	5 U	5 U	7.6 J	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 U
Caprolactam		5 UJ	5 U	5 U	5 UJ	5 U	5 UL	5 UL	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 UJ	5.0 U	5.0 U	10 U
Di-n-butyl phthalate	19	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-octyl phthalate	22	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 UJ	10 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0 U
Dibenzo (a,h) Anthracene		5 U	5 U	5 UL	5 UL	5 U	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Diethylphthalate	210	5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorocyclopentadiene		5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 R	5.0 U	5.0 U	10 U
Indeno (1,2,3-cd) Pyrene		5 U	5 U	5 UL	5 UL	5 U	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	210	5 U	5 U	5 UJ	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	1.1	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Pentachlorophenol	0.5	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Phenol	4	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Biological Oxygen Demand (mg/l)		--	--	3.9	3.7	2.1	4.2	4	7	6	--	--	--	--	--	--	--
Field Parameters																	
Temperature (Degrees Celcius)		16.12	--	14.04	31.7	12.9	8.2	16.0	32.1	16.8	6.5	19.1	14.4	18.0	18.6	13.4	21.6
Conductivity (µs/cm)		383	--	267	283	233	402	350	362	400	243	379	301	244	375	283	495
pH (standard units)	6.5 - 9	11.24	--	8.24	8.19	6.87	8.30	7.36	7.25	7.20	7.37	7.24	6.99	6.43	7.09	6.54	6.89
Dissolved Oxygen (mg/l)		6.18	--	8.68	8.20	6.04	9.85	5.66	9.23	7.30	8.53	10.79	6.58	5.72	3.13	4.45	3.44
ORP (mV)		-8.9	--	30.5	-4.0	50	77	133	45	39	88	155	60	147	59	105	194

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWA															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Dissolved Inorganics* (µg/l)**																	
Aluminum	87	200 U	--	17 U	38.5 UJ	18.9 U	23.5 U	48.8 U	35.2 U	20.0 U	1100	11.1 U	200 U	200 U	200 U	200 U	200 U
Antimony	30	2.9	--	3.8 U	5.2 UJ	1.6 U	1.5 U	1.1 U	1.8 U	1.4 J	1.7	2.1 U	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U
Arsenic	5	1.8 U	--	3 U	3.7 UJ	2 U	1.4 U	1.6 U	2.8 U	2.6 U	2.2 U	2.8 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Barium	4	38.8	--	44.7	53.9 J	66.1	33.7	52.7	62.4	62.8	37.3	53.1	39.5 J	63.4 U	52.8 J	55.5 J	78.5 J
Beryllium	0.66	0.1 U	--	0.1 U	0.55 UJ	0.18 U	0.13 U	0.69 U	0.40 U	0.10 U	0.32 U	0.20 U	5.0 U	5.0 U	5.0 U	0.30 J	5.0 U
Cadmium	0.25	0.2 U	--	0.4 U	0.5 UJ	0.2 U	0.20 U	0.20 U	0.40 U	0.20 U	0.20 U	0.40 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Calcium	116000	41200	--	17900	16400 J	15400	10100	13800	18600	16400	9760	20700	14900	15800	17300	14200	23600
Chromium	85	0.5 U	--	2 U	1.1 UJ	0.6 U	0.40 U	0.60 U	0.50 U	0.73 U	1.9	0.30 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Cobalt	23	0.74	--	1.5 U	1.1 UJ	2.3	0.74	1.0	0.75	1.9 U	0.76 U	0.90 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Copper	9	0.5 U	--	1.1	1.2 J	1.5	2.5	1.5 U	1.9 J	4.3 U	4.1 U	1.9 U	25.0 U	25.0 U	0.78 J	25 U	25.0 U
Iron (mg/l)	0.3	0.024	0.846 L	0.387	0.331 J	0.0634	0.159	0.316	0.298	0.0763 U	1.31	0.0445 U	0.140	0.231	0.100 UJ	0.210 J	0.114 U
Lead	2.5	0.9 U	--	1.3	1.6 UJ	1.1 U	1.0 U	1.0 U	1.9 U	1.6 U	1.3	2.3 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Magnesium	82000	2010	--	5780	4190 J	4690	3910	4750	5640	5450	3520	7750	4720 J	5100	7230	5130	8280
Manganese (mg/l)	0.12	0.0057	0.271	0.273	0.030 J	0.0931	0.0871	0.167	0.111	0.123	0.0519	0.195	0.0862	0.102	0.0453	0.122	0.362
Mercury	0.026	0.2 U	--	0.1 U	0.1 UJ	0.1 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.20 U	0.20 U	0.20 U	0.20 U	0.026 J
Nickel	52	0.5 U	--	3.6 U	2.3 J	2.5	1.6	2.5	1.1	2.2 U	2.9 U	1.9	40.0 U	40.0 U	40.0 U	1.2 J	40.0 U
Potassium	53000	4850	--	3580 J	4260 J	4460	2110	4120	4670	5080	3110	3530 J	3780 J	2980 J	2860 J	3150 J	5780
Selenium	1	2.7	--	2.5 U	4.5 UJ	4.3 U	3.3 U	1.8 U	2.2 U	2.5 U	2.1 U	2.7 U	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U
Silver	3.2	0.7 U	--	1.4 U	1.3 UJ	0.2 U	0.50 U	0.50 U	0.30 U	0.65 U	0.40 U	1.2 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Sodium	680000	18800	--	39900	28400 J	13900	16700	22700	20000	16200	8280	43700	20600	24200	36400	26200	65200
Thallium	0.8	1.9 U	--	3.2 U	4 UJ	4.5 U	5.5	2.1 U	5.2 U	3.2 U	4.2 U	3.3 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Vanadium	20	50 U	--	1 U	2 J	0.5 U	0.52	0.84	1.3	0.49 U	2.8 U	0.50 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Zinc	120	2.4	--	13.3 U	2.7 UJ	7.9	11.3	2.3	3.6 U	4.5	14.9 U	1.7 U	60.0 U	5.2 J	3.9 J	60 U	60 U
***Pesticides/Herbicides* (µg/l)**																	
4,4'-DDD		0.018 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDE		0.0091 U	0.02 U	0.02 U	0.02 UJ	0.0084 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	0.0005	0.0091 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Aldrin	3	0.0091 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.029 J	0.050 U	0.067	0.050 U	0.050 U
alpha-BHC		0.0091 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Alpha-Chlordane		0.0091 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
beta-BHC		0.0091 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.025 J	0.050 U	0.050 U
delta-BHC	141	0.0091 U	0.01 U	0.01 U	0.0019 JN	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Dieldrin	0.056	0.018 U	0.02 U	0.02 U	0.02 U	0.0039 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan I	0.051	0.0091 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.0038 J	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Endosulfan II	0.051	0.018 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan sulfate		0.018 U	0.02 U	0.02 U	0.02 UJ	0.0064 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin	0.036	0.018 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin Aldehyde		0.0029 J	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin Ketone		0.018 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
gamma-BHC (Lindane)	0.01	0.0068 J	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 UJ
gamma-Chlordane		0.0091 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Heptachlor	0.0019	0.0091 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Heptachlor Epoxide		0.011 J	0.01 U	0.014 JN	0.008 J	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Methoxychlor	0.019	0.091 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.10 U	--	--	--	--	--	0.050 U	0.50 U	0.50 U	0.50 U	0.50 U
Toxaphene	0.0002	--	--	--	1 UJ	1 U	1.0 U	--	--	--	--	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed
N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
P - Discrepency in GC analysis. Lower value reported.

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWB 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Non-Halogenated VOCs* (µg/l)**																	
Benzene	370	0.51	2 J	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Toluene	2	0.2	0.8 J	5 U	5 U	5 UJ	10 U	0.28 J	0.19 J	1 U	1 U	1 U	--	--	--	--	--
Ethylbenzene	90	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Xylene (total)	13	0.5 U	5 U	5 U	5 U	5 UJ	10 U	3 U	3 U	3 U	3 U	3 U	--	--	--	--	--
2-Butanone	14000	5 U	10 R	10 R	10 R	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
Acetone	1500	9.6	20 R	20 R	7 J	20 R	1.5 J	5 UJ	8.2 U	5 U	5 UJ	5 U	--	--	--	--	--
Carbon Disulfide	0.92	0.23 J	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Cyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Isopropylbenzene	2.6	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methy-tert-butyl ether	11070	0.52	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylcyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
4-Methy-2-pentanone	170	5 U	10 U	10 U	10 UJ	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
***Halogenated VOCs* (µg/l)**																	
Bromoform	320	0.5 U	5 U	5 U	5 U	5 UJ	10 UJ	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Bromodichloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Carbon Tetrachloride	13.3	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chlorobenzene	1.3	1.7	6	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroform	1.8	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Dibromochloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethane	100	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethane	47	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,2-Dichloroethene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
trans-1,2-Dichloroethene	970	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethene	25	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichlorobenzene	0.7	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,3-Dichlorobenzene	150	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,4-Dichlorobenzene	26	0.22 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 R	1 U	1 U	1 U	1 U	--	--	--	--	--
Tetrachloroethene	111	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1,1-Trichloroethane	11	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Trichloroethene	21	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Vinyl Chloride	930	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2,4-Trichlorobenzene	24	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,3-Dichloropropene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylene Chloride	98.1	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 UJ	1 UJ	1 U	1 U	--	--	--	--	--
Trichlorofluoromethane		0.5 U	--	--	--	--	10 U	1 UJ	1 U	1 U	1 U	1 U	--	--	--	--	--
***Semi-Volatiles* (µg/l)**																	
1,1'-Biphenyl	14	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)		5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	--
2,4-Dimethylphenol		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dinitrophenol		20 U	20 U	20 UJ	20 U	20 U	20 UL	20 U	20 UL	20 U	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	81	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	4.7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	13	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
4,6-Dinitro-2-methylphenol		20 U	20 U	20 U	20 U	20 U	20 UL	20 U	20 U	20 U	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	543	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Acetophenone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Atrazine	1.8	5 UJ	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 UL	5.1 UJ	5.0 U	5.0 U	5.0 U	10 U
Benzaldehyde		5 UJ	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5.1 UJ	5.0 UJ	5.0 U	5.0 U	10 U
Benzo (a) pyrene	0.015	5 UL	5 UL	5 UL	5 UL	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (b) Fluoranthene		5 UL	5 UL	5 UL	5 UL	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (g,h,i) Perylene		5 UL	5 UL	5 UL	5 UL	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (k) Fluoranthene		5 UL	5 UL	5 UL	5 UL	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Bis(2-chloroethyl)Ether		2.2 J	0.095 B	0.065	0.02 U	0.019 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Bis(2-ethylhexyl)phthalate	16	5 U	54	5 U	5 U	5 U	5 U	5 UL	4.5 J	5 U	5 UL	5 UL	5.1 U	5.0 U	5.0 U	2.4 J	5.0 U
Caprolactam		5 UJ	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 UL	5.1 U	5.0 UJ	5.0 U	5.0 U	10 U
Di-n-butyl phthalate	19	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-octyl phthalate	22	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 U	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0 U
Dibenzo (a,h) Anthracene		5 UL	5 U	5 UL	5 UL	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Diethylphthalate	210	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorocyclopentadiene		5 U	5 U	5 U	5 R	5 U	5 UL	5 U	5 U	5 R	5 U	5 UL	5.1 U	5.0 R	5.0 U	5.0 U	10 U
Indeno (1,2,3-cd) Pyrene		5 UL	5 UL	5 UL	5 UL	5 U	5 U	5 U	5 U	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	210	5 U	5 U	5 UJ	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	1.1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Pentachlorophenol	0.5	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Phenol	4	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Biological Oxygen Demand (mg/l)		--	--	2.9	8.0	3.3	3.7	5	9	4	--	--	--	--	--	--	--
Field Parameters																	
Temperature (Degrees Celcius)		17.67	--	13.0	29.1	11.0	7.0	16.3	33.7	25.1	5.5	23.6	14.0	18.5	17.7	14.2	21.2
Conductivity (µs/cm)		318	--	263	453	238	342	306	514	297	136	307	330	240	390	318	393
pH (standard units)	6.5 - 9	7.99	--	8.53	6.78	6.93	7.17	7.20	8.71	7.45	6.58	8.69	7.16	6.72	7.00	6.62	7.12
Dissolved Oxygen (mg/l)		3.64	--	9.38	3.09	5.34	9.45	4.91	10.25	8.89	5.85	9.37	7.40	0.00	2.89	4.80	4.62
ORP (mV)		-161.4	--	62.9	11.2	130	118	69	70	79	94	49	-1	-51	1	-75	172

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWB 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Dissolved Inorganics* (µg/l)**																	
Aluminum	87	200 U	--	26.8 U	44.6 U	14 U	16.6 U	46.3 U	66.1 U	20.0 U	30.3 U	29.6 U	200 U	200 U	200 U	200 U	200 U
Antimony	30	2 U	--	3.8 U	3.7 U	1.6 U	1.2 U	1.1 U	1.8 U	1.2 U	1.7 U	2.1 U	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U
Arsenic	5	1.8 U	--	3 U	3.7 U	2 U	3.3	1.6 U	2.8 U	2.6 U	2.2 U	2.8 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Barium	4	29.5	--	26.3 B	55.5	47.9	49	57.2	42.4	44.5	47.4	21.8	36.9 J	58.7 J	58.9 J	53.2 J	64.4 J
Beryllium	0.66	0.1 U	--	0.1 U	0.56 U	0.13 U	0.15 U	0.67 U	0.68 U	0.10 U	0.30 U	0.20 U	5.0 U	5.0 U	5.0 U	0.48 J	5.0 U
Cadmium	0.25	0.2 U	--	0.4 U	0.5 U	0.2 U	0.20 U	0.20 U	0.40 U	0.20 U	0.20 U	0.40 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Calcium	116000	31200	--	17900	16200	14800	15200	12400	17100	15300	12900	20400	16200	16300	24300	15400	21300
Chromium	85	0.5 U	--	1.2 U	1.1 U	0.6 U	0.40 U	0.60 U	0.50 U	0.45 U	0.60 U	0.37 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Cobalt	23	50 U	--	1.2 U	1.3	0.5 U	1.4	0.73	0.70 U	0.54 U	0.40 U	0.90 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Copper	9	0.5 U	--	1.2	0.8 U	1.1	0.65	0.67 U	1.5 U	3.5 U	2.9 U	2.2 U	25.0 U	25.0 U	1.1 J	25 U	25 U
Iron (mg/l)	0.3	0.0697	46.9	0.479 K	0.484	0.0466	0.104	0.249	0.405	0.0688 U	0.118 U	0.262	0.386	0.564	0.205	0.381	0.159 K
Lead	2.5	0.9 U	--	1.2 U	1.6 U	1.1	1.0 U	1.0 U	1.9 U	1.6 U	1.2 U	2.2 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Magnesium	82000	2100	--	5980	4530	4970	6000	4410	5080	5570	4580	8050	5100	5290	8180	5650	6970
Manganese (mg/l)	0.12	0.0066	1.56	0.136	0.172	0.0209	0.104	0.189	0.0387	0.0546	0.0416	0.0294	0.100	0.193	0.0756	0.0886	0.128
Mercury	0.026	0.1 U	--	0.1 U	0.1 U	0.1 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	52	0.5 U	--	3.1 U	2	2.5	1.5	1.9	1.3	2.1 U	1.6 U	1.7	40.0 U	40.0 U	40.0 U	1.3 J	40.0 U
Potassium	53000	5110	--	3290 J	4390	4140	2980	3780	4530	3290	4290	2500 J	3520 J	2770 J	3430 J	3370 J	10500
Selenium	1	2.6 U	--	1.7 U	4.5 U	4.3 U	3.3 UJ	1.8 U	2.2 U	2.5 U	3.1	2.7 U	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U
Silver	3.2	0.7 U	--	1.4 U	1.3 U	0.2 U	0.50 U	0.50 U	0.30 U	0.50 U	0.40 U	1.2 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Sodium	680000	17500	--	40600	30900	15300	29500	20500	20200	16000	10800	47000	23700	25700	41100	29700	47900
Thallium	0.8	1.9 U	--	2.9 U	4 U	4.5 U	3.9 U	2.1 U	3.6 U	3.2 U	3.4 U	2.9 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Vanadium	20	50 U	--	1.2 U	2.8	0.5 U	0.30 U	0.98 U	2.8	0.49 U	0.40 U	2.2 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Zinc	120	0.7 U	--	11 U	3.9 U	3.9	4.3	0.80 U	4.6 U	2.6	10.3 U	1.9 U	60.0 U	2.5 J	4.0 J	60 U	7.8 J
***Pesticides/Herbicides* (µg/l)**																	
4,4'-DDD		0.018 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
4,4'-DDE		0.0091 U	0.02 U	0.02 U	0.013 J	0.012 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
4,4'-DDT	0.0005	0.0091 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
Aldrin	3	0.0091 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.026 J	0.050 U	0.050 U
alpha-BHC		0.0091 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Alpha-Chlordane		0.0091 U	0.01 U	0.01 U	0.01 U	0.0013 J	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
beta-BHC		0.0091 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
delta-BHC	141	0.0091 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Dieldrin	0.056	0.018 U	0.0027 J	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
Endosulfan I	0.051	0.0091 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Endosulfan II	0.051	0.018 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
Endosulfan sulfate		0.0042 J	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.050 U
Endrin	0.036	0.018 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
Endrin Aldehyde		0.018 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.010 J
Endrin Ketone		0.018 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
gamma-BHC (Lindane)	0.01	0.0091 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
gamma-Chlordane		0.0091 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.10 U
Heptachlor	0.0019	0.0091 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Heptachlor Epoxide		0.0091 U	0.01 U	0.01 UJ	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Methoxychlor	0.019	0.091 U	0.1 U	0.1 U	0.1 U	0.0047 J	0.10 U	--	--	--	--	--	0.050 U	0.50 U	0.53 U	0.50 U	0.50 U
Toxaphene	0.0002	--	--	--	1 U	1 U	1.0 U	--	--	--	--	--	5.0 U	5.0 U	5.3 U	5.0 U	5.0 U

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed
N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
P - Discrepency in GC analysis. Lower value reported.

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWC 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Non-Halogenated VOCs* (µg/l)**																	
Benzene	370	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Toluene	2	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Ethylbenzene	90	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Xylene (total)	13	0.5 U	5 U	5 U	5 U	5 UJ	10 U	3 U	3 U	3 U	3 U	3 U	--	--	--	--	--
2-Butanone	14000	5 U	10 U	10 R	10 R	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
Acetone	1500	5 U	10 J	20 R	20 R	20 R	10 U	5 UJ	10 U	5 U	5 UJ	6.8 U	--	--	--	--	--
Carbon Disulfide	0.92	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Cyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Isopropylbenzene	2.6	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methy-tert-butyl ether	11070	0.27 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylcyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
4-Methy-2-pentanone	170	5 U	10 U	10 U	10 U	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
***Halogenated VOCs* (µg/l)**																	
Bromoform	320	0.5 U	5 U	5 U	5 U	5 UJ	10 UJ	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Bromodichloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Carbon Tetrachloride	13.3	0.5 U	5 UJ	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chlorobenzene	1.3	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroform	1.8	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Dibromochloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethane	100	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethane	47	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,2-Dichloroethene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
trans-1,2-Dichloroethene	970	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethene	25	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichlorobenzene	0.7	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,3-Dichlorobenzene	150	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,4-Dichlorobenzene	26	0.11 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 R	1 U	1 U	1 U	1 U	--	--	--	--	--
Tetrachloroethene	111	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1,1-Trichloroethane	11	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Trichloroethene	21	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Vinyl Chloride	930	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2,4-Trichlorobenzene	24	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,3-Dichloropropene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylene Chloride	98.1	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 UJ	1 UJ	1 U	1 U	--	--	--	--	--
Trichlorofluoromethane		0.5 U	--	--	--	--	10 U	1 UJ	1 U	1 U	1 U	1 U	--	--	--	--	--
***Semi-Volatiles* (µg/l)**																	
1,1'-Biphenyl	14	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)		5 UJ	5 U	5.1 U	5 U	5 U	5 UL	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	--
2,4-Dimethylphenol		5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dinitrophenol		20 U	20 U	21 UJ	20 U	20 U	20 UL	20 U	20 UL	20 UL	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	81	5 UJ	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	4.7	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	13	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
4,6-Dinitro-2-methylphenol		20 U	20 U	21 U	20 U	20 U	20 UL	20 U	20 U	20 U	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	543	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Acetophenone		5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Atrazine	1.8	5 U	5 U	5.1 U	5 U	5 U	5 UL	5 UL	5 U	5 UL	5 U	5 UL	5.0 UJ	5.0 U	5.0 U	5.0 U	10 U
Benzaldehyde		5 UJ	5 U	5.1 UL	5 UL	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5.0 UJ	5.0 UJ	5.0 U	5.0 U	10 U
Benzo (a) pyrene	0.015	5 U	5 UL	5.1 UL	5 UL	5 U	5 U	5 UL	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (b) Fluoranthene		5 U	5 UL	5.1 UL	5 UL	5 U	5 U	5 UL	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (g,h,i) Perylene		5 U	5 UL	5.1 UL	5 UL	5 U	5 U	5 UL	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (k) Fluoranthene		5 U	5 UL	5.1 UL	5 UL	5 U	5 U	5 UL	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Bis(2-chloroethyl)Ether		0.93	0.043 B	0.073	0.019 U	0.02 UL	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Bis(2-ethylhexyl)phthalate	16	5 U	5 U	5.1 U	5 U	5 U	5 U	5 UL	7.2 J	5 UL	5 U	4.1 L	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Caprolactam		5 UJ	5 U	5.1 U	5 U	5 U	5 UL	5 UL	5 U	5 UL	5 U	5 UL	5.0 U	5.0 UJ	5.0 U	5.0 U	10 U
Di-n-butyl phthalate	19	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-octyl phthalate	22	5 U	5 U	5.1 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0 J
Dibenzo (a,h) Anthracene		5 UJ	5 UL	5.1 UL	5 UL	5 U	5 U	5 UL	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Diethylphthalate	210	5 U	5 U	5.1 U	5 U	5 U	5 UL	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorocyclopentadiene		5 U	5 U	5.1 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 R	5.0 U	5.0 U	10 U
Indeno (1,2,3-cd) Pyrene		5 UJ	5 UL	5.1 UL	5 UL	5 U	5 U	5 UL	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	210	5 U	5 U	5.1 UJ	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	1.1	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Pentachlorophenol	0.5	5 U	5 U	5.1 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Phenol	4	5 U	5 U	5.1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Biological Oxygen Demand (mg/l)		--	--	5.9	7.2	1.8	2.5	< 2	10	12	--	--	--	--	--	--	--
Field Parameters																	
Temperature (Degrees Celcius)		15.8	--	16.8	30.9	13.1	7.1	17.0	33.2	28.8	7.4	28.2	13.6	18.1	17.5	15.1	21.0
Conductivity (µs/cm)		305	--	289	462	100	127	192	370	270	64	327	341	218	386	315	447
pH (standard units)	6.5 - 9	8.61	--	10.1	8.40	7.14	7.43	7.12	8.77	7.07	6.33	9.83	7.13	6.87	7.24	6.94	7.25
Dissolved Oxygen (mg/l)		8.29	--	11.63	7.92	5.74	8.54	6.20	10.28	8.92	6.84	9.29	8.41	5.23	10.18	6.72	3.66
ORP (mV)		63.9	--	68.8	50.6	80	149	32	84	84	39	2	61	100	-1	87	127

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWC 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Dissolved Inorganics* (µg/l)**																	
Aluminum	87	4.4 U	--	38.1 U	53.6 U	15.1 U	54.6	43.2 U	48.2 U	20.0 U	30.3 U	102 U	200 U	200 U	200 U	200 U	200 U
Antimony	30	2 U	--	3.8 U	3.7 U	1.6 U	1.2 U	1.1 U	1.8 U	1.2 U	1.7 U	2.1 U	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U
Arsenic	5	1.8 U	--	3 U	3.7 U	2 U	1.4 U	1.6 U	2.8 U	2.6 U	2.2 U	2.8 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Barium	4	66.2	--	4.7	52.5	21.5	21.7	40.8	45.0	50.8	22.6	7.6	34.2 J	56.0 J	49.8 J	52.4 J	85.8 J
Beryllium	0.66	0.1 U	--	0.1 U	0.61 U	0.11 U	0.17 U	0.70 U	0.40 U	0.10 U	0.30 U	0.20 U	5.0 U	5.0 U	5.0 U	0.92 J	5.0 U
Cadmium	0.25	0.2 U	--	0.4 U	0.5 U	0.2 U	0.20 U	0.20 U	0.40 U	0.20 U	0.20 U	0.40 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Calcium	116000	19100	--	14500	15800	5820	5220	9830	16800	16300	6210	25800	16700	16000	23200	15100	22900
Chromium	85	0.5 U	--	1.2 U	1.1 U	0.6 U	0.40 U	0.60 U	0.50 U	0.42 U	0.60 U	0.30 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Cobalt	23	50 U	--	1.1 U	1.1 U	0.5 U	0.62	0.88	0.70 U	0.93 U	1.6 U	1.1 U	50.0 U	50.0 U	50.0 U	50.0 U	1.1 J
Copper	9	0.5 U	--	0.9 U	0.8 U	0.6 U	1.6	0.40 U	1.5 U	3.2 U	0.86 U	3.8 U	25.0 U	25.0 U	0.88 J	25 U	25.0 U
Iron (mg/l)	0.3	0.226	0.322	0.363	0.499	0.0345	0.112	0.487	0.385	0.0618 U	0.537	0.760	0.188	0.300	0.114	0.403	0.240 K
Lead	2.5	0.9 U	--	1.2 U	1.6 U	1.1 U	1.0 U	1.0 U	1.9 U	1.6 U	1.2 U	2 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Magnesium	82000	7080	--	4810	4550 J	4080	2940	4910	5550	6090	3390	8430	5280	5220	7730	5580	8110
Manganese (mg/l)	0.12	0.508	0.416	0.0347	0.0435	0.0269	0.0713	0.214	0.0551	0.0999	0.0553	0.0723	0.0325	0.157	0.0679	0.0943	0.363
Mercury	0.026	0.1 U	--	0.1 U	0.1 U	0.1 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	52	0.5 U	--	2.7 U	1.8	3.9	1.2	2.2	1.4	2.3 U	2.4 U	3.8	40.0 U	40.0 U	40.0 U	1.4 J	40.0 U
Potassium	53000	3620	--	2480 J	4210 J	1830	1340	1980	4590	3350	1270	2410 J	3400 J	2620 J	2690 J	3210 J	5380
Selenium	1	2.6 U	--	1.7 U	4.5 U	4.3 U	3.3 U	1.8 U	2.2 U	2.5 U	2.1 U	2.7 U	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U
Silver	3.2	0.7 U	--	1.4 U	1.3 U	0.2 U	0.50 U	0.50 U	0.30 U	0.51 U	0.40 U	1.2 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Sodium	680000	25400	--	33400	32300	2880	6400	7720	21900	17900	2580	49000	24400	25700	39500	29600	57000
Thallium	0.8	1.9 U	--	2.9 U	4 U	4.5 U	3.9 U	2.1 U	3.6 U	3.2 U	3.4 U	2.9 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Vanadium	20	50 U	--	1.7 U	2.7	0.5 U	0.53	0.40 U	2.1	0.46 U	0.40 U	4.2	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Zinc	120	5.1	--	34.7	2.8 U	4	7.3	0.80 U	4.8 U	3.3	8.4 U	2.3 U	60.0 U	2.1 J	60.0 U	60.0 U	60.0 U
***Pesticides/Herbicides* (µg/l)**																	
4,4'-DDD		0.02 UJ	0.002 J	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.010 J
4,4'-DDE		0.02 UJ	0.0039 J	0.02 U	0.015 J	0.0047 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	0.0005	0.02 UJ	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.011 J
Aldrin	3	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.052 U	0.050 U	0.050 U
alpha-BHC		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.052 U	0.050 U	0.050 U
Alpha-Chlordane		0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.052 U	0.050 U	0.050 U
beta-BHC		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.052 U	0.050 U	0.050 U
delta-BHC	141	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.052 U	0.050 U	0.050 U
Dieldrin	0.056	0.02 UJ	0.0025 J	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan I	0.051	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.052 U	0.050 U	0.050 U
Endosulfan II	0.051	0.02 UJ	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.0064 K
Endosulfan sulfate		0.02 UJ	0.0016 J	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin	0.036	0.02 UJ	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.012 J
Endrin Aldehyde		0.02 UJ	0.02 U	0.02 U	0.02 U	0.0025 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin Ketone		0.02 UJ	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
gamma-BHC (Lindane)	0.01	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.052 U	0.050 U	0.050 U
gamma-Chlordane		0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.052 U	0.050 U	0.050 U
Heptachlor	0.0019	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.052 U	0.050 U	0.050 U
Heptachlor Epoxide		0.01 UJ	0.0022 J	0.012 JN	0.01 U	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.052 U	0.050 U	0.050 U
Methoxychlor	0.019	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.10 U	--	--	--	--	--	0.050 U	0.50 U	0.15 J	0.50 U	0.50 U
Toxaphene	0.0002	--	--	--	1 U	1 U	1.0 U	--	--	--	--	--	5.0 U	5.0 U	5.2 J	5.0 U	5.0 U

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed
N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
P - Discrepency in GC analysis. Lower value reported.

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWD 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Non-Halogenated VOCs* (µg/l)**																	
Benzene	370	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Toluene	2	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Ethylbenzene	90	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Xylene (total)	13	0.5 U	5 U	5 U	5 U	5 UJ	10 U	3 U	3 U	3 U	3 U	3 U	--	--	--	--	--
2-Butanone	14000	5 U	10 U	10 R	10 R	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
Acetone	1500	5 U	20 R	20 R	20 R	20 R	10 U	5 UJ	9.7 U	5 U	5 UJ	5 U	--	--	--	--	--
Carbon Disulfide	0.92	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Cyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Isopropylbenzene	2.6	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methy-tert-butyl ether	11070	0.44 J	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylcyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
4-Methy-2-pentanone	170	5 U	10 U	10 U	10 U	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
***Halogenated VOCs* (µg/l)**																	
Bromoform	320	0.5 U	5 U	5 U	5 U	5 UJ	10 UJ	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Bromodichloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Carbon Tetrachloride	13.3	0.5 U	5 UJ	5 U	5 U	5 UJ	10 UJ	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chlorobenzene	1.3	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroform	1.8	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Dibromochloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethane	100	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethane	47	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,2-Dichloroethene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
trans-1,2-Dichloroethene	970	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethene	25	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichlorobenzene	0.7	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,3-Dichlorobenzene	150	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,4-Dichlorobenzene	26	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 R	1 U	1 U	1 U	1 U	--	--	--	--	--
Tetrachloroethene	111	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1,1-Trichloroethane	11	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Trichloroethene	21	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Vinyl Chloride	930	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2,4-Trichlorobenzene	24	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,3-Dichloropropene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylene Chloride	98.1	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 UJ	1 UJ	1 U	1 U	--	--	--	--	--
Trichlorofluoromethane		0.5 U	--	--	--	--	10 U	1 UJ	1 U	1 U	1 U	1 U	--	--	--	--	--
***Semi-Volatiles* (µg/l)**																	
1,1'-Biphenyl	14	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)		5 UJ	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	--
2,4-Dimethylphenol		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dinitrophenol		20 U	20 U	20 UJ	20 UJ	20 U	20 UL	20 U	20 UL	20 UL	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	81	5 UJ	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	4.7	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	13	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
4,6-Dinitro-2-methylphenol		20 U	20 U	20 U	20 UJ	20 U	20 UL	20 U	20 U	20 U	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	543	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Acetophenone		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Atrazine	1.8	5 U	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 U	5 UL	5 UL	5 UL	5.1 UJ	5.0 U	5.0 U	5.0 U	10 U
Benzaldehyde		5 UJ	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5.1 UJ	5.0 UJ	5.0 U	5.0 U	10 U
Benzo (a) pyrene	0.015	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (b) Fluoranthene		5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (g,h,i) Perylene		5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (k) Fluoranthene		5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Bis(2-chloroethyl)Ether		0.053	0.059	0.037	0.02 UJ	0.02 UL	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Bis(2-ethylhexyl)phthalate	16	12	8.2	5 U	6.4 J	5 U	5 U	4.8 L	4.5 L	5 UL	4.8 L	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Caprolactam		5 UJ	5 U	5 U	5 UJ	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 UJ	5.0 U	5.0 U	10 U
Di-n-butyl phthalate	19	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-octyl phthalate	22	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0 U
Dibenzo (a,h) Anthracene		5 UJ	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Diethylphthalate	210	5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorocyclopentadiene		5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 R	5.0 U	5.0 U	10 U
Indeno (1,2,3-cd) Pyrene		5 UJ	5 UL	5 UL	5 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	210	5 U	5 U	5 UJ	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	1.1	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Pentachlorophenol	0.5	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Phenol	4	5 U	1.7 J	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Biological Oxygen Demand (mg/l)		--	--	1.5	5.3	3.3	6.3	5	6	5	--	--	--	--	--	--	--
Field Parameters																	
Temperature (Degrees Celcius)		17.52	--	14.19	24.8	11.9	7.4	16.3	28.5	19.1	6.4	19.6	12.1	16.2	17.1	12.9	20.8
Conductivity (µs/cm)		328	--	308	500	253	196	290	484	313	118	350	737	363	474	475	150
pH (standard units)	6.5 - 9	8.39	--	7.8	6.41	6.69	7.29	6.97	7.52	6.78	6.31	8.51	7.05	6.54	6.98	6.27	7.68
Dissolved Oxygen (mg/l)		4.04	--	7.54	2.46	4.51	10.50	6.91	5.95	7.04	8.81	8.15	4.21	0.00	2.95	3.25	5.07
ORP (mV)		-42.9	--	31.8	40.6	121	168	65	156	-11	34	58	1	8	-9	-182	106

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWD 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Dissolved Inorganics* (µg/l)**																	
Aluminum	87	200 U	--	112 U	13.5 UJ	22.7 U	42.2 U	62.6 U	27.0 U	20.0 U	30.3 U	11.1 U	200 U	200 U	200 U	200 U	200 U
Antimony	30	2 U	--	32.7	3.7 UJ	1.6 U	1.2 U	1.1 U	1.8 U	1.4 J	1.7 U	2.1 I	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U
Arsenic	5	1.8 U	--	7.1	3.7 UJ	2 U	1.4 U	1.6 U	2.8 U	2.6 U	2.2 U	2.8 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Barium	4	66.1	--	172	65.7 J	65.7	47.1	40.4	63.9	56.1	33.2	76.5	72.8 J	89.8 J	85.3 J	76.4 J	32.8 J
Beryllium	0.66	0.1 U	--	2.7 U	0.6 UJ	0.13 U	0.18 U	0.74 U	0.54 U	0.10 U	0.30 U	0.20 U	5.0 U	5.0 U	5.0 U	0.89 J	5.0 U
Cadmium	0.25	0.2 U	--	2.5 U	0.5 UJ	0.2 U	0.20 U	0.20 U	0.40 U	0.20 U	0.20 U	0.40 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Calcium	116000	19500	--	21000	19200 J	16900	11300	12800	19900	18300	11800	22700	26500	23900	27300	22400	9030
Chromium	85	0.5 U	--	7.7 U	1.1 UJ	0.6 U	0.40 U	0.64	0.50 U	0.52 U	0.60 U	0.30 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Cobalt	23	50 U	--	27.1	1.1 UJ	0.5 U	0.50 U	0.40 U	1.5	0.96 U	0.40 U	0.90 U	50.0 U	1.6 J	50.0 U	50.0 U	50.0 U
Copper	9	0.5 U	--	13	0.8 UJ	2.5	1.3	2.4 U	1.5 U	3.7 U	2.8 U	1.4 U	25.0 U	25.0 U	1.2 J	25 U	25 U
Iron (mg/l)	0.3	1.17	10.1	0.422	0.743 J	0.0371	0.0952 U	0.338	0.0413 U	0.730	0.396	0.403	0.787	0.758	0.726	0.388	0.172 K
Lead	2.5	0.9 U	--	2.3	1.6 UJ	1.1 U	1.0 U	1.0 U	1.9 U	1.6 U	1.2 U	1.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Magnesium	82000	7390	--	8440	241 J	5960	5100	4510	7390	7180	4420	9200	10800	9360	10400	8800	3230 J
Manganese (mg/l)	0.12	0.368	1.99	0.352	7.15 J	0.0158	0.0244	0.0850	0.217	0.209	0.0745	0.243	0.382	0.262	0.291	0.246	0.0681
Mercury	0.026	0.2 U	--	0.1 U	0.1 UJ	0.1 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	52	0.68	--	25.1 U	2.2 J	2.7	2	2.1	1.3	2.1 U	1.7 U	2.2	40.0 U	2.3 J	40.0 U	2.5 J	40.0 U
Potassium	53000	3440	--	3860 J	4790 J	4290	4110	3460	4670	3770	2720	2920 J	4870 J	3360 J	3240 J	4400 J	4000 J
Selenium	1	2.6 U	--	4.4 U	4.5 UJ	4.3 U	3.3 U	1.8 U	2.2 U	2.5 U	2.1 U	2.7 U	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U
Silver	3.2	0.7 U	--	5.1	1.3 UJ	0.2 U	0.50 U	0.50 U	0.30 U	0.50 U	0.40 U	1.2 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Sodium	680000	28600	--	49400	41500 J	15400	7090	20100	28600	23000	12600	53100	66300	46900	46000	43300	12800
Thallium	0.8	1.9 U	--	6.4 U	4 UJ	4.5 U	4	2.1 U	3.6 U	3.2 U	3.4 U	2.9 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Vanadium	20	50 U	--	25.8	0.8 UJ	0.5 U	0.30 U	0.62 U	0.30 U	0.40 U	0.46 U	0.50 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Zinc	120	7.6	--	22.3 U	10.3 UJ	29.3	11.4	10.2	8.3 U	6.7	11.9 U	10.7	60.0 U	11.3 J	8.4 J	60 U	10.0 J
***Pesticides/Herbicides* (µg/l)**																	
4,4'-DDD		0.02 UJ	0.026	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
4,4'-DDE		0.02 UJ	0.036	0.02 U	0.02 UJ	0.0075 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
4,4'-DDT	0.0005	0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
Aldrin	3	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
alpha-BHC		0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Alpha-Chlordane		0.01 UJ	0.046 JN	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
beta-BHC		0.01 U	0.01 U	0.01 U	0.024 JN	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
delta-BHC	141	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Dieldrin	0.056	0.02 UJ	0.02 U	0.0044 J	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
Endosulfan I	0.051	0.01 UJ	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Endosulfan II	0.051	0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
Endosulfan sulfate		0.02 UJ	0.03	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.0048 J
Endrin	0.036	0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
Endrin Aldehyde		0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.023 J
Endrin Ketone		0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.11 U	0.10 U	0.10 U
gamma-BHC (Lindane)	0.01	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
gamma-Chlordane		0.01 UJ	0.038 JN	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Heptachlor	0.0019	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Heptachlor Epoxide		0.01 UJ	0.01 J	0.011 JN	0.061 J	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.053 U	0.050 U	0.050 U
Methoxychlor	0.019	0.1 UJ	0.1 U	0.1 U	0.1 UJ	0.1 U	0.10 U	--	--	--	--	--	0.050 U	0.50 U	0.53 U	0.50 U	0.50 U
Toxaphene	0.0002	--	--	--	1 UJ	1 U	1.0 U	--	--	--	--	--	5.0 U	5.0 U	5.3 U	5.0 U	5.0 U

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed
N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
P - Discrepency in GC analysis. Lower value reported.

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWE 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Non-Halogenated VOCs* (µg/l)**																	
Benzene	370	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Toluene	2	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Ethylbenzene	90	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Xylene (total)	13	0.5 U	5 U	5 U	5 U	5 UJ	10 U	3 U	3 U	3 U	3 U	3 U	--	--	--	--	--
2-Butanone	14000	5 U	10 U	10 R	10 R	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
Acetone	1500	5 U	20 R	20 R	20 R	20 R	1.6 J	5 UJ	8.4 U	5 U	5 UJ	5 U	--	--	--	--	--
Carbon Disulfide	0.92	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Cyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Isopropylbenzene	2.6	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methy-tert-butyl ether	11070	0.34 J	--	--	--	--	10 U	0.57 J	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylcyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
4-Methy-2-pentanone	170	5 U	10 U	10 U	10 U	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
***Halogenated VOCs* (µg/l)**																	
Bromoform	320	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 UJ	1 U	1 U	1 UJ	--	--	--	--	--
Bromodichloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Carbon Tetrachloride	13.3	0.5 U	5 UJ	5 U	5 U	5 UJ	10 UJ	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chlorobenzene	1.3	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroform	1.8	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Dibromochloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethane	100	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethane	47	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,2-Dichloroethene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
trans-1,2-Dichloroethene	970	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethene	25	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichlorobenzene	0.7	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,3-Dichlorobenzene	150	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,4-Dichlorobenzene	26	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 R	1 U	1 U	1 U	1 U	--	--	--	--	--
Tetrachloroethene	111	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1,1-Trichloroethane	11	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Trichloroethene	21	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Vinyl Chloride	930	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2,4-Trichlorobenzene	24	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,3-Dichloropropene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylene Chloride	98.1	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 UJ	1 UJ	1 U	1 U	--	--	--	--	--
Trichlorofluoromethane		0.5 U	--	--	--	--	10 U	1 UJ	1 U	1 U	1 U	1 U	--	--	--	--	--
***Semi-Volatiles* (µg/l)**																	
1,1'-Biphenyl	14	5 U	5 UL	5 U	5.3 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)		5 UJ	5 U	5 U	5.3 UJ	5 U	5 UL	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	--
2,4-Dimethylphenol		5 U	5 U	5 U	5.3 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dinitrophenol		20 U	20 U	20 UJ	21 UJ	20 U	20 UL	20 U	20 UL	20 UL	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	81	5 UJ	5 U	5 U	5.3 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	4.7	5 U	5 U	5 U	5.3 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	13	5 U	5 U	5 U	5.3 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
4,6-Dinitro-2-methylphenol		20 U	20 U	20 U	21 UJ	20 U	20 UL	20 U	20 U	20 U	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	543	5 U	5 U	5 U	5.3 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Acetophenone		5 U	5 U	5 U	5.3 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Atrazine	1.8	5 U	5 U	5 U	5.3 UL	5 U	5 UL	5 UL	5 U	5 UL	5 U	5 UL	5.0 UJ	5.0 U	5.0 U	5.0 U	10 U
Benzaldehyde		5 UJ	5 U	5 UL	5.3 UL	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5.0 UJ	5.0 UJ	5.0 U	5.0 U	10 U
Benzo (a) pyrene	0.015	5 UL	5 UL	5 U	5.3 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (b) Fluoranthene		5 UL	5 UL	5 U	5.3 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (g,h,i) Perylene		5 UL	5 UL	5 U	5.3 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (k) Fluoranthene		5 UL	5 UL	5 U	5.3 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Bis(2-chloroethyl)Ether		0.021	0.025	0.043	0.021 UJ	0.02 UL	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Bis(2-ethylhexyl)phthalate	16	5 U	5 U	48	4.6 J	5 U	5 U	5 UL	5 UL	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Caprolactam		5 UJ	5 UL	5 U	5.3 UJ	5 U	5 UL	5 UL	5 UL	5 UL	5 U	5 UL	5.0 U	5.0 UJ	5.0 U	5.0 U	10 U
Di-n-butyl phthalate	19	5 U	5 UL	5 U	5.3 UJ	5 U	5 U	5 U	5 UL	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-octyl phthalate	22	5 U	5 UL	5 U	5.3 UL	5 U	5 U	5 U	5 UL	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0 U
Dibenzo (a,h) Anthracene		5 UL	5 UL	5 U	5.3 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Diethylphthalate	210	5 U	5 UL	5 U	5.3 UJ	5 U	5 UL	5 U	5 UL	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorocyclopentadiene		5 U	5 U	5 U	5.3 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 R	5.0 U	5.0 U	10 U
Indeno (1,2,3-cd) Pyrene		5 UL	5 UL	5 U	5.3 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	210	5 U	5 U	5 UJ	5.3 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	1.1	5 U	5 U	5 U	5.3 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Pentachlorophenol	0.5	5 U	5 U	5 UJ	5.3 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Phenol	4	5 U	5 U	5 U	5.3 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Biological Oxygen Demand (mg/l)		--	--	1.1	5.8	1.6	3.4	< 2	5	5	--	--	--	--	--	--	--
Field Parameters																	
Temperature (Degrees Celcius)		14.58	--	11.5	25.2	12.1	7.3	16.0	25.9	21.2	6.7	19.5	12.8	16.6	17.2	13.1	21.2
Conductivity (µs/cm)		288	--	309	507	308	117	288	477	303	121	352	701	304	442	472	126
pH (standard units)	6.5 - 9	8.35	--	8.07	6.56	6.92	7.44	6.97	7.02	6.84	6.72	8.27	7.15	6.57	7.07	6.35	7.50
Dissolved Oxygen (mg/l)		4.95	--	7.69	5.18	5.89	8.73	6.82	5.85	7.31	9.10	10.10	5.28	0.00	3.71	2.84	4.39
ORP (mV)		35.1	--	93.3	108.3	36	160	98	151	54	51	81	29	42	61	76	138

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWE 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Dissolved Inorganics* (µg/l)**																	
Aluminum	87	200 U	--	11.9 U	15.6 UJ	10.9 U	48.3 U	50.6 U	22.4 U	20.0 U	65.3 U	11.1 U	200 U	200 U	200 U	200 U	200 U
Antimony	30	2 U	--	3.8 U	3.7 UJ	1.6 U	1.2 U	1.1 U	1.8 U	1.2 U	1.7 U	2.1 U	60.0 U	60.0 U	60.0 U	5.7 J	60.0 U
Arsenic	5	1.8 U	--	3 U	3.7 UJ	2 U	1.4 U	1.6 U	2.8 U	2.6 U	2.2 U	2.8 U	2.3 J	2.9 J	10.0 U	10.0 U	10.0 U
Barium	4	61	--	71.5	57.9 J	58	20.5	40.9	59.2	51.3	34.2	73.2	68.5 J	80.9 J	78.1 J	76.7 J	27.1 J
Beryllium	0.66	0.1 U	--	0.1 U	0.62 UJ	0.11 U	0.16 U	0.64 U	0.45 U	0.10 U	0.47 U	0.20 U	5.0 U	5.0 U	5.0 U	0.86 J	5.0 U
Cadmium	0.25	0.2 U	--	0.4 U	0.5 UJ	0.2 U	0.20 U	0.20 U	0.40 U	0.20 U	0.20 U	0.40 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Calcium	116000	20200	--	21400	18500 J	17800	6280	13300	19200	19500	12300	22100	26900	20700	22800	23500	8150
Chromium	85	0.5 U	--	1.5 U	1.1 UJ	0.6 U	0.43 U	0.60 U	0.50 U	0.52 U	0.60 U	0.30 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Cobalt	23	50 U	--	1.3 U	1.1 UJ	0.5 U	0.50 U	0.46	0.93	1.4 U	0.62 U	0.90 U	50.0 U	2.5 J	50.0 U	50.0 U	50.0 U
Copper	9	0.5 U	--	0.9 U	1.1 J	1.3	1.8	2.5 U	1.5 U	3.5 U	3.1 U	1.6 U	25.0 U	25.0 U	2.2 J	25 U	25 U
Iron (mg/l)	0.3	0.011 U	1.06	0.335	0.139 UJ	0.122	0.108	0.310	0.0124 U	0.141	0.324	0.0586 U	0.100 U	0.249	0.239	0.100 U	0.101 K
Lead	2.5	0.9 U	--	1.2 U	1.6 UJ	1.1 U	1.0 U	1.0 U	1.9 U	1.6 U	1.2 U	1.3 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Magnesium	82000	7660	--	8600	6960 J	6760	2870	4660	7220	7270	4660	8970	11200	7700	9400	9160	2820 J
Manganese (mg/l)	0.12	0.236	0.288	0.309	0.177 J	0.148	0.0246	0.103	0.144	0.423	0.0814	0.224	0.239	1.22	0.157	0.272	0.0458
Mercury	0.026	0.1 U	--	0.1 U	0.1 UJ	0.1 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	52	0.5 U	--	3.1 U	2.4 J	3.3	1.5	2.5	1.4	2.8 U	2.0 U	2.2	40.0 U	2.8 J	40.0 U	3.0 J	40.0 U
Potassium	53000	3730	--	3530 J	4610 J	4330	1990	3430	4600	3160	2790	2710 J	5140 J	3000 J	3250 J	4930 J	2690 J
Selenium	1	2.6 U	--	2.3 U	4.5 UJ	4.3 U	3.3 U	1.8 U	2.2 U	2.5 U	2.1 U	2.7 U	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U
Silver	3.2	0.7 U	--	1.4 U	1.3 UJ	0.2 U	0.50 U	0.50 U	0.30 U	0.59 U	0.40 U	1.2 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Sodium	680000	30300	--	54600	41500 J	22300	6050	20600	30300	21400	13200	52900	65600	35300	40200	41500	11000
Thallium	0.8	1.9 U	--	2.9 U	4 UJ	4.5 U	3.9 U	2.1 U	3.6 U	3.2 U	3.4 U	2.9 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Vanadium	20	0.4 U	--	1 U	0.8 UJ	0.5 U	0.31	0.74 U	0.30 U	0.40 U	0.81 U	0.50 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Zinc	120	8.1	--	14.3 U	8.3 UJ	15.5	9.2	11.8	9.7 U	7.1	13.1 U	10	60.0 U	10.1 J	9.6 J	60 U	10.2 J
***Pesticides/Herbicides* (µg/l)**																	
4,4'-DDD		0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.002 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDE		0.02 UJ	0.02 U	0.02 U	0.0027 JN	0.01 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	0.0005	0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Aldrin	3	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
alpha-BHC		0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Alpha-Chlordane		0.01 UJ	0.01 U	0.01 U	0.01 UJ	0.0049 J	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
beta-BHC		0.01 U	0.01 U	0.01 U	0.017 J	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
delta-BHC	141	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Dieldrin	0.056	0.02 UJ	0.02 U	0.0068 J	0.02 UJ	0.0073 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan I	0.051	0.01 UJ	0.01 U	0.01 U	0.01 UJ	0.01 U	0.0014 J	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Endosulfan II	0.051	0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan sulfate		0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.0073 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin	0.036	0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin Aldehyde		0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin Ketone		0.02 UJ	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
gamma-BHC (Lindane)	0.01	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
gamma-Chlordane		0.01 UJ	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Heptachlor	0.0019	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Heptachlor Epoxide		0.01 UJ	0.01 U	0.016 JN	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Methoxychlor	0.019	0.1 UJ	0.1 U	0.1 U	0.1 UJ	0.1 U	0.10 U	--	--	--	--	--	0.050 U	0.50 U	0.50 U	0.50 U	0.50 U
Toxaphene	0.0002	--	--	--	1 UJ	1 U	1.0 U	--	--	--	--	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed
N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
P - Discrepency in GC analysis. Lower value reported.

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWF 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Non-Halogenated VOCs* (µg/l)**																	
Benzene	370	0.14 J	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Toluene	2	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Ethylbenzene	90	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Xylene (total)	13	0.5 U	5 U	5 U	5 U	5 UJ	10 U	3 U	3 U	3 U	3 U	3 U	--	--	--	--	--
2-Butanone	14000	5 U	10 U	10 R	10 R	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
Acetone	1500	5 U	20 R	20 R	20 R	20 R	10 U	5 UJ	6.0 U	5 U	5 UJ	5 U	--	--	--	--	--
Carbon Disulfide	0.92	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Cyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Isopropylbenzene	2.6	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methy-tert-butyl ether	11070	0.5 J	--	--	--	--	10 U	0.42 J	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylcyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
4-Methy-2-pentanone	170	5 U	10 U	10 U	10 UJ	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
***Halogenated VOCs* (µg/l)**																	
Bromoform	320	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Bromodichloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Carbon Tetrachloride	13.3	0.5 U	5 UJ	5 U	5 U	5 UJ	10 UJ	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chlorobenzene	1.3	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroform	1.8	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Dibromochloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethane	100	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethane	47	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,2-Dichloroethene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
trans-1,2-Dichloroethene	970	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethene	25	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichlorobenzene	0.7	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,3-Dichlorobenzene	150	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,4-Dichlorobenzene	26	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 R	1 U	1 U	1 U	1 U	--	--	--	--	--
Tetrachloroethene	111	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1,1-Trichloroethane	11	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Trichloroethene	21	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Vinyl Chloride	930	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2,4-Trichlorobenzene	24	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,3-Dichloropropene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylene Chloride	98.1	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 UJ	1 UJ	1 U	1 U	--	--	--	--	--
Trichlorofluoromethane		0.5 U	--	--	--	--	10 U	1 UJ	1 U	1 U	1 U	1 U	--	--	--	--	--
***Semi-Volatiles* (µg/l)**																	
1,1'-Biphenyl	14	5 U	5 UL	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)		5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	--
2,4-Dimethylphenol		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dinitrophenol		20 U	20 U	20 UJ	20 UJ	20 U	20 UL	20 U	20 UL	20 U	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	81	5 UJ	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	4.7	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	13	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
4,6-Dinitro-2-methylphenol		20 U	20 U	20 U	20 UJ	20 U	20 UL	20 U	20 U	20 U	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	543	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Acetophenone		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Atrazine	1.8	5 U	5 U	5 U	5 UL	5 UJ	5 UL	5 UL	5 U	5 UL	5 U	5 UL	5.0 UJ	5.0 U	5.0 U	5.0 U	10 U
Benzaldehyde		5 UJ	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5.0 UJ	5.0 UJ	5.0 U	5.0 U	10 U
Benzo (a) pyrene	0.015	5 U	5 U	5 UL	5 UJ	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (b) Fluoranthene		5 U	5 U	5 UL	5 UJ	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (g,h,i) Perylene		5 U	5 U	5 UL	5 UJ	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (k) Fluoranthene		5 U	5 U	5 UL	5 UJ	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Bis(2-chloroethyl)Ether		0.019 U	0.69	0.037	0.02 UJ	0.02 UL	5 U	5 U	5 U	5 UL	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Bis(2-ethylhexyl)phthalate	16	5 U	5 U	5 U	16 J	5 U	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	6.5	6.5	5.0 U	5.0 U	5.0 U
Caprolactam		5 UJ	5 UL	5 U	5 UJ	5 U	5 UL	5 UL	5 UL	5 UL	2.3 L	5 UL	5.0 U	5.0 UJ	5.0 U	5.0 U	10 U
Di-n-butyl phthalate	19	5 U	5 UL	5 U	5 UJ	5 U	5 U	5 U	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-octyl phthalate	22	5 U	5 UL	5 U	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0 U
Dibenzo (a,h) Anthracene		5 U	5 U	5 UL	5 UJ	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Diethylphthalate	210	5 U	5 UL	5 U	5 UJ	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorocyclopentadiene		5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 R	5.0 U	5.0 U	10 U
Indeno (1,2,3-cd) Pyrene		5 U	5 U	5 UL	5 UJ	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	210	5 U	5 U	5 UJ	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	1.1	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Pentachlorophenol	0.5	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Phenol	4	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.0 U	5.0 U	5.0 U	5.0 U	10 U
Biological Oxygen Demand (mg/l)		--	--	1.2	2.9	2.1	3.3	3	6	7	--	--	--	--	--	--	--
Field Parameters																	
Temperature (Degrees Celcius)		16.1	--	14.12	21.2	12.3	6.7	16.5	25.9	19.9	6.8	21.7	12.3	16.6	17.6	13.5	22.0
Conductivity (µs/cm)		329	--	335	458	324	133	291	504	343	86	370	653	372	341	460	88
pH (standard units)	6.5 - 9	8.44	--	7.95	5.95	6.84	7.34	7.02	7.26	6.90	7.22	7.37	7.23	6.80	7.12	6.53	7.49
Dissolved Oxygen (mg/l)		4.74	--	8.14	4.50	4.94	9.59	7.22	5.05	5.36	10.51	9.72	3.72	3.97	4.60	2.31	3.61
ORP (mV)		26.2	--	42.2	201	40	159	96	143	8	-11	98	21	106	57	126	125

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWF 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Dissolved Inorganics* (µg/l)**																	
Aluminum	87	200 U	--	11.9 U	13 U	15.1	53.5 U	49.6 U	19.9 U	20.0 U	36.7 U	11.1 U	200 U	200 U	200 U	200 U	200 U
Antimony	30	2 U	--	3.8 U	3.7 U	1.6 U	1.2 U	1.1 U	1.8 U	1.2 U	1.7 U	2.1 U	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U
Arsenic	5	1.8 U	--	3 U	3.7 U	2 U	1.4 U	1.6 U	2.8 U	2.6 U	2.2 U	2.8 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Barium	4	63.7	--	68	53.7	62.3	19.8	39.8	60.1	62.8	36.6	71.3	60.5 J	90.4 J	64.8 J	77.1 J	25.2 J
Beryllium	0.66	0.1 U	--	0.1 U	0.38 U	0.12 U	0.17 U	0.66 U	0.41 J	0.10 U	0.30 U	0.20 U	5.0 U	5.0 U	5.0 U	0.65 J	5.0 U
Cadmium	0.25	0.2 U	--	0.4 U	0.5 U	0.2 U	0.20 U	0.20 U	0.40 U	0.20 U	0.20 U	0.40 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Calcium	116000	21000	--	20400	17600	19200	6720	13100	19300	19900	13000	22000	23700	25000	19000	23400	4710 J
Chromium	85	0.5 U	--	1.2 U	1.3 U	0.6 U	0.58 U	0.60 U	0.50 U	0.55 U	0.66	0.30 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Cobalt	23	50 U	--	1.1 U	1.6	0.5 U	0.50 U	0.53	0.71	1.1 U	0.61 U	0.90 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Copper	9	0.5 U	--	0.9 U	1.4	1.6	2.2	2.6 U	1.5 U	3.8 U	3.2 U	1 U	25.0 U	25.0 U	2.7 J	25 U	25.0 U
Iron (mg/l)	0.3	0.337	1.07	0.621	0.0914 U	0.0841	0.139	0.287	0.0124 U	0.784	0.382	0.021 U	0.100 U	0.154	0.322	0.100 U	0.875 K
Lead	2.5	0.9 U	--	1.2 U	1.6 U	1.1 U	1.0 U	1.0 U	1.9 U	1.6 U	1.2 U	1.8 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Magnesium	82000	7950	--	8250	6460 J	7370	2540	4520	7310	8150	5030	8930	10400	9970	8200	9350	6770
Manganese (mg/l)	0.12	0.220	0.283	0.254	0.150	0.0691	0.0369	0.0979	0.129	0.397	0.093	0.209	0.130	0.302	0.178	0.301	0.248
Mercury	0.026	0.2 U	--	0.1 U	0.1 U	0.1 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	52	0.5 U	--	3.4 U	3.1	3	1.4	2.4	1.5	2.7 U	2.3 U	2.2	40.0 U	40.0 U	40.0 U	1.7 J	5.3 J
Potassium	53000	3580	--	3380 J	4520 J	5800	1980	3450	4510	4370	3070	2880 J	4740 J	3220 J	2760 J	4520 J	1910 J
Selenium	1	3.1	--	4.1 U	4.5 U	4.3 U	3.3 U	1.8 U	2.2 U	2.5 U	2.1 U	2.7 U	35.0 U	35.0 U	35.0 U	3.0 J	35.0 U
Silver	3.2	0.7 U	--	1.4 U	1.3 U	0.2 U	0.50 U	0.50 U	0.30 U	0.59 U	0.40 U	1.2 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Sodium	680000	32300	--	53600	46400	23300	9120	20000	31700	26600	13800	53000	56600	46800	31300	42500	1650 J
Thallium	0.8	1.9 U	--	2.9 U	4 U	4.5 U	3.9 U	2.1 U	3.6 U	3.2 U	3.4 U	2.9 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Vanadium	20	0.4 U	--	1 U	1	0.5 U	0.57	0.77 U	0.30 U	0.61 U	0.79 U	0.50 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Zinc	120	10.3	--	13.6 U	10.9 UJ	15.2	11.4	13.8	8.9 U	8.6	12.6 U	9	60.0 U	10.9 J	10.2 J	60 U	60.0 U
***Pesticides/Herbicides* (µg/l)**																	
4,4'-DDD		0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDE		0.02 U	0.02 U	0.02 U	0.0016 J	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	0.0005	0.02 U	0.0033 J	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Aldrin	3	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
alpha-BHC		0.01 U	0.01 U	0.01 U	0.01 UJ	0.011 J	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Alpha-Chlordane		0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
beta-BHC		0.01 U	0.01 U	0.01 U	0.0067 J	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
delta-BHC	141	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Dieldrin	0.056	0.0076 J	0.011 J	0.0078 J	0.02 UJ	0.0053 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan I	0.051	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.0023 J	--	--	--	--	--	0.050 U	0.050 U	0.014 J	0.050 U	0.050 U
Endosulfan II	0.051	0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan sulfate		0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin	0.036	0.02 U	0.02 U	0.02 U	0.02 UJ	0.0077 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin Aldehyde		0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.011 J
Endrin Ketone		0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
gamma-BHC (Lindane)	0.01	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
gamma-Chlordane		0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Heptachlor	0.0019	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Heptachlor Epoxide		0.01 U	0.01 U	0.017	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Methoxychlor	0.019	0.1 U	0.1 U	0.1 U	0.1 UJ	0.0047 J	0.10 U	--	--	--	--	--	0.050 U	0.50 U	0.50 U	0.50 U	0.50 U
Toxaphene	0.0002	--	--	--	1 UJ	1 U	1.0 U	--	--	--	--	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed
N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
P - Discrepency in GC analysis. Lower value reported.

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWG 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Non-Halogenated VOCs* (µg/l)**																	
Benzene	370	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Toluene	2	0.5 U	5 U	5 U	5 U	5 UJ	10 U	0.19 J	1 U	1 U	1 U	1 U	--	--	--	--	--
Ethylbenzene	90	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Xylene (total)	13	0.5 U	5 U	5 U	5 U	5 U	10 U	3 U	3 U	3 U	3 U	3 U	--	--	--	--	--
2-Butanone	14000	5 U	10 U	10 R	10 R	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
Acetone	1500	5 U	20 R	20 R	20 R	20 R	10 U	5 UJ	11 U	5 U	5 UJ	5 U	--	--	--	--	--
Carbon Disulfide	0.92	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Cyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Isopropylbenzene	2.6	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methy-tert-butyl ether	11070	0.5 K	--	--	--	--	1.1 J	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylcyclohexane		0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
4-Methy-2-pentanone	170	5 U	10 U	10 U	10 U	10 UJ	10 U	5 U	5 U	5 U	5 U	5 U	--	--	--	--	--
***Halogenated VOCs* (µg/l)**																	
Bromoform	320	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 UJ	--	--	--	--	--
Bromodichloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Carbon Tetrachloride	13.3	0.5 U	5 UJ	5 U	5 U	5 UJ	10 UJ	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chlorobenzene	1.3	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroform	1.8	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Dibromochloromethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichloroethane	100	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethane	47	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,2-Dichloroethene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
trans-1,2-Dichloroethene	970	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1-Dichloroethene	25	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2-Dichlorobenzene	0.7	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,3-Dichlorobenzene	150	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,4-Dichlorobenzene	26	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Chloroethane		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 R	1 U	1 U	1 U	1 U	--	--	--	--	--
Tetrachloroethene	111	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,1,1-Trichloroethane	11	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Trichloroethene	21	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Vinyl Chloride	930	0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
1,2,4-Trichlorobenzene	24	0.5 U	--	--	--	--	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
cis-1,3-Dichloropropene		0.5 U	5 U	5 U	5 U	5 UJ	10 U	1 U	1 U	1 U	1 U	1 U	--	--	--	--	--
Methylene Chloride	98.1	0.27 K	5 U	5 U	5 U	5 UJ	10 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	--	--	--	--	--
Trichlorofluoromethane		0.5 U	--	--	--	--	10 U	1 UJ	1 U	1 U	1 U	1 U	--	--	--	--	--
***Semi-Volatiles* (µg/l)**																	
1,1'-Biphenyl	14	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2,2'-oxybis (1-Chloropropane)		5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	--
2,4-Dimethylphenol		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dinitrophenol		20 U	20 U	20 UJ	20 UL	20 U	20 UL	20 U	20 UL	20 UL	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	81	5 UJ	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylnaphthalene	4.7	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 UL	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Methylphenol	13	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
4,6-Dinitro-2-methylphenol		20 U	20 U	20 U	20 UJ	20 U	20 UL	20 U	20 U	20 U	20 U	20 UL	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	543	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Acetophenone		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Atrazine	1.8	5 UJ	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 U	5 UL	5 U	5 UL	5.1 UJ	5.0 U	5.0 U	5.0 U	10 U
Benzaldehyde		5 UJ	5 U	5 UL	5 UL	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5.1 UJ	5.0 UJ	5.0 U	5.0 U	10 U
Benzo (a) pyrene	0.015	5 U	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (b) Fluoranthene		5 U	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (g,h,i) Perylene		5 U	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo (k) Fluoranthene		5 UJ	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Bis(2-chloroethyl)Ether		0.019 U	0.021	0.041	0.02 UJ	0.019 UL	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Bis(2-ethylhexyl)phthalate	16	5 U	5 U	5 U	5 UL	5 U	5 U	5 UL	5 UL	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Caprolactam		5 UJ	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Di-n-butyl phthalate	19	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-octyl phthalate	22	5 U	5 U	5 U	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0 U
Dibenzo (a,h) Anthracene		5 U	5 U	5 U	5 UL	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Diethylphthalate	210	5 U	5 U	5 U	5 UL	5 U	5 UL	5 U	5 UL	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorocyclopentadiene		5 U	5 U	5 U	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 R	5.0 U	5.0 U	10 U
Indeno (1,2,3-cd) Pyrene		5 U	5 U	5 U	5 UJ	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	210	5 U	5 U	5 UJ	5 UJ	5 U	5 UL	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	1.1	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 UL	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U
Pentachlorophenol	0.5	5 U	5 U	5 UJ	5 UL	5 U	5 U	5 U	5 U	5 UL	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Phenol	4	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5.1 U	5.0 U	5.0 U	5.0 U	10 U
Biological Oxygen Demand (mg/l)		--	--	1.8	4.4	2.4	3.9	3	10	5	--	--	--	--	--	--	--
Field Parameters																	
Temperature (Degrees Celcius)		16.2	--	11.7	23.01	12.3	7.1	19.2	29.6	19.0	6.3	20.4	11.9	16.6	18.2	13.0	21.0
Conductivity (µs/cm)		338	--	291	299	294	105	273	270	278	107	334	554	296	444	323	143
pH (standard units)	6.5 - 9	8.25	--	5.89	6.40	6.76	7.40	7.08	6.93	6.94	6.62	7.66	7.23	6.83	6.80	6.41	7.34
Dissolved Oxygen (mg/l)		5.38	--	7.55	1.78	3.83	9.93	7.45	7.44	7.03	9.36	10.55	3.24	3.18	5.89	9.58	4.75
ORP (mV)		-7.3	--	51	76.9	-24	160	82	55	37	42	77	48	53	67	39	141

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
B - Analyte Detected in Method Blank
-- Not analyzed.
UL - Not detected, quantitation limit is probably higher

D - Sample diluted in the lab for analysis.
K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected

Table 3 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/l	SWG 10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Dissolved Inorganics* (µg/l)**																	
Aluminum	87	4.4 U	--	11.9 U	18.7 UJ	27.1 U	83.7 U	50.5 U	37.6 U	20.0 U	43.0 U	11.1 U	200 U	200 U	200 U	200 U	200 U
Antimony	30	2 U	--	3.8 U	3.7 UJ	1.6 U	1.2 U	1.1 U	1.8 U	1.2 U	1.7 U	2.1 U	60.0 U	60.0 U	60.0 U	60.0 U	60.0 U
Arsenic	5	1.8 U	--	3 U	3.7 UJ	2 U	2.4	1.6 U	2.8 U	2.6 U	2.2 U	2.8 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Barium	4	52.6	--	51.1	59.4 J	70.5	17.9	48.3	47.3	55.1	30.6	67.5	46.3 J	66.7 J	62.7 J	52.3 J	36.4 J
Beryllium	0.66	0.1 U	--	0.1 U	0.59 UJ	0.2 U	0.38 U	0.65 U	0.62 U	0.10 U	0.30 U	0.20 U	5.0 U	5.0 U	5.0 U	0.76 J	5.0 U
Cadmium	0.25	0.2 U	--	0.4 U	0.5 UJ	0.2 U	0.23 U	0.20 U	0.40 U	0.20 U	0.20 U	0.40 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Calcium	116000	18600	--	17200	20100 J	18000	6150	13500	17800	19000	11100	22300	22700	21800	31800	19500	10300
Chromium	85	0.5 U	--	1.6 U	1.1 UJ	0.6 U	0.72 U	0.60 U	0.50 U	0.77 U	0.60 U	0.30 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Cobalt	23	50 U	--	1.1 U	1.1 UJ	0.75	0.50 U	0.40	2.4	0.65 U	0.40 U	0.90 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Copper	9	0.5 U	--	0.99	0.83 J	1.2	2.4	2.2 U	1.7	3.4 U	3.3 U	1.2 U	25.0 U	25.0 U	1.3 J	25 U	25 U
Iron (mg/l)	0.3	0.011 U	0.713	0.207 U	0.571 J	1.29	0.159	0.390	0.112	0.0663 U	0.295	0.108 U	0.100 U	0.148	0.124	0.0877 J	0.204 K
Lead	2.5	0.9 U	--	1.2 U	1.6 UJ	1.1 U	1.0 U	1.0 U	1.9 U	1.6 U	1.2 U	1.5 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U
Magnesium	82000	7060	--	6240	8780 J	7410	2090	5070	6760	7090	3950	8610	9900	7630	9530	6850	3440 J
Manganese (mg/l)	0.12	0.173	0.339	0.263	0.190 J	0.322	0.0404	0.188	0.126	0.163	0.0787	0.164	0.0865	0.116	0.220	0.149	0.0833
Mercury	0.026	0.2 U	--	0.1 U	0.1 UJ	0.1 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	52	0.5 U	--	3.6 U	2.9 J	2.6	1.5	2.0	1.4	1.9 U	2.2 U	2.5	40.0 U	2.1 J	40.0 U	1.6 J	1.5 J
Potassium	53000	3560	--	3140 J	3580 J	4270	1810	3520	4390	4160	2910	2420 J	4790 J	3090 J	2730 J	3510 J	6050
Selenium	1	2.6 U	--	1.7 U	4.5 J	4.3 U	3.3 U	1.8 U	2.2 U	2.5 U	2.1 U	2.7 U	35.0 U	35.0 U	35.0 U	35.0 U	35.0 U
Silver	3.2	0.7 U	--	1.4 U	1.3 UJ	0.2 U	0.50 U	0.50 U	0.30 U	0.53 U	0.40 U	1.2 U	10.0 U	10.0 U	10 U	10.0 U	10 U
Sodium	680000	24100	--	26900	26800 J	18700	6130	17300	17700	17900	11300	43300	36000	32400	32200	30900	11700
Thallium	0.8	1.9 U	--	2.9 U	4 UJ	4.5 U	3.9 U	2.1 U	3.6 U	3.3 U	3.4 U	2.9 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Vanadium	20	0.4 U	--	1 U	0.96 J	0.5 U	0.85	0.59 U	0.78	0.40 U	0.67 U	0.50 U	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U
Zinc	120	8.7	--	10.7 U	5.3 UJ	13.1	11	6.1	7.7 U	6.2	10.7 U	8.8	60.0 U	12.1 J	7.9 J	60 U	10 J
***Pesticides/Herbicides* (µg/l)**																	
4,4'-DDD		0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDE		0.02 U	0.02 U	0.02 U	0.0039 J	0.0077 J	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	0.0005	0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Aldrin	3	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
alpha-BHC		0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Alpha-Chlordane		0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
beta-BHC		0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
delta-BHC	141	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Dieldrin	0.056	0.02 U	0.0083 J	0.02 U	0.0071 JN	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan I	0.051	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.0035 J	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.017 J	0.050 U
Endosulfan II	0.051	0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan sulfate		0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin	0.036	0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin Aldehyde		0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin Ketone		0.02 U	0.02 U	0.02 U	0.02 UJ	0.02 U	0.020 U	--	--	--	--	--	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
gamma-BHC (Lindane)	0.01	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
gamma-Chlordane		0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.0037 J
Heptachlor	0.0019	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Heptachlor Epoxide		0.01 U	0.01 U	0.025 J	0.01 UJ	0.01 U	0.010 U	--	--	--	--	--	0.050 U	0.050 U	0.050 U	0.050 U	0.022 K
Methoxychlor	0.019	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.10 U	--	--	--	--	--	0.050 U	0.50 U	0.50 U	0.50 U	0.50 U
Toxaphene	0.0002	--	--	--	1 UJ	1 U	1.0 U	--	--	--	--	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U

N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

U - Analyte was not detected above the reporting limit.

J - Estimated concentration.

B - Analyte Detected in Method Blank

-- Not analyzed

D - Sample diluted in the lab for analysis.

K - Analyte present. May be biased High.

L - Analyte present. May be biased low

R - Data Rejected

P - Discrepency in GC analysis. Lower value reported.

Table K-3: Summary of Sediment Data for Army Creek and Army Pond.

RUTH ASSOCIATES, INC.

Table 4

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/kg	SEDA															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Semi-Volatiles* (µg/kg)**																	
1,1'-Biphenyl	1220	410 U	520 U	520 UJ	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	270 U
2,2'-oxybis (1-Chloropropane)		410 U	520 UL	520 UJ	520 UL	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	--
2,4-Dimethylphenol	29	410 U	520 UL	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	270 U
2,4-Dinitrophenol		1000 UJ	1300 U	1300 UL	1300 UJ	1300 UL	1400 UL	1200 UL	1300 R	1200 UL	1300 UL	1300 U	520 U	510 U	530 U	530 U	520 U
2,6-Dinitrotoluene		410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	270 U
2-Methylnaphthalene	20.2	410 U	520 U	520 UJ	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	270 U
2-Methylphenol		410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	520 U
4,6-Dinitro-2-methylphenol		1000 UJ	1300 UL	1300 U	1300 UJ	1300 U	1400 UL	1200 U	1300 UL	1200 U	1300 UL	1300 U	520 U	510 U	530 U	530 U	520 U
4-Methylphenol	670	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	520 U
Acetophenone		410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	180 J	260 U	270 U	270 U	520 U
Atrazine	6.62	410 U	520 U	520 UJ	520 UL	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 UJ	260 U	270 U	270 U	520 U
Benzaldehyde		410 UJ	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 UJ	260 UJ	270 U	270 UJ	520 U
Benzo (a) anthracene	108	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	33 J
Benzo (a) pyrene	150	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	56 J
Benzo (b) Fluoranthene	27.2+	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	150 J
Benzo (g,h,i) Perylene	170	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 UL	500 U	270 U	260 U	270 U	270 U	78 J
Benzo (k) Fluoranthene	27.2+	410 UJ	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	45 J
Bis(2-chloroethyl)Ether		0.41 UJ	1.1	0.52 U	2.1 UJ	2 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	520 U
Bis(2-ethylhexyl)phthalate	180	410 U	520 U	520 UJ	520 UJ	500 U	540 U	110 J	530 U	460 U	510 U	500 U	670	260 U	270 U	270 U	53 J
Caprolactam		410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 UJ	520 U
Di-n-butyl phthalate	6470	410 U	520 UL	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	270 U
Di-n-octyl phthalate		410 UJ	520 U	520 UJ	520 UJ	500 U	540 U	480 UJ	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	520 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	110 R
Dibenzo (a,h) Anthracene	33	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	270 U
Diethylphthalate	603	410 U	520 U	520 U	520 UJ	500 U	540 U	480 UJ	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	270 U
Hexachlorocyclopentadiene		410 UJ	520 U	520 U	520 UJ	500 U	540 U	480 U	530 UL	460 UL	510 UL	500 UL	270 R	260 R	270 U	270 R	520 U
Indeno (1,2,3-cd) Pyrene	17	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	69 J
N-Nitrosodiphenylamine	2680	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	270 U
Naphthalene		410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	270 U
Pentachlorophenol	504	1000 UJ	1300 U	1300 U	1300 UJ	1300 UL	1400 U	1200 U	1300 UL	1200 UL	1300 U	1300 UL	520 U	510 U	530 U	530 U	520 U
Phenol	420	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	520 U
Chrysne	166	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	93 J
Fluoranthene		410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	100 J
Phenanthrene	204	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	270 U
Carbazole		410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 UL	460 UL	510 U	500 U	270 U	260 U	270 U	270 U	520 U
Pyrene	195	410 U	520 U	520 U	520 UJ	500 U	540 U	480 U	530 U	460 U	510 U	500 U	270 U	260 U	270 U	270 U	91 J

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
-- Not analyzed

UL - Not detected, quantitation limit is probably higher
B - Analyte also detected in blank
+ - Value is for Benzo (b) fluoranthene and Benzo (k) fluoranthene

K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level	SEDA															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Inorganics* (mg/kg)**																	
Aluminum		28300	48100	22900	25100 J	23000	24000	28100	22700	23500	34600	32500	21900 J	40700	53900	16500 L	28200 J
Antimony	2	0.48 U	0.9 J	1.2 UL	1.1 UJ	0.86 UJ	0.98 J	0.74 L	1.1 UJ	0.99 UJ	1.3 L	0.64 R	10.6 UL	1.6 L	6.0 R	9.5 UL	6.7 R
Arsenic	9.8	3	4.3	4.5	2.9 J	3.2	5.7	3.8	3.9	3.9	5.9	4.1 L	3.6	3.7	2.5	2.5 L	3.2 L
Barium		66.2	137	75.9	67.5 J	93.3	92.6	131	84.7	87.9	129	87.0	88.1	78.5	74.3	51.9	67.4 L
Beryllium		0.84	1.4	0.74 U	0.83 J	0.51	0.93	1.1	0.72 U	0.95 U	1.4	1.3	1.2	1.5	1.6	1.0	0.56 UJ
Cadmium	0.99	0.23	0.86	1.1 U	0.2 J	0.12	0.082	0.058 U	0.13 U	0.48 U	0.062 U	0.12 U	0.88 U	0.66 J	0.80 U	0.79 U	0.091 J
Calcium		698	794	1070 J	687 J	980	1310	1120	580 J	650 J	1120 J	795	746 J	742 J	1520 J	479 L	838 J
Chromium	43.4	20.5	42 J	19.3	20.1 J	21.6	23.8	23.6	21.0	21.5	30.1	28.8	21.4 J	30.4	40.8	17.2 L	21.4 L
Cobalt	50	14.9	12.5 J	10.9 U	12.4 J	16.7	17.7	18.9	21.0 J	15.5	25.8	14.8	19.9	21.4	19.5	11.6 L	10.3 L
Copper	31.6	9.1	17.9	9.1	8.7 J	12.3	14.2	14.0	11.4	12.5	15.5	12.3	13.7 J	9.9	14.1	8.5 L	10.4 L
Iron	20000	25500	38100 J	30900	24400 J	26800	33400	30600	36100	30500	47800	56900 J	26300 J	61300	31500	18700 L	23500 J
Lead	35.8	18.4	31.4 J	21.2 J	18.9 J	30.1	57.2	43.1	20.5 J	24.8	33.9	23.7 K	26.2 K	16.6	19.6 K	20.6 L	24.2
Magnesium		783	1480 J	716	711 J	1060	1300	1180	766 J	827 J	1200 J	902	874 J	767 J	1120	650 L	942
Manganese	460	343	242 J	520 K	264 J	358 J	439	348 L	387 J	374 J	608 L	247	207 J	287 K	106	98.8 J	148
Mercury	0.18	3.2	0.89 J	0.078 U	0.058 UJ	0.075 U	0.082 U	0.072 U	0.081 U	0.070 U	0.077 U	0.15 U	0.18 U	0.15 U	0.16 U	0.16 U	0.075 J
Nickel	22.7	10.9	21.2	11.2	11.6 J	13.8	15.5 J	14.6	12.6	12.1	18.6 J	15.1 J	12.6	15.2	21.8	9.6 L	9.8 L
Potassium		710	1600	657	651 J	839	947 J	1150	596 J	801 J	1040 J	703 J	680 J	573 J	1090	495 L	771
Selenium	2	0.63 U	1.2 UJ	0.52 UL	1.3 UJ	1.3 UJ	1.4	0.52 UL	0.71 UJ	0.70 U	0.65 UL	0.82 UL	1.2 J	5.4 UL	5.6 U	0.95 J	1.1 J
Silver	1.0	0.17 U	0.22 U	0.43 U	0.38 UJ	0.06 U	0.16 U	0.14 U	0.097 U	0.14 U	0.12 U	0.36 U	1.8 U	1.5 U	1.6 U	1.6 U	1.1 UJ
Sodium		152 U	141	126 U	69.1 UJ	126	112 U	341	155 U	260	94.9 U	130 U	533 J	232 J	500 U	791 U	107 J
Thallium		0.54	2 U	5.2	1.2 UJ	1.6 J	1.3 U	0.61 U	1.2 U	0.90 U	1.1 U	2 U	4.4 U	3.9 U	4.0 U	2.0 J	2.8 UJ
Vanadium		37.6	77.1	35.1	36.7 J	40.7	46.2	46.1	41.8	43.4	60.5	57.2	46.4 J	58.2	70.6	32.6 L	35.7 L
Zinc	121	38.2	68.7	50.7 J	39.8 J	59.8	72.1	56.5	42.8 J	36.9	61.2	61.0	46.8 J	46.2	54.1	37.8 L	49.2 L
***Pesticides/Herbicides* (µg/kg)**																	
4,4'-DDD		6.8	5.2 U	5.2 U	5.2 UJ	5 U	5.4 U	--	--	--	--	--	5.2 U	5.1 U	5.3 U	5.3 U	0.60 J
4,4'-DDE		1.8 J	5.2 U	1.7 J	5.2 UJ	2.3 J	1.6 J	--	--	--	--	--	1.9 J	5.1 U	2.1 J	5.3 UJ	1.1 J
4,4'-DDT		4.1 U	5.2 U	5.2 U	5.2 UJ	5 U	5.4 U	--	--	--	--	--	5.2 U	5.1 U	5.3 U	5.3 UJ	2.1 J
Aldrin	2	2.1 U	2.7 U	2.7 U	2.7 UJ	2.6 U	2.8 U	--	--	--	--	--	2.7 U	2.6 U	2.7 U	2.7 U	1.7 U
alpha-BHC	6	2.1 U	2.7 U	2.7 U	2.7 UJ	2.6 U	2.8 U	--	--	--	--	--	2.7 U	2.6 U	2.7 U	2.7 U	1.7 U
Alpha-Chlordane		2.1 U	2.7 U	2.7 U	2.7 UJ	2.6 U	2.8 U	--	--	--	--	--	5.2 U	5.1 U	2.7 U	2.7 UJ	1.7 U
beta-BHC	5	2.1 U	2.7 U	2.7 U	2.7 UJ	1.4 J	2.8 U	--	--	--	--	--	2.7 U	2.6 U	2.7 U	2.7 UJ	1.7 U
delta-BHC	6400	2.1 U	2.7 U	2.7 U	2.7 UJ	2.6 U	2.8 U	--	--	--	--	--	2.7 U	2.6 U	2.7 U	2.7 U	1.7 U
Dieldrin	1.9	4.1 U	5.2 U	5.2 U	5.2 UJ	5 U	5.4 U	--	--	--	--	--	5.2 U	5.1 U	5.3 U	5.3 U	3.3 U
Endosulfan I	2.9	2.1 U	2.7 U	2.7 U	2.7 UJ	2.6 U	2.8 U	--	--	--	--	--	2.7 U	2.6 U	2.7 U	2.7 U	1.7 U
Endosulfan II	14	4.1 U	5.2 U	5.2 U	5.2 UJ	5 U	5.4 U	--	--	--	--	--	5.2 U	5.1 U	5.3 U	5.3 U	3.3 U
Endosulfan sulfate	5.4	4.1 U	5.2 U	5.2 U	5.2 UJ	5 U	5.4 U	--	--	--	--	--	5.2 U	5.1 U	5.3 UL	5.3 U	3.3 U
Endrin	2.22	4.1 U	5.2 U	5.2 U	5.2 UJ	5 U	5.4 U	--	--	--	--	--	5.2 U	5.1 U	5.3 U	5.3 U	3.3 U
Endrin Aldehyde		4.1 U	5.2 U	5.2 U	5.2 UJ	5 U	5.4 U	--	--	--	--	--	5.2 U	5.1 U	5.3 U	5.3 U	3.3 U
Endrin Ketone		4.1 U	5.2 U	5.2 U	5.2 UJ	5 U	5.4 U	--	--	--	--	--	5.2 U	5.1 U	5.3 U	5.3 U	1.2 J
gamma-BHC (Lindane)	2.37	2.1 U	2.7 U	2.7 U	2.7 UJ	2.6 U	2.8 U	--	--	--	--	--	2.7 U	2.6 U	2.7 U	2.7 U	1.7 U
gamma-Chlordane		2.1 U	2.7 U	2.7 U	2.7 UJ	2.6 U	0.62 J	--	--	--	--	--	5.2 U	5.1 U	2.7 U	2.7 U	1.7 U
Heptachlor	68	2.1 U	2.7 U	2.7 U	2.7 UJ	2.6 U	2.8 U	--	--	--	--	--	2.7 U	2.6 U	2.7 U	2.7 U	1.7 U
Heptachlor Epoxide	2.47	2.1 U	2.7 U	2.7 U	2.7 UJ	2.6 U	2.8 U	--	--	--	--	--	2.7 U	1.0 J	2.7 U	2.7 U	1.7 U
Methoxychlor	18.7	21 U	27 U	27 U	27 UJ	26 U	28 U	--	--	--	--	--	27 U	26 U	27 U	27 U	2.5 J
Toxaphene	0.1	--	--	--	270 UJ	260 U	280 U	--	--	--	--	--	270 U	260 U	270 U	270 U	170 U

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
-- Not analyzed.
N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"
D - Sample diluted in the lab for analysis.

K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
P - Discrepency in GC analysis. Lower value reported.
S - Sample spike recovery is outside of control limits

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/kg	SEDB															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Semi-Volatiles* (µg/kg)**																	
1,1'-Biphenyl	1220	520 U	490 U	470 UJ	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	290 U
2,2'-oxybis (1-Chloropropane)		520 U	490 UL	470 UJ	410 UL	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	--
2,4-Dimethylphenol	29	520 U	490 UL	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	290 U
2,4-Dinitrophenol		1300 UJ	1200 U	1200 UL	1000 UJ	1100 UL	1800 UL	1600 UL	1000 R	1100 UL	1900 UL	1200 U	970 U	970 U	670 U	370 U	290 U
2,6-Dinitrotoluene		520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	290 U
2-Methylnaphthalene	20.2	520 U	490 U	470 UJ	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	290 U
2-Methylphenol		520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	560 U
4,6-Dinitro-2-methylphenol		1300 UJ	1200 UL	1200 U	1000 UJ	1100 U	1800 UL	1600 U	1000 UL	1100 U	1900 UL	1200 U	970 U	970 U	670 U	370 U	560 U
4-Methylphenol	670	520 U	490 U	520 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	560 U
Acetophenone		520 U	490 U	520 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	370 J	500 U	350 U	190 U	560 U
Atrazine	6.62	520 U	490 U	520 UJ	410 UL	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 UJ	500 U	350 U	190 U	560 U
Benzaldehyde		520 UJ	490 U	520 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 UJ	500 UJ	350 U	190 UJ	560 U
Benzo (a) anthracene	108	520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	120 J	350 U	190 U	290 U
Benzo (a) pyrene	150	520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	220 J	75 J	190 U	290 U
Benzo (b) Fluoranthene	27.2+	520 U	490 U	470 U	410 UJ	450 U	730 U	140 J	410 U	450 U	180 J	460 U	500 U	380 J	180 J	190 U	87 J
Benzo (g,h,i) Perylene	170	520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 UL	460 U	500 U	190 J	350 U	190 U	38 J
Benzo (k) Fluoranthene	27.2+	520 UJ	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	230 J	350 U	190 U	290 U
Bis(2-chloroethyl)Ether		0.79 J	0.5	0.48 U	1.6 UJ	1.8 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	560 U
Bis(2-ethylhexyl)phthalate	180	520 U	490 U	470 UJ	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	42 J
Caprolactam		520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 UJ	560 U
Di-n-butyl phthalate	6470	520 U	490 UL	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	290 U
Di-n-octyl phthalate		520 UJ	490 U	470 UJ	410 UJ	450 U	730 U	650 UJ	410 U	450 U	750 U	460 U	500 U	110 J	350 U	190 U	560 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	110 UJ
Dibenzo (a,h) Anthracene	33	520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	290 U
Diethylphthalate	603	520 U	490 U	470 U	410 UJ	450 U	730 U	650 UJ	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	290 U
Hexachlorocyclopentadiene		520 UJ	490 U	470 U	410 UJ	450 U	730 U	650 U	410 UL	450 UL	750 UL	460 UL	500 R	500 R	350 U	190 R	560 U
Indeno (1,2,3-cd) Pyrene	17	520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	250 J	120 J	190 U	34 J
N-Nitrosodiphenylamine	2680	520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	290 U
Naphthalene		520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	290 U
Pentachlorophenol	504	1300 UJ	1200 U	1200 U	1000 UJ	1100 UL	1800 U	1600 U	1000 UL	1100 UL	1900 U	1200 UL	970 U	970 U	670 U	370 U	560 U
Phenol	420	520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	560 U
Chrysne	166	520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	77 J	290 J	100 J	190 U	60 J
Fluoranthene		520 U	490 U	470 U	410 UJ	450 U	730 U	150 J	410 U	450 U	170 J	460 U	94 J	370 J	140 J	190 U	68 J
Phenanthrene	204	520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	110 J	350 U	190 U	290 U
Carbazole		520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 UL	450 UL	750 U	460 U	500 U	500 U	350 U	190 U	560 U
Pyrene	195	520 U	490 U	470 U	410 UJ	450 U	730 U	650 U	410 U	450 U	750 U	460 U	500 U	500 U	350 U	190 U	58 J

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
-- Not analyzed
B - Analyte also detected in blank

K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
UL - Not detected, quantitation limit is probably higher

+ - Value is for Benzo (b) fluoranthene and Benzo (k) fluoranthene

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level	SEDB															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Inorganics* (mg/kg)**																	
Aluminum		25900	29900	11400 L	1840 J	4330	16700	13200	1340	2270	18400	1730	19500 J	20600	12900	4600	9410
Antimony	2	0.59 U	0.85 J	1 UL	0.86 UJ	0.42 UJ	1.1 J	0.53 L	0.74 UJ	0.30 UJ	0.77 UL	0.57 R	0.67 UL	16.8 R	6.0 R	6.7 UL	9.0 U
Arsenic	9.8	3.9	4.8	2.8 L	0.86 UJ	0.79	5.0	1.7 J	0.69 U	0.65 U	4.2	0.76 UL	4.3	4.7	1.5 J	1.2	1.3 J
Barium		96.6	103	55.4 U	10.4 J	25.6	137	106	7.7	19.5	156	10.4	182	150	73.5	31.9	64.3
Beryllium		1	0.95	0.4 U	0.13 J	0.17	0.83	0.92	0.15 U	0.22 U	1.1	0.13 U	1.4 J	1.3 J	0.65 J	0.30 J	0.75 U
Cadmium	0.99	0.21	0.73	0.71 U	0.12 UJ	0.053 U	0.088 U	0.18	0.099 U	0.050 U	0.15 U	0.11 U	1.7 U	0.62 J	0.052 J	0.13 J	0.11 J
Calcium		696	786	644 UJ	137 UJ	347	2690	2940	108 J	734 J	2850 J	152	3560 J	2470	1600 J	506 J	1120
Chromium	43.4	26.3	29.6 J	11.9 L	3.6 J	8.7	20.8	15.3	2.4	4.0	27.2	5.0	26.9 J	25.5	17.3	7.2	12.6
Cobalt	50	12.3	18.7 J	11.1 L	4.1 J	5.7	18.4	10	2.2 J	6.1	23.6	6.4	15.9 J	15.0	11.0	4.5 J	5.2 J
Copper	31.6	12.9	14.2	7.7 L	1.8 J	3.8	16.3	17.2	1.4	3.4	24.8	6.4	31.3 J	28.8	16.6	5.6	7.7
Iron	20000	26400	29700 J	16500 L	2990 J	5910	22100	11300	2050	4090	22200	3050 J	18500 J	20000	11400	4510	7610
Lead	35.8	45	33 J	18 L	5.3 J	11.8	56.8	27.8	4.3 J	7.5	57.9	7.7 K	63.5 K	54.7	34.8 K	20.0 L	16.8
Magnesium		1050	1150 J	556 L	113 J	315	1620	1460	87.6 J	192 J	1880 J	146 U	2130	2030	1070	454 J	859
Manganese	460	186	179 J	103 L	24.1 J	46.5 J	418	170 L	13.6 J	37.8 J	302 L	22.9	281 J	284 K	99.7	38.6 J	108
Mercury	0.18	0.079 U	0.061 UJ	0.068 U	0.056 UJ	0.064 U	0.10 U	0.079	0.063 U	0.061 U	0.099 U	0.070 U	0.36 U	0.29 U	0.20 U	0.11 U	0.076 J
Nickel	22.7	13.1	16.7	8.5 L	3 J	5.1	17.2 J	15.2	1.9	3.9	24.6 J	3.2 J	23.4	22.3	14.6	5.8	7.9
Potassium		819	1090	411 L	72.7 J	192	838 J	737	46.4 J	83.2 J	885 J	54.5 J	879 J	708 J	505 J	201 J	439 J
Selenium	2	0.77 U	1.1 UJ	0.49 UL	1 UJ	1.1 UJ	1.9	1.9 L	0.55 UJ	0.63 U	3.0 L	0.73 UL	4.5 J	9.8 UL	1.7 J	0.95 J	0.90 J
Silver	1.0	0.21 U	0.2 U	0.37 U	0.3 UJ	0.053 U	0.22 U	0.19 U	0.074 U	0.13 U	0.18 U	0.32 U	3.5 U	0.35 U	2.0 U	1.1 U	1.5 U
Sodium		193 U	92	57.4 U	55.1 UJ	112	223 J	190	216 U	99.3	175 U	169 U	664 J	292 J	533 U	559 U	63.2 J
Thallium		0.56 U	1.7 U	1.2 L	0.93 UJ	1.2 UJ	1.7 U	0.80 U	0.89 U	0.81 U	1.5 U	0.78 U	8.6 U	7.0 U	5.1 U	2.8 U	3.8 U
Vanadium		48.5	58.2	22.4 L	4.6 J	9.8	46.4	27.0	3.7	6.3	48.7	5.9	49.7 J	44.9	29.2	12.3	18.5
Zinc	121	47.5	57.7	43.9 L	16.6 UJ	20.7	78.9	90.8	13.1 J	21.6	124	20.0	110 J	120	84.0	28.2	41.9
***Pesticides/Herbicides* (µg/kg)**																	
4,4'-DDD		6.3	4.9 U	4.7 U	4.1 UJ	4.5 U	7.3 U	--	--	--	--	--	9.7 U	2.5 J	6.8 U	3.7 U	3.3 U
4,4'-DDE		1.3 J	4.9 U	1.2 J	4.1 UJ	1.6 J	1.7 J	--	--	--	--	--	4.5 J	3.9 J	6.8 U	3.7 U	3.3 U
4,4'-DDT		5.2 U	4.9 U	4.7 U	4.1 UJ	4.5 U	7.3 U	--	--	--	--	--	9.7 U	9.7 U	6.8 U	3.7 U	3.3 U
Aldrin	2	2.7 U	2.5 U	2.4 U	2.1 UJ	2.3 U	3.8 U	--	--	--	--	--	5.0 U	5.0 U	3.5 U	1.9 U	1.7 U
alpha-BHC	6	2.7 U	2.5 U	2.4 U	2.1 UJ	2.3 U	3.8 U	--	--	--	--	--	5.0 U	5.0 U	3.5 U	1.9 U	1.7 U
Alpha-Chlordane		2.7 U	0.94 J	2.4 U	2.1 UJ	1.5 J	3.8 U	--	--	--	--	--	9.7 U	5.0 U	3.5 U	1.9 U	1.7 U
beta-BHC	5	2.7 U	2.5 U	2.4 U	2.1 UJ	2.3 U	1.2 J	--	--	--	--	--	5.0 U	9.7 J	3.2 J	1.0 J	1.7 U
delta-BHC	6400	2.7 U	2.5 U	2.4 U	2.1 UJ	2.3 U	3.8 U	--	--	--	--	--	5.0 U	5.0 U	3.5 U	1.9 U	1.7 U
Dieldrin	1.9	5.2 U	4.9 U	4.7 U	4.1 UJ	4.5 U	7.3 U	--	--	--	--	--	9.7 U	9.7 U	6.8 U	3.7 U	3.3 U
Endosulfan I	2.9	2.7 U	2.5 U	2.4 U	2.1 UJ	2.3 U	3.8 U	--	--	--	--	--	5.0 U	5.0 U	3.5 U	1.9 U	1.7 U
Endosulfan II	14	5.2 U	4.9 U	4.7 U	4.1 UJ	4.5 U	7.3 U	--	--	--	--	--	9.7 U	9.7 U	6.8 U	3.7 U	3.3 U
Endosulfan sulfate	5.4	5.2 U	4.9 U	4.7 U	4.1 UJ	6	7.3 U	--	--	--	--	--	9.7 U	9.7 U	6.8 R	3.7 U	3.3 U
Endrin	2.22	5.2 U	4.9 U	4.7 U	4.1 UJ	4.5 U	7.3 U	--	--	--	--	--	9.7 U	9.7 U	6.8 U	3.7 U	3.3 U
Endrin Aldehyde		5.2 U	4.9 U	4.7 U	4.1 UJ	4.5 U	1.7 J	--	--	--	--	--	9.7 U	9.7 U	6.8 U	3.7 U	3.3 U
Endrin Ketone		5.2 U	4.9 U	4.7 U	4.1 UJ	4.5 U	7.3 U	--	--	--	--	--	9.7 U	9.7 U	6.8 U	3.7 U	3.3 U
gamma-BHC (Lindane)	2.37	2.7 U	2.5 U	2.4 U	2.1 UJ	2.3 U	3.8 U	--	--	--	--	--	5.0 U	5.0 U	3.5 U	1.9 U	1.7 U
gamma-Chlordane		2.7 U	0.72 J	2.4 U	2.1 UJ	2.3 U	3.8 U	--	--	--	--	--	9.7 U	5.0 U	4.1 J	1.9 U	1.7 U
Heptachlor	68	2.7 U	2.5 U	2.4 U	2.1 UJ	2.3 U	3.8 U	--	--	--	--	--	5.0 U	5.0 U	3.5 U	1.9 U	1.7 U
Heptachlor Epoxide	2.47	2.7 U	2.5 U	2.4 U	2.1 UJ	2.3 U	3.8 U	--	--	--	--	--	5.0 U	1.3 JP	3.5 U	1.9 U	1.7 U
Methoxychlor	18.7	27 U	25 U	24 U	21 UJ	23 U	38 U	--	--	--	--	--	50	50	35 U	19 U	1.2 J
Toxaphene	0.1	--	--	--	210 UJ	230 U	380 U	--	--	--	--	--	500 U	500 U	350 U	190 U	170 U

U - Analyte was not detected above the reporting limit.

J - Estimated concentration.

-- Not analyzed.

N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.

K - Analyte present. May be biased High.

L - Analyte present. May be biased low

R - Data Rejected

P - Discrepency in GC analysis. Lower value reported.

S - Sample spike recovery is outside of control limits

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/kg	SEDC															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Semi-Volatiles* (µg/kg)**																	
1,1'-Biphenyl	1220	1400 U	470 U	790 UJ	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	1100 U
2,2'-oxybis (1-Chloropropane)		1400 U	470 UL	790 UJ	520 UL	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	--
2,4-Dimethylphenol	29	1400 U	470 UL	790 U	520 UJ	530 U	410 U	400 U	920 U	670 U	770 U	830 U	280 U	280 U	260 U	220 U	1100 U
2,4-Dinitrophenol		3600 UJ	1200 U	2000 UL	1300 UJ	1300 UL	1000 UL	1000 UL	2300 R	1700 UL	1900 U	2100 U	540 U	550 U	510 U	420 U	1100 U
2,6-Dinitrotoluene		1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	1100 U
2-Methylnaphthalene	20.2	1400 U	470 U	790 UJ	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	1100 U
2-Methylphenol		1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 U	670 U	770 U	830 U	280 U	280 U	260 U	220 U	2100 U
4,6-Dinitro-2-methylphenol		3600 UJ	1200 UL	2000 U	1300 UJ	1300 U	1000 UL	1000 U	2300 UL	1700 U	1900 UL	2100 U	2100 U	280 U	260 U	420 U	2100 U
4-Methylphenol	670	430 J	470 U	790 U	520 UJ	530 U	410 U	400 U	920 U	670 U	770 U	830 U	280 U	280 U	260 U	220 U	2100 U
Acetophenone		1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	170 J	280 U	260 U	220 U	2100 U
Atrazine	6.62	1400 U	470 U	790 UJ	520 UL	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 UJ	280 U	260 U	220 U	2100 U
Benzaldehyde		1400 UJ	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 UJ	280 UJ	260 U	220 UJ	2100 U
Benzo (a) anthracene	108	1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	80 J	70 J	220 U	130 J
Benzo (a) pyrene	150	1400 U	470 U	300 J	520 UJ	530 U	410 U	400 U	290 L	670 U	180 J	190 J	280 U	130 J	100 J	220 U	260 J
Benzo (b) Fluoranthene	27.2+	1400 U	470 U	440 J	520 UJ	530 U	410 U	400 U	410 L	190 J	280 J	330 J	280 U	240 J	240 J	220 U	750 J
Benzo (g,h,i) Perylene	170	1400 U	470 U	280 J	520 UJ	530 U	410 U	400 U	300 L	670 U	770 UL	230 J	280 U	120 J	100 J	220 U	340 J
Benzo (k) Fluoranthene	27.2+	1400 U	470 U	370 J	520 UJ	530 U	410 U	400 U	390 L	170 J	230 J	230 J	280 U	180 J	260 U	220 U	240 J
Bis(2-chloroethyl)Ether		1.4 U	0.64	7.9	2 UJ	2.1 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	2100 U
Bis(2-ethylhexyl)phthalate	180	420 J	470 U	470 J	520 UJ	530 U	410 U	99 J	920 UL	230 J	770 U	320 J	280 U	280 U	130 J	220 U	170 J
Caprolactam		1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 UJ	2100 U
Di-n-butyl phthalate	6470	1400 U	470 UL	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	1100 U
Di-n-octyl phthalate		1400 UJ	470 U	790 UJ	520 UJ	530 U	410 U	400 UJ	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	2100 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	430 UJ
Dibenzo (a,h) Anthracene	33	1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	1100 U
Diethylphthalate	603	1400 U	470 U	790 U	520 UJ	530 U	410 U	400 UJ	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	1100 U
Hexachlorocyclopentadiene		1400 UJ	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 UL	770 UL	830 UL	280 R	280 R	260 U	220 R	2100 U
Indeno (1,2,3-cd) Pyrene	17	1400 U	470 U	290 J	520 UJ	530 U	410 U	400 U	330 L	160 J	240 J	240 J	280 U	150 J	160 J	220 U	330 J
N-Nitrosodiphenylamine	2680	1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	1100 U
Naphthalene		1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	1100 U
Pentachlorophenol	504	3600 U	1200 U	2000 U	1300 UJ	1300 UL	1000 U	1000 U	2300 UL	1700 UL	1900 U	2100 UL	540 U	550 U	510 U	420 U	2100 U
Phenol	420	1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	280 U	260 U	220 U	2100 U
Chrysne	166	1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	420 L	180 J	240 J	270 J	49 J	190 J	160 J	220 U	360 J
Fluoranthene		1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	590 L	200 J	350 J	340 J	56 J	270 J	250 J	220 U	490 J
Phenanthrene	204	1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 U	770 U	830 U	280 U	72 J	54 J	220 U	1100 U
Carbazole		1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	920 UL	670 UL	770 U	830 U	280 U	280 U	260 U	220 U	2100 U
Pyrene	195	1400 U	470 U	790 U	520 UJ	530 U	410 U	400 U	490 L	260 J	240 J	300 J	280 U	310	260 U	220 U	450 J

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
-- Not analyzed
UL - Not detected, quantitation limit is probably higher

K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
B - Analyte detected in Method Blank

+ - Value is for Benzo (b) fluoranthene and Benzo (k) fluoranthene

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level	SEDC															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Inorganics* (mg/kg)**																	
Aluminum		15800	13600	16800	10600 J	6420	13500	5080	18500	16400	14700	19500	4740 J	8250	7970	2530	20200
Antimony	2	1.6 U	1 J	1.5 UL	1.1 UJ	0.51 UJ	0.28 UJ	0.27 R	2.3 UJ	0.90 UJ	0.74 UL	1 R	0.27 UL	0.49 L	6.0 R	7.5 UL	5.3 U
Arsenic	9.8	13.1	4.1	3.7	1.8 J	0.85	3.7	0.39 U	6.2	3.8	4.8	6.7 L	1.2 U	2.8	1.8	1.2 U	6.1
Barium		140	91.7	81.6	66.4 J	35	68.5	20.3	143	107	121	147	37.5	55.0	48.4	18.3 J	105
Beryllium		1	0.54	0.58 U	0.52 J	0.2	0.57	0.34	1.1	1.0 U	0.72	1.2	0.31 J	0.45 J	0.44 J	0.23 J	0.86
Cadmium	0.99	2.2	0.56	0.98 U	0.3 J	0.064 U	0.047 U	0.048 U	0.20 U	0.95 U	0.55	0.20 U	0.80 U	0.49 J	0.16 J	0.62 U	0.60
Calcium		3180	872	946 J	1200 J	657	163	221	2340 J	1310 J	2490 J	1480	742 J	1990	948 J	393 J	2220
Chromium	43.4	24.9	19.3 J	17.6	14.9 J	8.7	16.3	6.8	29.0	24.3	24.4	30.3	9.5 J	12.5	15.0	4.8	24.6
Cobalt	50	30.3	11.3 J	16.3	7.4 J	4.3	5.4	1.9	17.9 J	20.6	14.1	14	4.5 J	6.1 J	5.8 J	1.5 J	11.8
Copper	31.6	40.9	15.2	11.4	10.9 J	5.9	6.5	2.7	34.4	26.2	23.2	31.6	6.9 J	14.6	12.4	4.1	28.8
Iron	20000	30500	22600 J	24200	13200 J	8660	14700	5910	33400	25300	25000	36600 J	8470 J	12900	12600	3410	17600
Lead	35.8	90.6	57 J	26.2 J	23.5 J	11.8	10.2	4.3	79.3 J	57.0	49.7	74.3 K	12.6 K	28.3	24.9 K	6.6 L	39.6
Magnesium		1780	1100 J	819	1050 J	594	1440	416	2220 J	1620 J	1760 J	2050	559 J	940	2260	259 J	1690
Manganese	460	671	157 J	150 K	126 J	64.8 J	61.4	42.3 L	374 J	199 J	232 L	210	131 J	171 K	154	30.4 J	335
Mercury	0.18	0.21 U	0.074 UJ	0.095 U	0.063 UJ	0.067 U	0.060 U	0.049 U	0.14 U	0.10 U	0.080 U	0.28	0.17 U	0.17 U	0.15 U	0.13 U	0.22
Nickel	22.7	25.4	11.7	12.6	12.6 J	9	8.8 J	5.1	24.6	23.4	24.5 J	22.2 J	9.3	10.5	32.6	3.6 J	19.4
Potassium		939	649	605	493 J	319	445 J	216	690 J	661 J	600 J	603 J	198 J	319 J	305 J	100 J	991
Selenium	2	2.1	1.1 UJ	0.91 UL	1.3 UJ	1.4 UJ	0.78 U	0.44 UL	1.1 UJ	0.94 U	1.0 L	1.3 UL	1.0 J	5.6 UL	5.3 U	0.64 J	1.8 J
Silver	1.0	0.56 U	0.19 U	0.55 U	0.37 UJ	0.064 U	0.12 U	0.12 U	0.15 U	0.19 U	0.21 U	0.60 U	1.6 U	0.18 U	1.5 U	1.2 U	0.89 U
Sodium		366	111	94.2 U	67.9 UJ	86.3	71.3 U	40.4 U	293 U	166	142 U	162 U	191 J	161 J	500 U	622 U	372 J
Thallium		1.5 U	1.7 U	3.4	1.1 UJ	1.4 UJ	0.92 U	0.51 U	1.8 U	1.2 U	1.5 U	1.4 U	4.0 U	4.0 U	3.8 U	3.1 U	2.2 U
Vanadium		59.3	43.9	33	21.4 J	13.8	27.6	9.6	44.7	36.3	35.6	46.5	12.6 J	18.7	18.6	6.6	41.1
Zinc	121	398	42.6	64.3 J	74.7 J	32.1	25.2	10.2	258 J	176	163	131	36.2 J	86.1	74.0	13.3	117
***Pesticides/Herbicides* (µg/kg)**																	
4,4'-DDD		14 U	4.7 U	7.9 U	5.2 UJ	5.3 U	4.1 U	--	--	--	--	--	5.4 U	5.5 U	5.1 U	4.2 U	3.2 U
4,4'-DDE		14 U	1.4 J	7.9 U	5.2 UJ	5.3 U	4.1 U	--	--	--	--	--	5.4 U	2.2 J	5.1 U	4.2 U	2.8 J
4,4'-DDT		14 U	4.7 U	7.9 U	5.2 UJ	5.3 U	4.1 U	--	--	--	--	--	5.4 U	5.5 U	5.1 U	4.2 U	2.3 J
Aldrin	2	7.4 U	2.4 U	4 U	2.7 UJ	2.7 U	2.1 U	--	--	--	--	--	2.8 U	2.8 U	2.6 U	2.2 U	1.7 U
alpha-BHC	6	7.4 U	2.4 U	4 U	2.7 UJ	2.7 U	2.1 U	--	--	--	--	--	2.8 U	2.8 U	2.6 U	2.2 U	1.7 U
Alpha-Chlordane		6 J	2.4 U	4.3 J	2.7 UJ	2.7 U	2.1 U	--	--	--	--	--	5.4 U	4.9 JN	1.2 JN	2.2 U	1.9
beta-BHC	5	7.4 U	2.4 U	4 U	2.7 UJ	2.7 U	2.1 U	--	--	--	--	--	2.8 U	6.7 J	2.6 U	2.2 U	1.7 U
delta-BHC	6400	7.4 U	2.4 U	4 U	2.7 UJ	2.7 U	2.1 U	--	--	--	--	--	2.8 U	2.8 U	2.6 U	2.2 U	1.7 U
Dieldrin	1.9	14 U	4.7 U	7.9 U	5.2 UJ	5.3 U	4.1 U	--	--	--	--	--	5.4 U	5.5 U	5.1 U	4.2 U	3.2 U
Endosulfan I	2.9	7.4 U	2.4 U	4 U	2.7 UJ	2.7 U	2.1 U	--	--	--	--	--	2.8 U	2.8 U	2.6 U	2.2 U	1.7 U
Endosulfan II	14	14 U	4.7 U	7.9 U	5.2 UJ	5.3 U	4.1 U	--	--	--	--	--	5.4 U	5.5 U	5.1 U	4.2 U	3.2 U
Endosulfan sulfate	5.4	14 U	4.7 U	7.9 U	5.2 UJ	5.3 U	4.1 U	--	--	--	--	--	5.4 U	5.5 U	1.3 L	4.2 U	4.9 JN
Endrin	2.22	14 U	4.7 U	7.9 U	5.2 UJ	5.3 U	4.1 U	--	--	--	--	--	5.4 U	5.5 U	5.1 U	4.2 U	1.7 J
Endrin Aldehyde		14 U	4.7 U	7.9 U	5.2 UJ	5.3 U	4.1 U	--	--	--	--	--	5.4 U	5.5 U	5.1 U	4.2 U	3.2 U
Endrin Ketone		3.4 J	4.7 U	3.2 J	5.2 UJ	5.3 U	4.1 U	--	--	--	--	--	5.4 U	5.5 U	5.1 U	4.2 U	3.2 U
gamma-BHC (Lindane)	2.37	7.4 U	2.4 U	4 U	2.7 UJ	2.7 U	2.1 U	--	--	--	--	--	2.8 U	2.8 U	2.6 U	2.2 U	1.7 U
gamma-Chlordane		7.4 U	2.4 U	4 U	2.7 UJ	2.7 U	2.1 U	--	--	--	--	--	5.4 U	5.5 U	1.6 JN	2.2 U	1.7 U
Heptachlor	68	7.4 U	2.4 U	4 U	2.7 UJ	2.7 U	2.1 U	--	--	--	--	--	2.8 U	2.8 U	2.6 U	2.2 U	1.7 U
Heptachlor Epoxide	2.47	7.4 U	2.4 U	4 U	2.7 UJ	2.7 U	2.1 U	--	--	--	--	--	2.8 U	2.8 U	2.6 U	2.2 U	1.7 U
Methoxychlor	18.7	74 U	24 U	40 U	27 UJ	27 U	21 U	--	--	--	--	--	28 U	28 U	26 U	22 U	17 U
Toxaphene	0.1	--	--	--	270 UJ	270 U	210 U	--	--	--	--	--	280 U	280 U	260 U	220 U	170 U

U - Analyte was not detected above the reporting limit.

J - Estimated concentration.

-- Not analyzed.

N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.

K - Analyte present. May be biased High.

L - Analyte present. May be biased low

R - Data Rejected

P - Discrepency in GC analysis. Lower value reported.

S - Sample spike recovery is outside of control limits

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/kg	SEDD															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Semi-Volatiles* (µg/kg)**																	
1,1'-Biphenyl	1220	570 U	1000 U	920 UJ	940 UJ	750 U	700 U	700 U	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 U	580 U
2,2'-oxybis (1-Chloropropane)		570 U	1000 UL	920 UJ	940 UL	750 U	700 U	700 U	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 U	--
2,4-Dimethylphenol	29	570 U	1000 UL	920 U	940 UJ	750 U	700 U	700 U	920 U	850 U	790 U	730 U	590 U	450 U	400 U	370 U	580 U
2,4-Dinitrophenol		1400 UJ	2600 U	2300 UL	2400 UJ	1900 UL	1800 UL	1800 UL	2300 R	2100 UL	2000 U	1800 U	1100 U	870 U	780 U	720 U	1100 U
2,6-Dinitrotoluene		570 U	1000 U	920 U	940 UJ	750 U	700 U	700 U	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 U	580 U
2-Methylnaphthalene	20.2	570 U	1000 U	920 UJ	940 UJ	750 U	700 U	700 U	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 U	580 U
2-Methylphenol		570 U	1000 U	920 U	940 UJ	750 U	700 U	700 U	920 U	850 U	790 U	730 U	590 U	450 U	400 U	370 U	1100 U
4,6-Dinitro-2-methylphenol		1400 UJ	2600 UL	2300 U	2400 UJ	1900 U	1800 UL	1800 U	2300 UL	2100 U	2000 UL	1800 U	1100 U	870 U	780 U	720 U	1100 U
4-Methylphenol	670	570 U	1000 U	920 U	940 UJ	750 U	700 U	700 U	920 U	850 U	790 U	730 U	590 U	450 U	400 U	370 U	1100 U
Acetophenone		570 U	1000 U	920 U	940 UJ	750 U	700 U	700 U	1200 L	850 U	790 U	730 U	320 J	450 U	400 U	370 U	1100 U
Atrazine	6.62	570 U	1000 U	920 UJ	940 UL	750 U	700 U	700 U	920 UL	850 U	790 U	730 U	590 UJ	450 U	400 U	370 U	1100 U
Benzaldehyde		570 UJ	1000 U	920 U	940 UJ	750 U	700 U	700 U	920 UL	850 U	790 U	730 U	140 J	450 UJ	150 J	130 J	1100 U
Benzo (a) anthracene	108	570 U	1000 U	920 U	300 J	470 J	700 U	430 J	250 L	850 U	280 J	260 J	210 J	750	400 J	270 J	500 J
Benzo (a) pyrene	150	570 U	1000 U	330 J	550 J	730 J	190 J	850	410 L	190 J	490 J	420 J	350 J	1200	690	430	860
Benzo (b) Fluoranthene	27.2+	570 U	1000 U	460 J	730 J	1200	300 J	1500	680 L	330 J	700 J	700 J	810 K	2000	1400	1000	1900
Benzo (g,h,i) Perylene	170	570 U	1000 U	350 J	590 J	880	700 U	870	920 UL	850 U	260 L	420 J	230 J	1100	680	530	920
Benzo (k) Fluoranthene	27.2+	570 UJ	1000 U	450 J	680 J	820	230 J	890	470 L	220 J	640 J	430 J	870 K	1400	450	270 J	640
Bis(2-chloroethyl)Ether		0.57 U	1.5	6.8	3.7 UJ	3 U	700 U	700 U	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 U	1100 U
Bis(2-ethylhexyl)phthalate	180	570 U	1000 U	410 J	390 J	750 U	160 J	520 J	1200 UL	270 J	790 U	360 J	260 J	1100 U	280 J	120 J	250 J
Caprolactam		570 U	1000 U	920 U	940 UJ	750 U	700 U	700 U	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 UJ	1100 U
Di-n-butyl phthalate	6470	570 U	1000 UL	920 U	940 UJ	750 U	700 U	700 U	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 U	580 U
Di-n-octyl phthalate		570 UJ	1000 U	920 UJ	940 UJ	750 UL	700 U	700 UJ	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 UJ	1100 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	230 UJ
Dibenzo (a,h) Anthracene	33	570 U	1000 U	920 U	940 UJ	200 J	700 U	330 J	920 UL	850 U	180 J	730 U	590 U	300 J	140 J	130 J	580 U
Diethylphthalate	603	570 U	1000 U	920 U	940 UJ	750 U	700 U	700 UJ	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 U	580 U
Hexachlorocyclopentadiene		570 UJ	1000 U	920 U	940 UJ	750 U	700 U	700 U	920 R	850 UL	790 UL	730 UL	590 R	450 R	400 R	370 R	1100 U
Indeno (1,2,3-cd) Pyrene	17	570 U	1000 U	320 J	580 J	840	700 U	1100	430 L	240 J	630 J	460 J	310 J	1600	1100	680	870
N-Nitrosodiphenylamine	2680	570 U	1000 U	920 U	940 UJ	750 U	700 U	700 U	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 U	580 U
Naphthalene		570 U	1000 U	920 U	940 UJ	750 U	700 U	700 U	920 UL	850 U	790 U	730 U	590 U	450 U	400 U	370 U	580 U
Pentachlorophenol	504	1400 U	2600 U	2300 U	2400 UJ	1900 U	1800 U	1800 U	2300 U	2100 UL	2000 U	1800 UL	1100 U	870 U	780 U	720 U	1100 U
Phenol	420	570 U	1000 U	920 U	940 UJ	750 U	700 U	700 U	920 U	850 U	790 U	730 U	590 U	450 U	400 U	370 U	1100 U
Chrysne	166	570 U	1000 U	920 U	680 J	990	240 J	1100	610 L	300 J	590 J	520 J	450 J	1600	790	530	1200
Fluoranthene		570 U	1000 U	920 U	1000 J	1400	360 J	1400	920 L	380 J	980	740	540 J	1800	1300	710	1600
Phenanthrene	204	570 U	1000 U	920 U	330 J	410 J	700 U	440 J	260 L	850 U	310 J	200 J	210 J	710	310 J	190 J	410 J
Carbazole		570 U	1000 U	920 U	940 UJ	750 U	700 U	700 U	920 UL	850 UL	790 U	730 U	590 U	450 U	400 U	370 U	1100 U
Pyrene	195	570 U	1000 U	920 U	800 J	1400	260 J	1200	740 L	420 J	640 J	630 J	590 U	2300	1100	640	1500

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
-- Not analyzed
UL - Not detected, quantitation limit is probably higher

K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
B - Analyte detected in Method Blank

+ - Value is for Benzo (b) fluoranthene and Benzo (k) fluoranthene

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level	SEDD															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Inorganics* (mg/kg)**																	
Aluminum		15800	28400	26900	24000 J	22600	24700	27300	16300	20500	17300	16700	15100 J	19500	30400	16300	15800
Antimony	2	0.65 U	1.7 J	2 UL	2 UJ	1.4 UJ	1.4 J	0.95 L	2.5 UJ	1.2 UJ	1.1 L	0.96 R	0.60 UL	1.0 L	6.0 R	13.1 UL	4.6 U
Arsenic	9.8	7.9	11.8	9.9	11.5 J	10.7	8.1	11.0	9.4	10.8	10.6	10.6 L	8.6	9.8	7.0	9.1	6.2
Barium		119	194	165	170 J	183	196	176	127	159	152	144	145	154	195	129	176
Beryllium		1	1.4	1.2 U	1.4 J	0.81	1.1	1.6	1.2	1.5 U	1.0	1.2	1.3 J	1.3 J	1.7	1.2	0.70
Cadmium	0.99	0.44	2.7	2.9 U	1.5 J	1	0.57	0.7	0.31 U	1.9 U	0.87	1.4	0.29 J	1.4	1.2	2.2	0.62
Calcium		889	2000	2420 J	4310 J	3560	2370	3200	1470 J	2200 J	2680 J	2370	1620 J	2270	1510 J	1390	2980
Chromium	43.4	19.1	42.4 J	39.4	38.6 J	37.1	34.4	41.7	27.8	33.8	30.7	30.9	27.5 J	33.2	47.4	30.7	24.7
Cobalt	50	14.7	36.8 J	18.6	17.3 J	19.3	14.6	17.6	15.4 J	20.1	14.7	12.7	13.4 J	16.1	16.3	14.5	15.0
Copper	31.6	14.5	42.8	40.1	40.5 J	36.6	27.8	40.5	37.6	43.4	36.3	42.2	37.8 J	42.3	44.6	30.5	26.8
Iron	20000	20900	46500 J	39500	41400 J	38800	38200	41500	30100	32500	36900	30400 J	27800 J	37000	39200	26600	29100
Lead	35.8	32.2	152 J	97.6 J	110 J	89.9	87.3	105	88.3 J	111	84.8	92.7 K	85.8 K	89.5	130 K	88.3 L	33.7
Magnesium		1620	2840 J	2820	2950 J	3110	2870	3490	2000 J	2520 J	2410 J	2310	1920	2490	3440	2270	1870
Manganese	460	355	404 J	442 K	636 J	1390 J	568	867 L	300 J	373 J	569 L	368	270 J	451 K	311	269 J	456
Mercury	0.18	0.2 U	0.14 UJ	0.13 U	0.12 J	0.15	0.092 U	0.17	0.14 U	0.13	0.18	0.22	0.34 U	0.15 J	0.17 J	0.076 J	0.11
Nickel	22.7	14.8	34.2	30.4	31.8 J	31.2	24.7 J	33.4	24.2	28.6	26.3 J	27.0 J	22.7	26.1	37.2	28.8	19.7
Potassium		557	1200	1180	1220 J	1330 UJ	1830 J	1530	671 J	985 J	806 J	661 J	697 J	757 J	1160 J	649 J	986
Selenium	2	0.85 U	2.4 UJ	2.6 UL	2.5 UJ	2 UJ	2.4	0.75 UL	1.2 UJ	1.3 U	0.98 UL	2.1 L	2.9 J	9.2 UL	1.8 J	1.7 J	0.73 J
Silver	1.0	0.23 U	0.42 U	0.75 U	0.71 UJ	0.091 U	0.20 U	0.21 U	0.17 U	0.26 U	0.19 U	0.54 U	3.3 U	2.6 U	2.4 U	2.2 U	0.76 U
Sodium		210 U	254	476 U	221 J	194	176 U	209	344 U	260	178 U	447	410 J	325 J	580 U	263 J	204 J
Thallium		0.62 U	3.8 U	4.9	2.2 UJ	2.1 UJ	1.6 U	0.87 U	2.0 U	1.6 U	1.6 U	1.8 U	8.2 U	6.5 U	5.9 U	2.5 J	1.9 U
Vanadium		31.9	79.8	61.4	63.7 J	60.1	60.2	66.7	53.3	59.2	50.4	53.0	49.5 J	54.3	73.2	47.9	33.0
Zinc	121	117	310	330 J	283 J	272	158	294	282 J	313	270	335	232 J	271	315	269	184
***Pesticides/Herbicides* (µg/kg)**																	
4,4'-DDD		5.7 U	10 U	2.5 J	9.4 UJ	7.5 U	7.0 U	--	--	--	--	--	5.6 J	4.3 J	5.6 J	4.9 J	1.3 J
4,4'-DDE		5.7 U	10 U	9.2 U	3.3 J	7.5 U	2.6 J	--	--	--	--	--	7.2 J	5.0 J	3.2 JN	3.6 J	1.8 J
4,4'-DDT		5.7 U	8.4 J	2.8 J	9.4 UJ	7.5 U	7.0 U	--	--	--	--	--	11 U	8.7 U	5.8 J	4.4 J	3.6 J
Aldrin	2	2.9 U	1.7 J	4.7 U	4.9 UJ	3.9 U	3.6 U	--	--	--	--	--	1.8 J	4.5 U	4.0 U	3.7 U	1.7 U
alpha-BHC	6	2.9 U	5.3 U	4.7 U	4.9 UJ	3.9 U	3.6 U	--	--	--	--	--	5.9 U	4.5 U	4.0 U	3.7 U	1.7 U
Alpha-Chlordane		2.9 U	3 J	8.8 J	8.1 J	13 JN	3.2 U	--	--	--	--	--	7.3 JN	14 JN	8.5 JN	7.0 J	2.8
beta-BHC	5	2.9 U	5.3 U	4.7 U	9.1 JN	3.9 U	3.6 U	--	--	--	--	--	5.9 U	16 J	4.0 U	3.7 U	1.7 U
delta-BHC	6400	2.9 U	5.3 U	4.7 U	4.9 UJ	3.9 U	3.6 U	--	--	--	--	--	5.9 U	4.5 U	4.0 U	3.7 U	1.7 U
Dieldrin	1.9	5.7 U	7.2 J	3.7 J	3.7 J	11 J	7.0 U	--	--	--	--	--	4.8 J	8.7 U	7.3 J	1.9 J	4.5 JN
Endosulfan I	2.9	2.9 U	5.3 U	4.7 U	4.9 UJ	3.9 U	3.6 U	--	--	--	--	--	5.9 U	4.5 U	4.0 U	3.7 U	1.7 U
Endosulfan II	14	5.7 U	10 U	9.2 U	9.4 UJ	7.5 U	7.0 U	--	--	--	--	--	11 U	8.7 U	4.0 U	7.2 U	3.3 U
Endosulfan sulfate	5.4	5.7 U	10 U	9.2 U	9.4 UJ	7.5 U	7.0 U	--	--	--	--	--	11 U	8.7 U	7.7 R	7.2 U	3.3 U
Endrin	2.22	5.7 U	7.9 J	9.2 U	9.4 UJ	7.5 U	7.0 U	--	--	--	--	--	11 U	8.7 U	7.7 U	7.2 U	3.3 U
Endrin Aldehyde		5.7 U	10 U	9.2 U	9.4 UJ	7.5 U	3.3 J	--	--	--	--	--	11 U	8.7 U	4.0 U	7.2 U	3.3 U
Endrin Ketone		5.7 U	10 U	9.2 U	9.4 UJ	7.7 JN	7.0 U	--	--	--	--	--	11 U	8.7 U	2.8 J	7.2 U	3.3 U
gamma-BHC (Lindane)	2.37	2.9 U	4.1 J	4.7 U	4.9 UJ	3.9 U	3.6 U	--	--	--	--	--	5.9 U	4.5 U	4.0 U	3.7 U	1.5 J
gamma-Chlordane		2.9 U	2.1 J	5.4 JN	4.9 UJ	6.1 J	2.2 J	--	--	--	--	--	8.4	8.7 U	14 J	7.7	1.7 JN
Heptachlor	68	2.9 U	3.8 J	4.7 U	4.9 UJ	3.9 U	3.6 U	--	--	--	--	--	5.9 U	1.9 J	4.0 U	3.7 U	1.7 U
Heptachlor Epoxide	2.47	2.9 U	5.3 U	2.6 JN	4.9 UJ	3.9 U	3.6 U	--	--	--	--	--	5.9 U	4.5 U	3.4 J	3.7 U	0.71 J
Methoxychlor	18.7	29 U	53 U	47 U	49 UJ	12 J	36 U	--	--	--	--	--	59 U	45 U	40 U	37 U	17 U
Toxaphene	0.1	--	--	--	490 UJ	390 U	360 U	--	--	--	--	--	590 U	450 U	400 U	370 U	170 U

U - Analyte was not detected above the reporting limit.

J - Estimated concentration.

-- Not analyzed.

N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.

K - Analyte present. May be biased High.

L - Analyte present. May be biased low

R - Data Rejected

P - Discrepency in GC analysis. Lower value reported.

S - Sample spike recovery is outside of control limits

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/kg	SEDE															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Semi-Volatiles* (µg/kg)**																	
1,1'-Biphenyl	1220	690 U	630 U	750 UJ	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	370 U
2,2'-oxybis (1-Chloropropane)		690 U	630 UL	750 UJ	690 UL	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	--
2,4-Dimethylphenol	29	690 U	630 UL	750 U	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	370 U
2,4-Dinitrophenol		1700 UJ	1600 U	1900 UL	1700 UJ	3000 UL	1400 R	1900 UL	2400 R	1300 UL	1600 UL	1600 U	690 U	930 U	670 U	520 U	710 U
2,6-Dinitrotoluene		690 U	630 U	750 U	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	370 U
2-Methylnaphthalene	20.2	690 U	630 U	750 UJ	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	370 U
2-Methylphenol		690 U	630 U	750 U	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	710 U
4,6-Dinitro-2-methylphenol		1700 UJ	1600 UL	1900 U	1700 UJ	3000 U	1400 UL	1900 U	2400 UL	1300 U	1600 UL	1600 U	690 U	480 U	350 U	520 U	710 U
4-Methylphenol	670	690 U	630 U	750 U	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	710 U
Acetophenone		690 U	630 U	750 U	690 UJ	1200 U	540 U	700 U	970 U	520 U	630 U	650 U	150 J	480 U	350 U	270 U	710 U
Anthracene		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	78 J
Atrazine	6.62	690 U	630 U	750 UJ	690 UL	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 UJ	480 U	350 U	270 U	710 U
Benzaldehyde		690 UJ	630 U	750 U	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 UJ	170 J	350 U	270 UJ	710 U
Benzo (a) anthracene	108	690 U	630 U	750 U	420 J	710 J	540 U	680 J	770 J	520 U	300 J	410 J	470	1100	530	84 J	980
Benzo (a) pyrene	150	180 J	630 U	630 J	750 J	1100 J	120 J	1200	1300	110 J	480 J	660	850	1800	970	120 J	1400
Benzo (b) Fluoranthene	27.2+	220 J	630 U	860	1100 J	2100 J	170 J	1800	2000	160 J	830	890	2300 K	2900	2200	240 J	2800
Benzo (g,h,i) Perylene	170	190 J	630 U	570 J	720 J	1400	540 U	1200	1200	130 J	370 L	640 J	510	1700	920	150 J	1200
Benzo (k) Fluoranthene	27.2+	200 J	630 U	770	850 J	1300 J	160 J	1500	1300	140 J	480 J	800	2500 K	2200	590	96 J	870
Bis(2-chloroethyl)Ether		0.69 U	0.66	5.2	2.7 UJ	4.6 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	50 J
Bis(2-ethylhexyl)phthalate	180	470 J	250 J	240 J	410 J	2300 U	120 J	750 J	1200 U	110 J	630 U	190 J	230 J	1100 U	240 J	270 UJ	260 J
Caprolactam		690 U	630 U	750 U	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 UJ	710 U
Di-n-butyl phthalate	6470	690 U	630 UL	750 U	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	370 U
Di-n-octyl phthalate		690 UJ	630 U	750 UJ	690 UJ	1200 U	540 U	770 UJ	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 UJ	710 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	140 UJ
Dibenzo (a,h) Anthracene	33	690 U	630 U	750 U	180 J	280 J	540 U	470 J	450 J	520 U	130 J	190 J	220 J	500	210 J	270 U	320 J
Diethylphthalate	603	690 U	630 U	750 U	690 UJ	1200 U	540 U	770 UJ	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	370 U
Hexachlorocyclopentadiene		690 UJ	630 U	750 U	690 UJ	1200 U	540 U	770 U	970 UL	520 UL	630 UL	650 UL	350 R	480 R	350 U	270 R	710 U
Indeno (1,2,3-cd) Pyrene	17	200 J	630 U	560 J	730 J	1300	110 J	1500	970 U	130 J	390 J	720	760	2400	1400	170 J	1200
N-Nitrosodiphenylamine	2680	690 U	630 U	750 U	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	370 U
Naphthalene		690 U	630 U	750 U	690 UJ	1200 U	540 U	770 U	970 U	520 U	630 U	650 U	350 U	480 U	350 U	270 U	370 U
Pentachlorophenol	504	1700 U	1600 U	1900 U	1700 UJ	3000 U	1400 U	1900 U	2400 UL	1300 UL	1600 U	1600 UL	690 U	930 U	670 U	520 U	710 U
Phenol	420	690 U	630 U	750 U	690 UJ	1200 U	540 U	770 U	970 U	520 U	140 J	650 U	350 U	480 U	350 U	270 U	710 U
Chrysne	166	690 U	630 U	750 U	940 J	1800 J	140 J	1500	1700	150 J	660	780	1100	2300	1100	160 J	2000
Fluoranthene		690 U	630 U	750 U	1400 J	2100	230 J	2000	2600	200 J	1200	1200	1200	2400	1800	240 J	2500
Phenanthrene	204	690 U	630 U	750 U	420 J	670 J	540 U	680 J	850 J	520 U	370 J	370 J	380	830	420	58 J	730
Carbazole		690 U	630 U	750 U	690 UJ	1200 U	540 U	180 J	970 UL	520 UL	630 U	650 U	350 U	480 U	98 J	270 U	140 J
Pyrene	195	690 U	630 U	750 U	1100 J	2300	180 J	1800	2100	240 J	710	980	1200	3200	1500	200 J	2600

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
-- Not analyzed
UL - Not detected, quantitation limit is probably higher

K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
B - Analyte detected in Method Blank

+ - Value is for Benzo (b) fluoranthene and Benzo (k) fluoranthene

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level	SEDE															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Inorganics* (mg/kg)**																	
Aluminum		22000	22500	22700	20700 J	14100	13000	20500	21700	11000	27400	14900	14300 J	18900	15200	13100	15700
Antimony	2	0.78 U	1.2 J	1.6 UL	1.5 UJ	1.8 UJ	1 J	0.66 L	2.3 UJ	0.67 UJ	0.82 L	0.78 R	12.6 UL	1.1 L	6.0 R	9.5 UL	11.7 U
Arsenic	9.8	7.7	7.8	10.4	11 J	7.4	6.1	8.3	9.7	4.3	8.7	8.4 L	9.0	8.9	6.1	5.5	5.9
Barium		127	142	167	164 J	170	106	164	190	91.1	189	146	143	152	132	99.5	114
Beryllium		1.1	0.9	1.1 U	1.1 J	0.57	0.75	1.3	1.5	0.89 U	1.3	0.96	1.1	1.1 J	0.92 J	0.87	0.97 U
Cadmium	0.99	1.1	1.6	2.6 U	1.3 J	0.92	0.2	0.57	0.37 U	0.43 U	0.91	0.5	1.1 U	1.6	0.62 J	0.52 J	0.51 J
Calcium		1300	1420	1700 J	2510 J	9540	2050	3690	2560 J	2250 J	2120 J	3090	2180 J	3200	4810 J	1880	3000
Chromium	43.4	35.8	36 J	40.2	37.2 J	26.2	19.6	36.0	45.5	17.9	42.8	29.7	29.4 J	35.3	26.9	22.1	28.6
Cobalt	50	10.1	10.6 J	10.6 U	14.6 J	14.6	10.6	13	17.0 J	6.9	20.8	10.9	13.3	13.6 J	10.9	8.2	8.7 J
Copper	31.6	31.5	32.1	40.5	37.6 J	32.2	16.4	36.3	52.3	18.4	39.0	33.2	35.2 J	45.2	30.2	17.4	29.6
Iron	20000	25500	27500 J	40000	38500 J	29800	19100	34800	37700	16800	36000	31300 J	38100 J	32200	25700	20100	24000
Lead	35.8	80	80.8 J	84.3 J	74.4 J	59.6	74.7	66.5	94.9 J	54.0	101	61.0 K	58.8 K	87.3	61.8 K	56.2 L	52.9
Magnesium		2910	2650 J	2810	2700 J	2190	1690	3100	3360 J	1500 J	3400 J	2390	2200	2720	2180	2000	2130
Manganese	460	199	262 J	426 K	835 J	2570 J	310	1100 L	544 J	210 J	467 L	1260	748 J	477 K	723	377 J	421
Mercury	0.18	0.1 U	0.18 UJ	0.14	0.1 J	0.14 U	0.12	0.12	0.15 U	0.074 U	0.14	0.11 U	0.21 U	0.21 J	0.087 J	0.16 U	0.12 J
Nickel	22.7	35.3	24.1	30.4	30.7 J	22.5	16 J	28.1	37.6	14.6	29.2 J	24.2 J	23.5	29.3	21.1	16.0	16.0
Potassium		950	1220	1070	957 J	1380	751 J	1100	1030 J	706 J	1350 J	519 J	348 J	777 J	1110	1100	988
Selenium	2	1.4	1.4 UJ	1.1 UL	1.8 UJ	3 UJ	2.0	0.81 L	1.3 UJ	0.76 U	0.79 UL	1.0 UL	2.4 J	9.9 UL	1.2 J	1.1 J	1.9 J
Silver	1.0	0.27 U	0.25U	0.6 U	0.52 UJ	0.14 U	0.15 U	0.23 U	0.17 U	0.15 U	0.15 U	0.45 U	2.1 U	0.31 U	0.24 J	1.6 U	1.9 U
Sodium		254	197	229 U	200 J	415	111 U	297	392 U	283	195 U	287	487 J	386 J	506 U	143 J	67.2 J
Thallium		0.74 U	2.2U	6.7	1.6 UJ	3.2 UJ	1.2 U	0.95 U	2.1 U	0.98 U	1.3 U	1.1 U	5.3 U	7.1 U	4.8 U	2.0 J	4.9 U
Vanadium		54.8	56.5	58.9	55.1 J	40.8	42.9	53.2	67.8	33.4	68.7	46.4	48.0 J	56.6	43.3	40.6	39.1
Zinc	121	212	229	307 J	295 J	272	80.2	272	456 J	92.8	290	254	222 J	311	190	94.9	192
***Pesticides/Herbicides* (µg/kg)**																	
4,4'-DDD		6.9 U	6.3 U	7.5 U	6.9 UJ	2.9 JP	5.4 U	--	--	--	--	--	2.9 J	4.2 J	3.2 JN	5.2 U	1.9 J
4,4'-DDE		6.9 U	6.3 U	7.5 U	6.9 UJ	12 U	12	--	--	--	--	--	1.9 JN	4.6 J	2.1 JN	3.2 J	1.6 J
4,4'-DDT		6.9 U	6.3 U	7.5 U	6.9 UJ	4.1 JP	8.7 J	--	--	--	--	--	5.3 J	9.3 U	4.9 JN	3.6 J	2.8 J
Aldrin	2	3.5 U	3.3 U	2.6 JN	4.4 J	6.1 U	2.8 U	--	--	--	--	--	1.4 J	2.9 J	3.5 U	2.7 U	1.7 U
alpha-BHC	6	3.5 U	3.3 U	3.9 U	3.5 UJ	6.1 U	2.8 U	--	--	--	--	--	3.5 U	9.3 JN	3.5 U	2.7 U	1.7 U
Alpha-Chlordane		4.5	3 J	9.7	15 J	22 JP	2.8 U	--	--	--	--	--	11 J	22 JN	9.4	2.7 U	3.1
beta-BHC	5	3.5 U	3.3 U	3.9 U	6.9 UJ	6.1 U	2.8 U	--	--	--	--	--	3.5 U	9.3 P	3.5 U	2.7 U	1.7 U
delta-BHC	6400	3.5 U	3.3 U	3.9 U	3.5 UJ	6.1 U	2.8 U	--	--	--	--	--	3.5 U	4.8 U	3.5 U	2.7 U	1.7 U
Dieldrin	1.9	6.9 U	6.3 U	2.4 J	4.9 J	12 U	5.4 U	--	--	--	--	--	6.2 J	9.3 U	14	5.2 U	3.3 U
Endosulfan I	2.9	3.5 U	3.3 U	3.9 U	3.5 UJ	6.1 U	2.8 U	--	--	--	--	--	3.5 U	4.8 U	2.0 J	2.7 U	1.7 U
Endosulfan II	14	6.9 U	6.3 U	7.5 U	6.9 UJ	12 U	5.4 U	--	--	--	--	--	6.9 U	2.9 J	3.5 U	5.2 U	3.3 U
Endosulfan sulfate	5.4	6.9 U	6.3 U	7.5 U	6.9 UJ	12 U	5.4 U	--	--	--	--	--	6.9 U	4.6 U	6.7 R	3.0 J	3.3 U
Endrin	2.22	6.9 U	6.3 U	7.5 U	6.9 UJ	12 U	5.4 U	--	--	--	--	--	6.9 U	9.3 U	6.7 U	5.2 U	3.3 U
Endrin Aldehyde		6.9 U	6.3 U	7.5 U	6.9 UJ	12 U	5.4 U	--	--	--	--	--	6.9 U	9.3 U	6.7 U	5.2 U	3.3 U
Endrin Ketone		6.9 U	6.3 U	7.5 U	6.9 UJ	12 U	5.4 U	--	--	--	--	--	6.9 U	9.3 U	4.3 JN	5.2 U	3.3 U
gamma-BHC (Lindane)	2.37	3.5 U	3.3 U	3.9 U	3.5 UJ	6.1 U	2.8 U	--	--	--	--	--	3.5 U	4.8 U	3.5 U	2.7 U	1.3 J
gamma-Chlordane		3.5 U	3.3 U	4.2 JN	6.7 JN	6.8 JN	0.94 J	--	--	--	--	--	7.1	9.3 U	6.7	2.7 U	2.3 JN
Heptachlor	68	3.5 U	3.3 U	3.9 U	3.5 UJ	6.1 U	2.8 U	--	--	--	--	--	3.5 U	4.8 U	3.5 U	2.7 U	1.7 U
Heptachlor Epoxide	2.47	3.5 U	3.3 U	3.9 U	3.5 UJ	6.1 U	2.8 U	--	--	--	--	--	3.5 U	4.8 U	3.6 J	2.7 U	1.7 U
Methoxychlor	18.7	35 U	33 U	39 U	12 J	14 J	28 U	--	--	--	--	--	35 U	48 U	35 U	27 U	1.7 U
Toxaphene	0.1	--	--	--	350 UJ	610 U	280 U	--	--	--	--	--	350 U	480 U	350 U	270 U	170 U

U - Analyte was not detected above the reporting limit.

J - Estimated concentration.

-- Not analyzed.

N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.

K - Analyte present. May be biased High.

L - Analyte present. May be biased low

R - Data Rejected

P - Discrepency in GC analysis. Lower value reported.

S - Sample spike recovery is outside of control limits

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/kg	SEDF															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Semi-Volatiles* (µg/kg)**																	
1,1'-Biphenyl	1220	430 U	460 U	600 UJ	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	380 U
2,2'-oxybis (1-Chloropropane)		430 U	460 UL	600 UJ	560 UL	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	--
2,4-Dimethylphenol	29	430 U	460 UL	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	380 U
2,4-Dinitrophenol		1100 UJ	1200 U	1500 UL	1400 UJ	1400 UL	1200 R	1100 UL	1300 R	1200 UL	1300 UL	1200 U	460 U	480 U	520 U	470 U	740 U
2,6-Dinitrotoluene		430 U	460 U	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	380 U
2-Methylnaphthalene	20.2	430 U	460 U	600 UJ	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	380 U
2-Methylphenol		430 U	460 U	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	740 U
4,6-Dinitro-2-methylphenol		1100 UJ	1200 UL	1500 U	1400 UJ	1400 U	1200 UL	1100 U	1300 UL	1200 U	1300 UL	1200 U	460 U	480 U	520 U	470 U	740 U
4-Methylphenol	670	430 U	460 U	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	740 U
Acetophenone		430 U	460 U	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	54 J	250 U	270 U	240 U	740 U
Atrazine	6.62	430 U	460 U	600 UJ	560 UL	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 UJ	250 U	270 U	240 U	740 U
Benzaldehyde		430 UJ	460 U	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 UJ	250 UJ	270 U	240 UJ	740 U
Benzo (a) anthracene	108	430 U	460 U	600 U	120 J	270 J	130 J	110 J	510 U	490 U	120 J	480 U	240 U	110 K	130 J	130 J	380 U
Benzo (a) pyrene	150	160 J	110 J	1600	180 J	490 J	190 J	170 J	510 U	490 U	190 J	480 U	240 UL	130 K	180 J	170 J	380 U
Benzo (b) Fluoranthene	27.2+	160 J	140 J	2300	220 J	760	270 J	220 J	110 J	490 U	310 J	100 J	240 UL	160 K	330	340 J	380 U
Benzo (g,h,i) Perylene	170	100 J	460 U	1300	160 J	350 J	190 J	140 J	510 U	490 U	500 UL	480 U	240 UL	110 K	160 J	200 J	380 U
Benzo (k) Fluoranthene	27.2+	190 J	140 J	1300	210 J	780	210 J	210 J	510 U	490 U	200 J	480 U	240 UL	150 K	110 J	140 J	380 U
Bis(2-chloroethyl)Ether		0.43 U	1.2	5	2.2 UJ	2.1 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	380 U
Bis(2-ethylhexyl)phthalate	180	150 J	460 U	320 J	150 J	540 UL	490 U	200 J	510 U	490 U	500 U	480 U	240 U	510 U	270 U	47 J	380 UJ
Caprolactam		430 U	460 U	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 UJ	740 U
Di-n-butyl phthalate	6470	430 U	460 UL	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	380 U
Di-n-octyl phthalate		430 UJ	460 U	600 UJ	560 UJ	540 UL	490 U	450 UJ	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 UJ	740 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	150 UJ
Dibenzo (a,h) Anthracene	33	430 U	460 U	330 J	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 UL	250 U	270 U	46 J	380 U
Diethylphthalate	603	430 U	460 U	600 U	560 UJ	540 U	490 U	450 UJ	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	380 U
Hexachlorocyclopentadiene		430 UJ	460 U	600 U	560 UJ	540 U	490 U	450 U	510 UL	490 UL	500 UL	480 UL	240 R	250 R	270 R	240 R	740 U
Indeno (1,2,3-cd) Pyrene	17	160 J	100 J	1300	160 J	360 J	200 J	180 J	510 U	490 U	220 J	480 U	240 R	120 K	210 J	240 J	380 U
N-Nitrosodiphenylamine	2680	430 U	460 U	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	380 U
Naphthalene		430 U	460 U	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	380 U
Pentachlorophenol	504	1100 U	1200 U	1500 U	1400 UJ	1400 U	1200 U	1100 U	1300 UL	1200 UL	1300 U	1200 UL	460 U	480 U	520 U	470 U	740 U
Phenol	420	430 U	460 U	600 U	560 UJ	540 U	490 U	450 U	510 U	490 U	500 U	480 U	240 U	250 U	270 U	240 U	740 U
Chrysne	166	430 U	460 U	600 U	250 J	610	260 J	220 J	110 J	490 U	250 J	110 J	240 U	180 K	220 J	250 J	380 U
Fluoranthene		430 U	460 U	600 U	360 J	840	340 J	300 J	130 J	100 J	390 J	130 J	240 U	270 J	360	310 J	49 J
Phenanthrene	204	430 U	460 U	600 U	130 J	260 J	100 J	100 J	510 U	490 U	120 J	480 U	240 U	250 U	110 J	100 J	380 U
Carbazole		430 U	460 U	600 U	560 UJ	540 U	490 U	450 U	510 UL	490 UL	500 U	480 U	240 U	250 U	270 U	240 U	740 U
Pyrene	195	430 U	460 U	600 U	310 J	680	280 J	250 J	140 J	130 J	260 J	140 J	240 U	250 U	330	300 J	54 J

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
-- Not analyzed
UL - Not detected, quantitation limit is probably higher

K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
B - Analyte detected in Method Blank

+ - Value is for Benzo (b) fluoranthene and Benzo (k) fluoranthene

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level	SEDF															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Inorganics* (mg/kg)**																	
Aluminum		2970	2950	8270	17000 J	19500	15700	9280	17900	18300	10200	16700	9660 J	13800	18300	16300	16200
Antimony	2	0.49 U	0.64 UJ	1.3 UL	1.2 UJ	1.1 UJ	1.3 J	0.38 L	1.7 UJ	1 UJ	0.51 UL	0.61 R	8.3 UL	0.64 L	1.4 R	8.6 UL	10.9 U
Arsenic	9.8	1.8	2.4	4.7	5.6 J	6.2	6.5	2.9	9.6	7.3	4.1	8.9 L	4.0	6.3	8.5	8.1	4.9
Barium		21.2	35.8	66.1	110 J	114	99.1	60.4	179	108	73.8	143	76.8	119	136	102	81.8
Beryllium		0.22	0.2	0.41 U	1.1 J	0.65	0.87	0.59	1.3	1.1 U	0.56 U	1.1	0.73	0.91	1.1	1.2	0.91 U
Cadmium	0.99	0.3	0.31	0.97 U	0.36 J	0.22	0.18	0.13	0.12 U	0.73 U	0.089 U	0.12 U	0.69 U	0.47 J	0.29 J	0.29 J	0.15 J
Calcium		9.4	533	3510 J	1380 J	2410	1410	766	1450 J	1570 J	1000 J	934	737 J	1300	2990 J	786	966
Chromium	43.4	6.7	5.8 J	17.7	24.4 J	31.2	24.9	14.3	26.3	26.9	18.7	25.5	15.3 J	19.9	26.5	24.7	19.1
Cobalt	50	1.7	1.9 J	5.3 U	9.2 J	9.7	9.7	5.1	7.4 J	9.7	6.1	9.1	5.2 J	7.2	7.5 J	7.7	6.4 J
Copper	31.6	7.7	4.8	14.8	19.1 J	28.5	19.6	11.5	32.6	24.6	17.0	32.5	15.1 J	26.0	25.3	22.7	11.2
Iron	20000	5650	8530 J	18400	23700 J	25400	25400	15500	35700	27800	18400	29000 J	16500 J	21400	28100	26400	17700
Lead	35.8	14.8	10.8 J	29.7 J	68.7 J	102	97.6	42.3	151 J	132	66.0	175 K	66.4 K	132	141 K	132 L	46.0
Magnesium		514	502 J	1520	1880 J	2680	2110	1170	2040 J	2300 J	1450 J	2110	1180	1550	2090	1890	1800
Manganese	460	51.2	76.5 J	542 K	242 J	305 J	434	196 L	176 J	489 J	185 L	328	153 J	183 K	176	133 J	142
Mercury	0.18	0.065 U	0.055 UJ	0.093 U	0.66 UJ	0.12	0.095	0.068 U	0.11	0.082	0.12	0.20	0.14 U	0.10 J	0.16 U	0.069 J	0.14 J
Nickel	22.7	6.3	4.4	13.1	17.3 J	22.7	17.8 J	10.3	17.5	18.9	13.0 J	17.8 J	9.5	13.2	18.3	15.2	30.5
Potassium		128	209	423	802 J	1020	829 J	517	597 J	1160 J	604 J	727 J	541 J	602 J	982	747	739 J
Selenium	2	0.74	1 UJ	0.81 UL	1.4 UJ	1.3 UJ	1.5	0.47 UL	0.66 UJ	0.98 U	0.62 UL	1.1 L	1.1 J	5.0 UL	5.3 U	1.3 J	6.4 U
Silver	1.0	0.17 U	0.18 U	0.49 U	0.41 UJ	0.062 U	0.14 U	0.13 U	0.089 U	0.14 U	0.12 U	0.35 U	1.4 U	1.4 U	1.5 U	1.4 U	1.8 U
Sodium		159 U	94.1	142 U	127 J	181	116 U	138 U	215 U	272	127 U	155 U	247 J	191 J	500 U	140 J	28.7 J
Thallium		0.47 U	1.6 U	1.8	1.3 UJ	1.4 UJ	1.1 U	0.55 U	1.1 U	0.87 U	1.0 U	1.4 U	3.5 U	3.5 U	3.8 U	2.5 J	4.6 U
Vanadium		9.9	8.8	24.1	39 J	51.6	48.2	22.9	52.2	55.5	36.1	59.3	34.3 J	37.7	50.8	53.3	34.7
Zinc	121	70.6	69.4	137 J	125 J	173	116	93.0	128 J	126	91.7	140	56.4 J	110	131	88.0	59.9
***Pesticides/Herbicides* (µg/kg)**																	
4,4'-DDD		4.3 U	4.6 U	6 U	1.6 J	5.4 U	2.5 U	--	--	--	--	--	5.7	12	17 J	4.2 J	3.3 U
4,4'-DDE		4.3 U	4.6 U	6 U	2.6 J	5.4 U	15	--	--	--	--	--	27	28	10 J	23 J	2.1 J
4,4'-DDT		4.3 U	4.6 U	6 U	5.6 UJ	5.4 U	8.5 J	--	--	--	--	--	8.6 J	14 JN	9.3 J	9.4	1.2 J
Aldrin	2	2.2 U	2.4 U	3.1 U	2.9 UJ	2.8 U	2.5 U	--	--	--	--	--	2.4 U	2.5 U	1.5 J	2.4 U	1.7 U
alpha-BHC	6	2.2 U	2.4 U	3.1 U	2.9 UJ	2.8 U	2.5 U	--	--	--	--	--	2.4 U	2.5 U	2.7 U	2.4 U	1.7 U
Alpha-Chlordane		2.4	1.7 J	8.1	2.9 UJ	3.9 JN	2.5 U	--	--	--	--	--	4.6 U	4.6 JN	6.0 J	4.1 JN	1.7 U
beta-BHC	5	2.2 U	2.9 JN	3.1 U	5.3 J	2.8 U	2.5 U	--	--	--	--	--	2.4 U	6.0	8.8 JN	2.4 U	1.7 U
delta-BHC	6400	2.2 U	2.4 U	3.1 U	2.9 UJ	2.8 U	2.5 U	--	--	--	--	--	2.4 U	2.5 U	2.7 U	2.4 U	1.7 U
Dieldrin	1.9	4.3 U	1.4 J	5.6 J	2.7 J	5.4 U	4.9 U	--	--	--	--	--	2.4 U	4.8 U	5.2 U	4.7 U	3.3 U
Endosulfan I	2.9	2.2 U	2.4 U	3.1 U	2.9 UJ	2.8 U	2.5 U	--	--	--	--	--	2.4 U	2.5 U	2.7 U	2.4 U	1.7 U
Endosulfan II	14	4.3 U	4.6 U	6 U	5.6 UJ	5.4 U	4.9 U	--	--	--	--	--	4.6 U	2.3 J	5.2 U	4.7 U	3.3 U
Endosulfan sulfate	5.4	4.3 U	4.6 U	6 U	5.6 UJ	2.4 J	4.9 U	--	--	--	--	--	4.6 U	4.8 U	2.7 UL	4.7 U	3.3 U
Endrin	2.22	4.3 U	4.6 U	6 U	5.6 UJ	5.4 U	4.9 U	--	--	--	--	--	4.6 U	4.8 U	2.7 U	1.6 J	3.3 U
Endrin Aldehyde		4.3 U	4.6 U	6 U	5.6 UJ	5.4 U	5.3	--	--	--	--	--	4.6 U	7.9 J	5.2 U	4.7 U	3.3 U
Endrin Ketone		4.3 U	4.6 U	6 U	5.6 UJ	6.1 JN	1.5 J	--	--	--	--	--	4.6 U	4.8 U	5.2 U	4.7 U	3.3 U
gamma-BHC (Lindane)	2.37	2.2 U	2.4 U	3.1 U	2.9 UJ	2.8 U	2.5 U	--	--	--	--	--	2.4 U	2.5 U	2.7 U	2.4 U	1.7 U
gamma-Chlordane		2.2 U	2.4 U	3.1 U	2.9 UJ	2.8 U	1.4 J	--	--	--	--	--	1.4 J	4.8 U	8.9	4.7 U	1.7 U
Heptachlor	68	2.2 U	2.4 U	3.1 U	2.9 UJ	2.8 U	2.5 U	--	--	--	--	--	2.4 U	2.5 U	2.7 U	2.4 U	1.7 U
Heptachlor Epoxide	2.47	2.2 U	2.4 U	3.1 U	2.9 UJ	2.8 U	2.5 U	--	--	--	--	--	2.4 U	2.5 U	2.7 U	2.4 U	1.7 U
Methoxychlor	18.7	22 U	24 U	8.2 J	29 UJ	28 U	25 U	--	--	--	--	--	24 U	25 U	27 U	24 U	0.96 J
Toxaphene	0.1	--	--	--	290 UJ	280 U	250 U	--	--	--	--	--	240 U	250 U	270 U	240 U	170 U

U - Analyte was not detected above the reporting limit.

J - Estimated concentration.

-- Not analyzed.

N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

D - Sample diluted in the lab for analysis.

K - Analyte present. May be biased High.

L - Analyte present. May be biased low

R - Data Rejected

P - Discrepency in GC analysis. Lower value reported.

S - Sample spike recovery is outside of control limits

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level µg/kg	SEDG															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Semi-Volatiles* (µg/kg)**																	
1,1'-Biphenyl	1220	550 U	520 U	1100 UJ	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	300 U
2,2'-oxybis (1-Chloropropane)		550 U	520 UL	1100 UJ	800 UL	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	--
2,4-Dimethylphenol	29	550 U	520 UL	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	300 U
2,4-Dinitrophenol		1400 UJ	1300 U	2900 UL	2000 UJ	2700 UL	1200 UL	1700 UL	2400 R	1500 UL	1600 UL	1300 U	430 U	440 U	840 U	560 U	590 U
2,6-Dinitrotoluene		550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	300 U
2-Methylnaphthalene	20.2	550 U	520 U	1100 UJ	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	300 U
2-Methylphenol		550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	590 U
4,6-Dinitro-2-methylphenol		1400 UJ	1300 UL	2900 U	2000 UJ	2700 U	1200 UL	1700 U	2400 UL	1500 U	1600 UL	1300 U	430 U	440 U	840 U	560 U	590 U
4-Methylphenol	670	550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	590 U
Acenaphthene	6.7	550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	150 J	95 J	160 J	300 U
Acetophenone		550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	180 J	230 U	430 U	290 U	590 U
Anthracene	57.2	550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	200 L	75 J	410	290 J	400	100 J
Atrazine	6.62	550 U	520 U	1100 UJ	800 UL	1100 U	490 UL	690 U	940 U	610 U	630 U	520 U	220 UJ	230 U	430 U	290 U	590 U
Benzaldehyde		550 UJ	520 U	1100 U	800 UJ	1100 U	490 UL	690 U	940 U	610 U	630 U	520 U	220 UJ	230 UJ	130 J	39 J	590 U
Benzo (a) anthracene	108	550 U	520 U	1100 U	690 J	1200	120 J	2000	1200	810	700	1400	430	2500	2900	2000	1200
Benzo (a) pyrene	150	350 J	520 U	2200	1000 J	1500	160 J	2600	1600	1100	990	1600	460	2700	3500	1900	1600
Benzo (b) Fluoranthene	27.2+	380 J	520 U	2600	1300 J	2300	220 J	4200	2100	1700	1300	1900	870 K	3200	6200	4000	2900
Benzo (g,h,i) Perylene	170	300 J	520 U	1600	890 J	870 J	100 J	1700	1300	570 J	500 L	1100	250	1700	2800	1500	1200
Benzo (k) Fluoranthene	27.2+	400 J	520 U	2100	1000 J	1800	160 J	2900	1900	1200	1100	1700	920 K	2600	2000	3500	910
Butyl benzyl phthalate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	58 J
Bis(2-chloroethyl)Ether		0.56 U	0.53 U	0.57 U	3.2 UJ	4.2 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	590 U
Bis(2-ethylhexyl)phthalate	180	190 J	520 U	1700 J	780 J	1700 U	490 U	1100	1300 U	400 J	630 U	810	220 U	340 U	1400	380 J	320 J
Caprolactam		550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 UJ	590 U
Di-n-butyl phthalate	6470	550 U	520 UL	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	300 U
Di-n-octyl phthalate		550 UJ	520 U	1100 UJ	800 UJ	1100 U	490 U	690 UJ	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 UJ	590 U
1,4-Dioxane		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	120 UJ
Dibenzo (a,h) Anthracene	33	550 U	520 U	410 J	230 J	220 J	490 U	820	490 J	250 J	220 J	390 J	91 J	600	630	440	310
Diethylphthalate	603	550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 UJ	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	300 U
Hexachlorocyclopentadiene		550 UJ	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 UL	610 UL	630 UL	520 UL	220 R	230 R	430 R	290 R	590 U
Indeno (1,2,3-cd) Pyrene	17	360 J	520 U	1700	870 J	910 J	120 J	2400	1500	940	980	1300	360	2500	4100	2000	1200
N-Nitrosodiphenylamine	2680	550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	300 U
Naphthalene		550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	300 U
Pentachlorophenol	504	1400 U	1300 U	2900 U	2000 UJ	2700 UL	1200 U	1700 U	2400 UL	1500 UL	1600 U	1300 UL	430 U	430 U	840 U	560 U	590 U
Phenol	420	550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	230 U	430 U	290 U	590 U
Chrysne	166	550 U	520 U	1100 U	1300 J	1900	180 J	3200	2200	1400	1200	1900	620	3300	4100	2600	2000
Fluorene	77.4	550 U	520 U	1100 U	800 UJ	1100 U	490 U	690 U	940 U	610 U	630 U	520 U	220 U	190 J	130 J	200 J	300 U
Fluoranthene		550 U	520 U	1100 U	2100 J	3100	320 J	4600	3300	2000	2100	3200	1000	5100 D	7300 D	2200 D	3200
Phenanthrene	204	550 U	520 U	1100 U	760 J	1100	110 J	1500	1200	720	690	1200	450	3000	2700	2400	1000
Carbazole		550 U	520 U	1100 U	800 UJ	1100 U	490 U	350 J	230 L	610 UL	630 U	180 J	220 U	380	460	230 J	160 J
Pyrene	195	550 U	520 U	1100 U	1600 J	3100	250 J	4000	2700	2000	1400	2600	910	3400 D	6600	4100	2800

U - Analyte was not detected above the reporting limit.
J - Estimated concentration.
-- Not analyzed.
UL - Not detected, quantitation limit is probably higher

K - Analyte present. May be biased High.
L - Analyte present. May be biased low
R - Data Rejected
D - Result is from diluted sample

+ - Value is for Benzo (b) fluoranthene and Benzo (k) fluoranthene

Table 4 (continued)

Summary of Sediment Data for Army Creek and Army Pond

Parameter	BTAG Screening Level	SEDG															
		10/04	1/05	4/05	7/05	10/05	1/06	4/06	7/06	10/06	1/07	4/07	10/09	10/10	10/11	10/12	10/17
***Inorganics* (mg/kg)**																	
Aluminum		10900	9240	8000	21000 J	19000	5950	19600	11800	16100	14200	5680	1100 J	2690	11200	7230	13100
Antimony	2	0.61 U	0.87 J	1.2 UL	1.8 UJ	2 UJ	0.5 J	0.69 L	2.0 UJ	1.3 UJ	0.99 L	0.73 R	10.7 UL	8.0 R	6.0 R	9.9 UL	9.7 U
Arsenic	9.8	5.4	3.7	4.3	8.2 J	8.9	2.2	5.8	5.4	7.6	7.4	2.9 L	0.38 U	1.1 J	3.5	5.7	5.4
Barium		89.3	82.3	70.2	171 J	193	55.5	169	135	156	146	50.7	10.9 J	20.5 J	115	91.8	109
Beryllium		0.64	0.58	0.39 U	1.2 J	0.71	0.41	1.2	0.91 U	1.0 U	0.95	0.39 U	0.17 J	0.16 J	0.85 J	0.55 J	0.50 J
Cadmium	0.99	0.64	0.56	0.96 U	1.3 J	1	0.14	0.70	0.23 U	1.2 U	0.5	0.4	0.89 U	0.19 J	1.0 J	0.73 J	0.55 J
Calcium		3110	1660	4700 J	4160 J	5430	2580	3980	4890 J	4030 J	4080 J	1980	2490 J	2360	2230 J	3670	5160
Chromium	43.4	23.3	16.4 J	18.3	39.1 J	39.6	10.5	34.5	25.7	32.8	28.2	15.4	5.1 J	14.5	42.1	27.4	28.9
Cobalt	50	6.7	3.2 J	4.8 U	11.8 J	11.9	2.8	11.3	11.5 J	11.7	12.1	4	0.98 J	2.1 J	6.4 J	6.1 J	8.1
Copper	31.6	23.9	13.2	20.5	41.7 J	49.7	8.6	160	32.6	37.9	33.7	15.4	5.7 J	19.0	38.0	33.5	32.9
Iron	20000	20200	11700 J	15500	30900 J	34200	8860	28100	25100	29100	27200	12300 J	4290 J	6600	15900	15600	19300
Lead	35.8	61.3	73.2 J	42.5 J	101 J	113	27.1	90.5	58.7 J	72.1	70.5	62.3 K	27.1 K	20.7	128 K	45.6 L	47.3
Magnesium		2340	1260 J	1750	3530 J	3540	995	3420	2200 J	2930 J	2470 J	1570	1450	1510	2530	2210	3040
Manganese	460	635	110 J	371 K	402 J	566 J	149	934 L	505 J	1240 J	559 L	284	26.9 J	72.3 K	138	284 J	587
Mercury	0.18	0.2 U	0.15 UJ	0.086	0.12 UJ	0.16	0.067 U	0.14	0.14 U	0.089	0.13	0.19	0.18 U	0.13 U	0.26 U	0.17 U	0.11 J
Nickel	22.7	18.6	10	14.3	32.5 J	33	6.9 J	29.7	21.8	27.4	23.3 J	11.2 J	2.7 J	5.6	25.2	15.6	18.9
Potassium		525	561	458	1190 J	1250	455 J	1200	593 J	808 J	749 J	261 J	80.5 J	182 J	681 J	365 J	809
Selenium	2	0.79 U	1.1 UJ	0.77 UL	2.2 UJ	2.7 UJ	0.97 U	0.75 UL	1.2 UJ	0.86 U	0.78 UL	0.85 UL	6.2 U	4.7 UL	1.8 J	1.4 J	5.6 U
Silver	1.0	0.21 U	0.2 U	0.45 U	0.63 UJ	0.13 U	0.15 U	0.21 U	0.17 U	0.17 U	0.15 U	0.38 U	1.8 U	0.10 U	2.4 U	1.7 U	1.6 U
Sodium		202 U	119	133 U	163 J	331	89.6 U	257	3.6 U	180	102 U	163 U	267 J	99.1 J	539 U	153 J	87.2 J
Thallium		0.58 U	1.8 U	1.8	2 UJ	2.9 UJ	1.1 U	0.87 U	2.0 U	1.1 U	1.3 U	0.92 U	4.4 U	3.3 U	6.1 U	1.2 J	4.0 U
Vanadium		37.2	37.5	26.1	64.2 J	63.2	19.6	53.2	40.7	50.0	46.2	21.6	5.7 J	11.0	43.1	28.4	35.3
Zinc	121	143	66.7	132 J	285 J	295	46.4	256	207 J	243	212	99.9	21.6 J	47.8	240	179	192
***Pesticides/Herbicides* (µg/kg)**																	
4,4'-DDD		5.5 U	3 J	5.7 U	8 UJ	11 U	1.6 J	--	--	--	--	--	2.3 JP	4.4 U	14	2.4 J	1.7 J
4,4'-DDE		5.5 U	6.6	5.7 U	5.2 J	11 U	3.8 J	--	--	--	--	--	4.3 U	2.5 J	8.8 JN	6.5 JN	2.1 J
4,4'-DDT		5.5 U	5.2 U	5.7 U	8 UJ	11 U	2.6 J	--	--	--	--	--	6.7	4.4 U	34	7.5	17
Aldrin	2	2.8 U	2.7 U	2.9 U	4.1 UJ	5.5 U	2.5 U	--	--	--	--	--	2.2 U	0.66 J	4.1 J	2.9 U	0.38 J
alpha-BHC	6	2.8 U	2.7 U	2.9 U	4.1 UJ	5.5 U	2.5 U	--	--	--	--	--	2.2 U	2.3 U	4.3 U	2.9 U	1.7 U
Alpha-Chlordane		6.7 JN	1.3 J	16	17 J	21 JN	3.1 J	--	--	--	--	--	11 JN	13 J	18 JN	14 J	5.2 J
beta-BHC	5	15 JN	2.7 U	2.9 U	20 J	5.5 U	2.5 U	--	--	--	--	--	2.2 U	3.6 JN	11 JN	2.9 U	1.7 U
delta-BHC	6400	2.8 U	2.7 U	2.9 U	4.1 UJ	5.5 U	2.5 U	--	--	--	--	--	2.2 U	2.3 U	4.3 U	2.9 U	1.7 U
Dieldrin	1.9	5.5 U	5.2 U	5.7	4 J	11 U	1.4 J	--	--	--	--	--	2.2 U	4.4 U	9.6	2.1 J	3.2 U
Endosulfan I	2.9	2.8 U	2.7 U	2.9 U	4.1 UJ	5.5 U	2.5 U	--	--	--	--	--	2.2 U	0.60 JN	4.3 U	2.9 U	1.7 U
Endosulfan II	14	5.5 U	5.2 U	5.7 U	8 UJ	11 U	4.9 U	--	--	--	--	--	4.3 U	4.4 U	7.5 J	5.6 U	3.2 U
Endosulfan sulfate	5.4	5.5 U	5.2 U	5.7 U	8 UJ	11 U	1.5 J	--	--	--	--	--	4.3 U	5.5 JN	8.4 UL	5.6 U	12
Endrin	2.22	5.5 U	5.2 U	5.7 U	4.1 UJ	11 U	4.9 U	--	--	--	--	--	4.3 U	4.4 U	8.4 U	5.6 U	3.2 U
Endrin Aldehyde		5.5 U	5.2 U	5.7 U	4.5 J	3.2 J	1.5 J	--	--	--	--	--	4.3 U	4.4 U	9.8 J	5.6 U	3.2 U
Endrin Ketone		5.5 U	5.2 U	5.7 U	8 UJ	10 J	4.9 U	--	--	--	--	--	3.5 J	4.4 U	15	5.2 J	3.2 U
gamma-BHC (Lindane)	2.37	2.8 U	2.7 U	2.9 U	4.1 UJ	5.5 U	2.5 U	--	--	--	--	--	2.2 U	2.3 U	4.3 U	2.9 U	1.7 U
gamma-Chlordane		4.2 JN	1.4 J	7.5 JN	6.3 JN	5.5 U	2.5 U	--	--	--	--	--	8.7	4.4 U	22	15	5.2 J
Heptachlor	68	2.8 U	2.7 U	2.9 U	4.1 UJ	5.5 U	2.5 U	--	--	--	--	--	2.2 U	2.3 U	4.3 U	2.9 U	1.7 U
Heptachlor Epoxide	2.47	5.2 JN	2.7 U	2.9 U	2.1 J	5.5 U	2.5 U	--	--	--	--	--	2.2 U	2.5 JN	10	2.9 U	0.87 J
Methoxychlor	18.7	28 U	27 U	7.7 J	12 J	14 J	25 U	--	--	--	--	--	22 U	23 U	51 JN	15 J	17 U
Toxaphene	0.1	--	--	--	410 UJ	550 U	250 U	--	--	--	--	--	220 U	230 U	430 U	290 U	170 U

N - Analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

U - Analyte was not detected above the reporting limit.

J - Estimated concentration.

-- Not analyzed.

D - Sample diluted in the lab for analysis.

K - Analyte present. May be biased High.

L - Analyte present. May be biased low

R - Data Rejected

P - Discrepency in GC analysis. Lower value reported.

S - Sample spike recovery is outside of control limits

Table K-4: September-October 2016 Semi-Annual Monitoring Program – Summary of Detected Perfluorinated Chemicals.

Table 2
September-October 2016 Semi-Annual Monitoring Program - Summary of Detected PFCs
Delaware Sand & Gravel Superfund Site
New Castle, Delaware

			Sample ID	DDA-05			DDA-01			DDA-02			DDA-03			DDA-07-US			DDA-10-US			DDA-11-LS			DDA-11-US			DDA-12-US			DDA-15-US			DGC-8S			DGC-8D			DGC-10D			DGC-10S		
			Sample Date	9/27/2016			9/27/2016			9/28/2016			9/29/2016			10/10/2016			10/5/2016			9/27/2016			9/27/2016			9/29/2016			10/6/2016			10/6/2016			10/6/2016			9/29/2016			9/29/2016		
			N=Normal, FD=Field Duplicate	N			N			N			N			N			N			N			N			N			N			N			N			N			N		
Parameter	Unit	CAS	HA	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL
Perfluorohexanoic acid	ng/l	307-24-4	NE	29	J-	1	29		1	25		1	61		1	25		1	43	J	1	25		1	27		1	60		1	21		1	31	J-	1	13		1	21		1	20		1
Perfluoroheptanoic acid	ng/l	375-85-9	NE	13		1	22		1	22	J-	1	48	J-	1	16		1	23	J	1	20	J+	1	23		1	34		1	17		1	8		1	8		1	13		1	13		1
Perfluorooctanoic acid (PFOA)	ng/l	335-67-1	70	76	J-	1	180		1	150		1	600		10	150		1	180	J	1	140		1	150		1	230		1	200		1	34		1	49		1	110		1	38		1
Perfluorononanoic acid	ng/l	375-95-1	NE	2	J	1	10		1	12		1	12		1	9		1	7	J	1	10	J	1	13		1	13		1	5	J+	1	5		1	3	J+	1	3		1	13		1
Perfluorodecanoic acid	ng/l	335-76-2	NE		U	1	2	J+	1	1	J	1	7		1	1	J	1	2	J	1	2	J+	1	3		1	2	J	1	1	J+	1	2		1	1	J+	1	5		1	12		1
Perfluoroundecanoic acid	ng/l	2058-94-8	NE		U	2		U	2		U	2		UJ	2		U	2		UJ	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2	4	J	2
Perfluorododecanoic acid	ng/l	307-55-1	NE		UJ	3		U	3		U	3		UJ	3		U	3		UJ	3		U	3		U	3		U	3		U	3		U	3		U	3		U	3		U	3
Perfluorotridecanoic acid	ng/l	72629-94-8	NE		UJ	2		U	2		U	2		UJ	2		U	2		UJ	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Perfluorotetradecanoic acid	ng/l	376-06-7	NE		UJ	3		U	3		U	3		UJ	3		U	3		UJ	3		U	3		U	3		U	3		U	3		U	3		U	3		U	3		U	3
Perfluorobutane Sulfonate	ng/l	29420-43-3	NE		UJ	4		UJ	4	6	J	4		U	4		U	4		UJ	4		UJ	4		UJ	4		U	4		U	4		U	4		U	4		U	4		U	4
Perfluorohexane Sulfonate	ng/l	108427-53-8	NE		U	4	41		4	19		4	73		4	21		4	53	J	4	14	J+	4	7	J	4	25		4	26		4		U	4	17		4	35		4	18		4
Perfluorooctane Sulfonate (PFOS)	ng/l	1763-23-1	70	7	J	5	29		5	18		5	64		5	19		5	16	J+	5	14	J	5	23		5	19		5	22		5		U	5	12		5	24		5	15		5
N-methyl perfluorooctanesulfonamidoacetic Acid	ng/l	2355-31-9	NE		U	4		U	4		UJ	4	4	J	4		U	4		UJ	4		U	4		U	4		UJ	4		U	4		U	4		U	4		UJ	4		UJ	4
N-ethyl perfluorooctanesulfonamidoacetic Acid	ng/l	2991-50-6	NE		UJ	5		UJ	5		U	5		UJ	5		U	5		UJ	5		UJ	5		UJ	5		U	5		U	5		U	5		U	5		UJ	5		UJ	5
Total PFOA + PFOS	ng/l	NA	70	83			209			168			664			169			196			154			173			249			222			34			61			134			53		

Table 2
September-October 2016 Semi-Annual Monitoring Program - Summary of Detected PFCs
Delaware Sand & Gravel Superfund Site
New Castle, Delaware

			Sample ID	DDA-16-US			DDA-17			DGC-2S			DGC-5			DGC-5			DGC-7S			MHW-1D			DGC-11D			DGC-11S			RT-1-UP			UPA-01			UPA-02D			UPA-02S			UPA-03D		
			Sample Date	9/27/2016			9/28/2016			9/27/2016			10/10/2016			10/10/2016			10/10/2016			10/6/2016			10/3/2016			10/3/2016			10/5/2016			10/6/2016			9/29/2016			9/29/2016			10/3/2016		
			N=Normal, FD=Field Duplicate	N			N			N			FD			N			N			N			N			N			N			N			N			N			FD		
Parameter	Unit	CAS	HA	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL
Perfluorohexanoic acid	ng/l	307-24-4	NE	29		1	57		1	34		1	44		1	55		1	23		1	``		1	22	J	1		UJ	1	3		1	38	J-	1	27		1	44		1	45	J	1
Perfluoroheptanoic acid	ng/l	375-85-9	NE	20	J+	1	34	J+	1	23	J+	1	29		1	31	J+	1	16		1	31		1	12	J	1		UJ	1		U	1	23		1	18		1	21		1	26	J	1
Perfluorooctanoic acid (PFOA)	ng/l	335-67-1	70	200		1	290		1	200		1	160		1	190		1	130		1	280		1	43	J+	1		UJ	1	2		1	120		1	180		1	60		1	170	J	1
Perfluorononanoic acid	ng/l	375-95-1	NE	7	J	1	7	J+	1	9	J+	1	5	J+	1	6	J+	1	10		1	13	J+	1	13	J	1		UJ	1		U	1	6		1	9		1	2		1	8	J	1
Perfluorodecanoic acid	ng/l	335-76-2	NE	1	J+	1	2	J+	1		U	1		U	1		U	1	1	J	1	2		1	3	J	1		UJ	1		U	1	5		1	3		1		U	1	13	J+	1
Perfluoroundecanoic acid	ng/l	2058-94-8	NE		U	2		U	2		U	2		U	2		U	2		U	2		U	2		UJ	2		UJ	2		U	2		U	2		U	2		U	2		UJ	2
Perfluorododecanoic acid	ng/l	307-55-1	NE		U	3		U	3		U	3		U	3		U	3		U	3		U	3		UJ	3		UJ	3		U	3		U	3		U	3		UJ	3		UJ	3
Perfluorotridecanoic acid	ng/l	72629-94-8	NE		U	2		U	2		U	2		U	2		U	2		U	2		U	2		UJ	2		UJ	2		U	2		U	2		U	2		UJ	2		UJ	2
Perfluorotetradecanoic acid	ng/l	376-06-7	NE		U	3		U	3		U	3		U	3		U	3		U	3		U	3		UJ	3		UJ	3		U	3		U	3		U	3		UJ	3		UJ	3
Perfluorobutane Sulfonate	ng/l	29420-43-3	NE		UJ	4		U	4		UJ	4		U	4		U	4		U	4		U	4		UJ	4		UJ	4		U	4		U	4		U	4		U	4		UJ	4
Perfluorohexane Sulfonate	ng/l	108427-53-8	NE	17		4	56	J+	4	6	J	4	7	J	4	7	J	4	9	J	4	14		4		UJ	4		UJ	4		U	4	52		4	34		4	5	J	4	110	J+	4
Perfluorooctane Sulfonate (PFOS)	ng/l	1763-23-1	70	17	J+	5	34	J+	5	12	J+	5	9	J	5	12		5	15		5	16		5	7	J+	5		UJ	5		U	5	29		5	21		5		U	5	50	J+	5
N-methyl perfluorooctanesulfonamidoacetic Acid	ng/l	2355-31-9	NE		U	4		U	4		U	4		U	4		U	4		U	4		U	4		UJ	4		UJ	4		U	4		U	4		UJ	4		UJ	4		UJ	4
N-ethyl perfluorooctanesulfonamidoacetic Acid	ng/l	2991-50-6	NE		UJ	5		U	5		UJ	5		U	5		U	5		U	5		U	5		UJ	5		UJ	5		U	5		U	5		UJ	5		UJ	5		UJ	5
Total PFOA + PFOS	ng/l	NA	70	217			324			212			169			202			145			296			50			0			2			149			201			60			220		

Table 2
September-October 2016 Semi-Annual Monitoring Program - Summary of Detected PFCs
Delaware Sand & Gravel Superfund Site
New Castle, Delaware

			Sample ID	UPA-03D			AWC-E1			AWC-E1			BW-1			BW-2			MW-18			MW-26N			MW-28			MW-29			MW-29			MW-31			MW-34			P-4_UPA			P-5L		
			Sample Date	10/3/2016			10/13/2016			10/13/2016			10/4/2016			10/4/2016			10/7/2016			10/3/2016			10/5/2016			10/5/2016			10/5/2016			10/5/2016			10/7/2016			10/14/2016			10/7/2016		
			N=Normal, FD=Field Duplicate	N			FD			N			N			N			N			N			N			FD			N			N			N			N			N		
Parameter	Unit	CAS	HA	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL
Perfluorohexanoic acid	ng/l	307-24-4	NE	51	J	1	29		1	29		1	25	J	1	20	J	1	28	J-	1	20	J	1	40		1	30	J	1	31	J	1	40	J-	1	18		1	86		1	9		1
Perfluoroheptanoic acid	ng/l	375-85-9	NE	29	J+	1	16		1	16		1	16	J	1	13	J	1	20		1	11	J+	1	23		1	19	J	1	19	J	1	28		1	10		1	33		1	5	J+	1
Perfluorooctanoic acid (PFOA)	ng/l	335-67-1	70	180	J	1	86		1	84		1	130	J	1	83	J	1	150	J-	1	87	J	1	54		1	130	J	1	120	J	1	190	J-	1	66		1	170		1	35		1
Perfluorononanoic acid	ng/l	375-95-1	NE	8	J+	1	10		1	10		1	10	J+	1	9	J	1	6		1	4	J+	1	3	J+	1	9	J	1	9	J	1	6		1	5		1	68		1	1	J+	1
Perfluorodecanoic acid	ng/l	335-76-2	NE	13	J+	1	2		1	3		1		UJ	1	2	J	1	2	J	1	1	J+	1		U	1	2	J	1	2	J	1		U	1		U	1	1	J	1		U	1
Perfluoroundecanoic acid	ng/l	2058-94-8	NE		UJ	2		U	2		U	2		UJ	2		UJ	2		U	2		UJ	2		U	2		UJ	2		UJ	2		U	2		U	2		U	2		U	2
Perfluorododecanoic acid	ng/l	307-55-1	NE		UJ	3		U	3		U	3		UJ	3		UJ	3		U	3		UJ	3		U	3		UJ	3		UJ	3		UJ	3		U	3		U	3		U	3
Perfluorotridecanoic acid	ng/l	72629-94-8	NE		UJ	2		U	2		U	2		UJ	2		UJ	2		U	2		UJ	2		U	2		UJ	2		UJ	2		UJ	2		U	2		U	2		U	2
Perfluorotetradecanoic acid	ng/l	376-06-7	NE		UJ	3		U	3		U	3		UJ	3		UJ	3		U	3		UJ	3		U	3		UJ	3		UJ	3		UJ	3		U	3		U	3		U	3
Perfluorobutane Sulfonate	ng/l	29420-43-3	NE		UJ	4		U	4		U	4		UJ	4		UJ	4		U	4		UJ	4	6	J	4		UJ	4		UJ	4	4	J	4		U	4	29		4		U	4
Perfluorohexane Sulfonate	ng/l	108427-53-8	NE	110	J	4	10	J	4	9	J	4	16	J	4	11	J	4	25		4	17	J	4	8	J	4	10	J	4	10	J	4	10		4	14		4	190		4	7	J	4
Perfluorooctane Sulfonate (PFOS)	ng/l	1763-23-1	70	55	J+	5	11		5	10	J	5	18	J+	5	17	J	5	47		5	11	J+	5	9	J	5	120	J	5	130	J	5	100		5	14		5	28		5	5	J	5
N-methyl perfluorooctanesulfonamidoacetic Acid	ng/l	2355-31-9	NE		UJ	4		U	4		U	4		UJ	4		UJ	4		U	4		UJ	4		U	4		UJ	4		UJ	4		U	4		U	4		U	4		U	4
N-ethyl perfluorooctanesulfonamidoacetic Acid	ng/l	2991-50-6	NE		UJ	5		U	5		U	5		UJ	5		UJ	5		U	5		UJ	5		U	5		UJ	5		UJ	5	25		5		U	5		U	5		U	5
Total PFOA + PFOS	ng/l	NA	70	235			97			94			148			100			197			98			63			250			250			290			80			198			40		

Table 2
September-October 2016 Semi-Annual Monitoring Program - Summary of Detected PFCs
Delaware Sand & Gravel Superfund Site
New Castle, Delaware

			Sample ID	P-5U			P-6_UPA			UPA-101-TZ			UPA-101-US			AWC-E1			AWC-E2			AWC-E2			AWC-K1		
			Sample Date	10/7/2016			9/28/2016			9/28/2016			9/28/2016			10/13/2016			10/13/2016			10/13/2016			10/13/2016		
			N=Normal, FD=Field Duplicate	N			N			N			N			N			N			N			N		
Parameter	Unit	CAS	HA	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL	Result	Qual	RDL
Perfluorohexanoic acid	ng/l	307-24-4	NE	46		1	38	J-	1	47	J-	1	52		1	30		1	30		1	33		1	7		1
Perfluoroheptanoic acid	ng/l	375-85-9	NE	23		1	33		1	22	J+	1	29	J+	1	15	J+	1	12		1	15		1	4	J+	1
Perfluorooctanoic acid (PFOA)	ng/l	335-67-1	70	76		1	140	J-	1	130		1	210		1	76		1	110		1	130		1	23		1
Perfluorononanoic acid	ng/l	375-95-1	NE	8		1	10		1	4		1	8		1	12	J+	1	6		1	5		1	2	J+	1
Perfluorodecanoic acid	ng/l	335-76-2	NE	4		1	4		1		U	1	5		1	4		1	3		1	3		1		U	1
Perfluoroundecanoic acid	ng/l	2058-94-8	NE	5		2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Perfluorododecanoic acid	ng/l	307-55-1	NE		U	3		U	3		U	3		U	3		U	3		U	3		UJ	3		U	3
Perfluorotridecanoic acid	ng/l	72629-94-8	NE		U	2		U	2		U	2		U	2		U	2		U	2		UJ	2		U	2
Perfluorotetradecanoic acid	ng/l	376-06-7	NE		U	3		U	3		U	3		U	3		U	3		U	3		UJ	3		U	3
Perfluorobutane Sulfonate	ng/l	29420-43-3	NE		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4
Perfluorohexane Sulfonate	ng/l	108427-53-8	NE		U	4	44		4	8	J	4	50	J+	4	8	J	4	30		4	26		4	6	J	4
Perfluorooctane Sulfonate (PFOS)	ng/l	1763-23-1	70		U	5	21		5		U	5	37		5	11		5	14		5	15		5	6	J	5
N-methyl perfluorooctanesulfonamidoacetic Acid	ng/l	2355-31-9	NE		U	4		U	4		UJ	4		U	4		U	4		U	4		U	4		U	4
N-ethyl perfluorooctanesulfonamidoacetic Acid	ng/l	2991-50-6	NE		U	5		U	5		UJ	5		U	5		U	5		U	5		U	5		U	5
Total PFOA + PFOS	ng/l	NA	70	76			161			130			247			87			124			145			29		

Table 2
September-October 2016 Semi-Annual Monitoring Program - Summary of Detected PFCs
Delaware Sand & Gravel Superfund Site
New Castle, Delaware

Notes:
Green highlight = Concentration exceeds HA

Abbreviations:
HA = the May 19, 2016 USEPA health advisory (HA) of 70 nanograms per liter (ng/l; parts per trillion [ppt]) for perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), and/or the combined concentrations of PFOA and PFOS
ng/L = nanograms per liter
Qual = interpreted qualifier
RDL = reporting detection limit
NE = standard does not exist
PFCs = perfluorinated compounds
Qualifiers:
J - The analyte is present; however, the reported value may not be accurate or precise.
J+ - The analyte is present; however, the reported value may not be accurate or precise. The result is biased high.
J- - The analyte is present; however, the reported value may not be accurate or precise. The result is biased low.
U - not detected above RDL
UJ - not detected above RDL, RDL is estimated

Prepared by: AZ
Checked by: BPC
Reviewed by: RWB

PWSID	PWSName	Size	FacilityID	FacilityNan	FacilityWat	SamplePoi
DE0000552	Artesian Water Company	L	90070	Chester Int	SW	SPIC02
DE0000552	Artesian Water Company	L	90070	Chester Int	SW	SPIC02
DE0000552	Artesian Water Company	L	90070	Chester Int	SW	SPIC02
DE0000552	Artesian Water Company	L	90065	Chesapeak	GW	DEP018
DE0000552	Artesian Water Company	L	90070	Chester Int	SW	SPIC02
DE0000552	Artesian Water Company	L	90070	Chester Int	SW	SPIC02
DE0000552	Artesian Water Company	L	90065	Chesapeak	GW	DEP018
DE0000552	Artesian Water Company	L	90065	Chesapeak	GW	DEP018
DE0000552	Artesian Water Company	L	90070	Chester Int	SW	SPIC02
DE0000552	Artesian Water Company	L	90054	Middle Rur	GW	DEP017
DE0000552	Artesian Water Company	L	90070	Chester Int	SW	SPIC02
DE0000552	Artesian Water Company	L	90070	Chester Int	SW	SPIC02
DE0000552	Artesian Water Company	L	90060	Old County	GW	DEP012
DE0000552	Artesian Water Company	L	90060	Old County	GW	DEP012
DE0000552	Artesian Water Company	L	90060	Old County	GW	DEP012
DE0000552	Artesian Water Company	L	90057	Midvale Pla	GW	DEP001
DE0000552	Artesian Water Company	L	90057	Midvale Pla	GW	DEP001
DE0000552	Artesian Water Company	L	90057	Midvale Pla	GW	DEP001
DE0000552	Artesian Water Company	L	90057	Midvale Pla	GW	DEP001
DE0000552	Artesian Water Company	L	90064	Wilm. Man	GW	DEP014
DE0000552	Artesian Water Company	L	90064	Wilm. Man	GW	DEP014
DE0000552	Artesian Water Company	L	90065	Chesapeak	GW	DEP018
DE0000552	Artesian Water Company	L	90064	Wilm. Man	GW	DEP014
DE0000552	Artesian Water Company	L	90064	Wilm. Man	GW	DEP014
DE0000552	Artesian Water Company	L	90060	Old County	GW	DEP012
DE0000552	Artesian Water Company	L	90062	Wilm. Man	GW	DEP013
DE0000552	Artesian Water Company	L	90062	Wilm. Man	GW	DEP013
DE0000552	Artesian Water Company	L	90062	Wilm. Man	GW	DEP013
DE0000552	Artesian Water Company	L	90062	Wilm. Man	GW	DEP013
DE0000552	Artesian Water Company	L	90042	Hockessin (	GW	DEP015
DE0000552	Artesian Water Company	L	90042	Hockessin (	GW	DEP015
DE0000552	Artesian Water Company	L	90031	Glendale Pl	GW	DEP010
DE0000552	Artesian Water Company	L	90031	Glendale Pl	GW	DEP010
DE0000552	Artesian Water Company	L	90042	Hockessin (	GW	DEP015
DE0000552	Artesian Water Company	L	90042	Hockessin (	GW	DEP015
DE0000552	Artesian Water Company	L	90025	Fairwinds F	GW	DEP009
DE0000552	Artesian Water Company	L	90025	Fairwinds F	GW	DEP009
DE0000552	Artesian Water Company	L	90031	Glendale Pl	GW	DEP010
DE0000552	Artesian Water Company	L	90031	Glendale Pl	GW	DEP010
DE0000552	Artesian Water Company	L	90052	Llangollen I	GW	DEP016
DE0000552	Artesian Water Company	L	90052	Llangollen I	GW	DEP016
DE0000552	Artesian Water Company	L	90014	Castle Hills	GW	DEP007
DE0000552	Artesian Water Company	L	90054	Middle Rur	GW	DEP017
DE0000552	Artesian Water Company	L	90054	Middle Rur	GW	DEP017
DE0000552	Artesian Water Company	L	90045	Jefferson F	GW	DEP011
DE0000552	Artesian Water Company	L	90045	Jefferson F	GW	DEP011

DE0000552	Artesian Water Company	L	90045	Jefferson F	GW	DEP011
DE0000552	Artesian Water Company	L	90045	Jefferson F	GW	DEP011
DE0000552	Artesian Water Company	L	90052	Llangollen I	GW	DEP016
DE0000552	Artesian Water Company	L	90052	Llangollen I	GW	DEP016
DE0000552	Artesian Water Company	L	90008	Artisan's Vi	GW	DEP004
DE0000552	Artesian Water Company	L	90008	Artisan's Vi	GW	DEP004
DE0000552	Artesian Water Company	L	90014	Castle Hills	GW	DEP007
DE0000552	Artesian Water Company	L	90003	Airport Ind	GW	DEP003
DE0000552	Artesian Water Company	L	90054	Middle Rur	GW	DEP017
DE0000552	Artesian Water Company	L	90003	Airport Ind	GW	DEP003
DE0000552	Artesian Water Company	L	90008	Artisan's Vi	GW	DEP004
DE0000552	Artesian Water Company	L	90008	Artisan's Vi	GW	DEP004
DE0000552	Artesian Water Company	L	90014	Castle Hills	GW	DEP007
DE0000552	Artesian Water Company	L	90003	Airport Ind	GW	DEP003
DE0000552	Artesian Water Company	L	90003	Airport Ind	GW	DEP003
DE0000552	Artesian Water Company	L	90019	Eastern Sta	GW	DEP008
DE0000552	Artesian Water Company	L	90019	Eastern Sta	GW	DEP008
DE0000552	Artesian Water Company	L	90019	Eastern Sta	GW	DEP008
DE0000552	Artesian Water Company	L	90019	Eastern Sta	GW	DEP008
DE0000552	Artesian Water Company	L	90025	Fairwinds F	GW	DEP009
DE0000552	Artesian Water Company	L	90025	Fairwinds F	GW	DEP009
DE0000552	Artesian Water Company	L	90016	Collins Park	GW	DEP006
DE0000552	Artesian Water Company	L	90016	Collins Park	GW	DEP006
DE0000552	Artesian Water Company	L	90014	Castle Hills	GW	DEP007
DE0000552	Artesian Water Company	L	90016	Collins Park	GW	DEP006
DE0000552	Artesian Water Company	L	90016	Collins Park	GW	DEP006

SamplePoi	SamplePoi	Associated	Associated	CollectionDate	SampleID	Contamina	MRL	MethodID
Valley Roa	EP	99001	DBP011	1/28/2014	2964101	PFOS	0.04	EPA 537
Valley Roa	EP	99001	DBP011	1/28/2014	2964101	PFOA	0.02	EPA 537
Valley Roa	EP	99001	DBP011	4/23/2014	3014331	PFOS	0.04	EPA 537
Chesapeak	EP	99001	DBP012	1/28/2014	2964215	PFOS	0.04	EPA 537
Valley Roa	EP	99001	DBP011	7/17/2013	2860930	PFOS	0.04	EPA 537
Valley Roa	EP	99001	DBP011	7/17/2013	2860930	PFOA	0.02	EPA 537
Chesapeak	EP	99001	DBP012	7/17/2013	2860759	PFOA	0.02	EPA 537
Chesapeak	EP	99001	DBP012	7/17/2013	2860759	PFOS	0.04	EPA 537
Valley Roa	EP	99001	DBP011	4/23/2014	3014331	PFOA	0.02	EPA 537
Middle Rur	EP	99001	DBP010	7/17/2013	2860886	PFOA	0.02	EPA 537
Valley Roa	EP	99001	DBP011	10/15/2013	2913847	PFOS	0.04	EPA 537
Valley Roa	EP	99001	DBP011	10/15/2013	2913847	PFOA	0.02	EPA 537
Old County	EP	99001	DBP012	1/28/2014	2964089	PFOA	0.02	EPA 537
Old County	EP	99001	DBP012	7/17/2013	2860347	PFOA	0.02	EPA 537
Old County	EP	99001	DBP012	1/28/2014	2964089	PFOS	0.04	EPA 537
Midvale EP	EP	99001	DBP011	8/12/2013	2875563	PFOA	0.02	EPA 537
Midvale EP	EP	99001	DBP011	8/12/2013	2875563	PFOS	0.04	EPA 537
Midvale EP	EP	99001	DBP011	1/28/2014	2964204	PFOS	0.04	EPA 537
Midvale EP	EP	99001	DBP011	1/28/2014	2964204	PFOA	0.02	EPA 537
Wilm. Man	EP	99001	DBP011	1/28/2014	2964185	PFOS	0.04	EPA 537
Wilm. Man	EP	99001	DBP011	1/28/2014	2964185	PFOA	0.02	EPA 537
Chesapeak	EP	99001	DBP012	1/28/2014	2964215	PFOA	0.02	EPA 537
Wilm. Man	EP	99001	DBP011	7/17/2013	2860744	PFOA	0.02	EPA 537
Wilm. Man	EP	99001	DBP011	7/17/2013	2860744	PFOS	0.04	EPA 537
Old County	EP	99001	DBP012	7/17/2013	2860347	PFOS	0.04	EPA 537
Wilm. Man	EP	99001	DBP011	1/28/2014	2964127	PFOS	0.04	EPA 537
Wilm. Man	EP	99001	DBP011	1/28/2014	2964127	PFOA	0.02	EPA 537
Wilm. Man	EP	99001	DBP011	7/17/2013	2860772	PFOA	0.02	EPA 537
Wilm. Man	EP	99001	DBP011	7/17/2013	2860772	PFOS	0.04	EPA 537
Hockessin (	EP	99001	DBP010	1/28/2014	2964058	PFOA	0.02	EPA 537
Hockessin (	EP	99001	DBP010	1/28/2014	2964058	PFOS	0.04	EPA 537
Glendale El	EP	99001	DBP011	7/17/2013	2860817	PFOS	0.04	EPA 537
Glendale El	EP	99001	DBP011	7/17/2013	2860817	PFOA	0.02	EPA 537
Hockessin (	EP	99001	DBP010	7/17/2013	2860837	PFOA	0.02	EPA 537
Hockessin (	EP	99001	DBP010	7/17/2013	2860837	PFOS	0.04	EPA 537
Fairwinds E	EP	99001	DBP011	7/17/2013	2860386	PFOA	0.02	EPA 537
Fairwinds E	EP	99001	DBP011	7/17/2013	2860386	PFOS	0.04	EPA 537
Glendale El	EP	99001	DBP011	1/28/2014	2964254	PFOA	0.02	EPA 537
Glendale El	EP	99001	DBP011	1/28/2014	2964254	PFOS	0.04	EPA 537
Llangollen	EP	99001	DBP011	7/17/2013	2860195	PFOA	0.02	EPA 537
Llangollen	EP	99001	DBP011	7/17/2013	2860195	PFOS	0.04	EPA 537
Castle Hills	EP	99001	DBP011	7/17/2013	2860336	PFOS	0.04	EPA 537
Middle Rur	EP	99001	DBP010	1/28/2014	2964145	PFOS	0.04	EPA 537
Middle Rur	EP	99001	DBP010	1/28/2014	2964145	PFOA	0.02	EPA 537
Jefferson F	EP	99001	DBP012	7/17/2013	2860509	PFOA	0.02	EPA 537
Jefferson F	EP	99001	DBP012	7/17/2013	2860509	PFOS	0.04	EPA 537

Jefferson F	EP	99001	DBP012	1/28/2014	2964271	PFOS	0.04	EPA 537
Jefferson F	EP	99001	DBP012	1/28/2014	2964271	PFOA	0.02	EPA 537
Llangollen	EP	99001	DBP011	1/28/2014	2964162	PFOS	0.04	EPA 537
Llangollen	EP	99001	DBP011	1/28/2014	2964162	PFOA	0.02	EPA 537
Artisan's Vi	EP	99001	DBP011	7/17/2013	2860941	PFOS	0.04	EPA 537
Artisan's Vi	EP	99001	DBP011	7/17/2013	2860941	PFOA	0.02	EPA 537
Castle Hills	EP	99001	DBP011	7/17/2013	2860336	PFOA	0.02	EPA 537
Airport Ind	EP	99001	DBP011	1/28/2014	2964039	PFOS	0.04	EPA 537
Middle Rur	EP	99001	DBP010	7/17/2013	2860886	PFOS	0.04	EPA 537
Airport Ind	EP	99001	DBP011	1/28/2014	2964039	PFOA	0.02	EPA 537
Artisan's Vi	EP	99001	DBP011	1/28/2014	2964242	PFOS	0.04	EPA 537
Artisan's Vi	EP	99001	DBP011	1/28/2014	2964242	PFOA	0.02	EPA 537
Castle Hills	EP	99001	DBP011	7/16/2014	3064487	PFOS	0.04	EPA 537
Airport Ind	EP	99001	DBP011	7/17/2013	2860259	PFOS	0.04	EPA 537
Airport Ind	EP	99001	DBP011	7/17/2013	2860259	PFOA	0.02	EPA 537
Eastern Sta	EP	99001	DBP012	7/17/2013	2860375	PFOA	0.02	EPA 537
Eastern Sta	EP	99001	DBP012	7/17/2013	2860375	PFOS	0.04	EPA 537
Eastern Sta	EP	99001	DBP012	1/28/2014	2964112	PFOA	0.02	EPA 537
Eastern Sta	EP	99001	DBP012	1/28/2014	2964112	PFOS	0.04	EPA 537
Fairwinds E	EP	99001	DBP011	1/28/2014	2964073	PFOA	0.02	EPA 537
Fairwinds E	EP	99001	DBP011	1/28/2014	2964073	PFOS	0.04	EPA 537
Collins Park	EP	99001	DBP011	1/28/2014	2964229	PFOA	0.02	EPA 537
Collins Park	EP	99001	DBP011	1/28/2014	2964229	PFOS	0.04	EPA 537
Castle Hills	EP	99001	DBP011	7/16/2014	3064487	PFOA	0.02	EPA 537
Collins Park	EP	99001	DBP011	7/17/2013	2860417	PFOS	0.04	EPA 537
Collins Park	EP	99001	DBP011	7/17/2013	2860417	PFOA	0.02	EPA 537

**data in ug/L*

AnalyticalF	AnalyticalF	SampleEve	Monitoring	Region	State
<		SE3	AM	3	DE
<		SE3	AM	3	DE
<		SE4	AM	3	DE
<		SE2	AM	3	DE
<		SE1	AM	3	DE
<		SE1	AM	3	DE
<		SE1	AM	3	DE
<		SE1	AM	3	DE
<		SE4	AM	3	DE
<		SE1	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
<		SE1	AM	3	DE
<		SE2	AM	3	DE
=	0.04	SE1	AM	3	DE
<		SE1	AM	3	DE
<		SE2	AM	3	DE
=	0.04	SE2	AM	3	DE
=	1.8	SE2	AM	3	DE
=	0.14	SE2	AM	3	DE
<		SE2	AM	3	DE
=	0.14	SE1	AM	3	DE
=	0.93	SE1	AM	3	DE
<		SE1	AM	3	DE
<		SE2	AM	3	DE
=	0.03	SE2	AM	3	DE
=	0.03	SE1	AM	3	DE
<		SE1	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
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<		SE1	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
=	0.06	SE1	AM	3	DE
=	0.18	SE1	AM	3	DE

=	0.13	SE2	AM	3	DE
=	0.04	SE2	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
<		SE1	AM	3	DE
<		SE1	AM	3	DE
=	0.04	SE1	AM	3	DE
<		SE2	AM	3	DE
<		SE1	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
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<		SE2	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
<		SE2	AM	3	DE
=	0.05	SE2	AM	3	DE
<		SE1	AM	3	DE
<		SE1	AM	3	DE

DEED

This Indenture Made the Sixteenth day of November, in the year of our Lord, one thousand nine hundred and eight. Between Alfred R. Haig and Cornelia E.B. Haig, his wife, both of Roxborough, County of Philadelphia, State of Pennsylvania, and James Alfred Smith and Adaline Smith his wife, both of the City of Philadelphia, County and State aforesaid, parties of the first part and the United States of America, party of the second part. Witnesseth That the Said parties of the first part, for and in consideration of the sum of Seven Thousand Dollars ($7000.) carried lawful money of the United States of America, unto them well and truly paid by the said party of the second part, at and before the Sealing and Delivery of these Presents, the receipt whereof is hereby acknowledged, have granted, bargained, sold, aliened, enfeoffed, released, conveyed and confirmed, and by these presents do grant, bargain, sell, alien enfeoff, release, convey and confirm unto the said party of the second part, and their Assigns, All that certain tract, piece or parcel of land with the houses and buildings thereon erected situate and lying in New Castle Hundred County of New Castle and State of Delaware bounded and described as follows (according to a recent survey made by Francis A. Price C E) to wit: Beginning at a point in the centre of the Hamburg or River Road leading from the City of New Castle to Delaware City, said point being in the centre of the bridge over *Gemmell's Gut; thence along the middle of said road South forty six

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* Commonly known today as Gambels Gut - see local maps

degrees fourteen and three fourth minutes West two thousand seven hundred and eighty seven and eight tenths feet to a point; thence South forty degrees thirty minutes West eight hundred and eighty one and six tenths feet to a point, a corner of lands of Florence B. Hilles; thence along the line of lands of said Florence B. Hilles, South, fifty degrees ten minutes East two thousand five hundred and seventy nine and two tenths feet to a point in a centre line of a ditch; thence thereby South Sixty two degrees four one hundredths minutes East fifty and four tenths feet to the end of a sluice; thence along the middle line of said sluice South fifty two degrees fifty six minutes East sixteen feet to the centre of said sluice; thence along the middle line of said sluice and down the various courses of the said ditch, in a Southeasterly direction about four hundred feet to low water mark of the Delaware River; thence in a Northeasterly direction along the said low water mark of the Delaware River about three thousand nine hundred and fifty feet to the centre line of Gemmell's Gut extended; thence up said Gemmell's Gut; in a Northwesterly direction about four hundred feet to a point in the centre of the sluice in the old river bank, said point in the centre of said sluice being distant North Thirty four degrees forty nine and one half minutes East, three thousand seven hundred and sixty and nine tenths feet from the centre of the sluice at the end of the Fifth course herein before described; thence up the centre line of Gemmel's Gut, North fifty eight degrees forty six minutes West One hundred and eighty five and nine tenths feet; thence North thirty six degrees forty minutes West, one hundred and

thirty two and two tenths feet; thence North sixty one degrees forty eight minutes West, one thousand one hundred and six tenths feet, thence North sixty nine degrees forty one minutes West, one hundred and seventy four and seven tenths feet; and thence North twenty seven degrees eight one hundredths minutes West four hundred and thirty and nine tenths feet to the place of Beginning. Containing within said metes and bounds about two hundred and twenty seven acres of land of which said land there are now two and fifty one one hundredths acres occupied by the Wilmington, New Castle and Southern Railway Company as a right of way and also one and sixty eight one hundredths acres thereof, are included in and a part pf the said public road to the middle of which this survey has been made with which two exceptions there are contained in the said lands and premises hereby conveyed about two hundred and twenty two and eighty one one hundredths acres of land including the marsh and flats in the above described premises, Being the same lands and premises which James Alfred Smith and wife, by Indenture bearing date the 18th day of September, as 1908, and recorded in Deed Record Book Y Vol. 21 Page 505, granted and conveyed into Alfred R. Haig in fee. The said James Alfred Smith and wife, being joined in this deed to convey and confirm in the United States their legal and equitable estate in the lands. Together with all and singular the houses and buildings, improvements, woods, ways, waters, watercourses, rights, liberties, privileges, hereditaments and appurtenances whatsoever thereunto belonging, or in anywise appertaining, and the reversions and remainders, rents, issues and profits thereof, and all the estate, right, title, interest, property,

claim and demand, whatsoever of them, the said parties of the first part in law, equity or otherwise, howsoever, of, in and to the same, and every part and parcel thereof. To Have And To Hold the said tract, piece or parcel, of land; hereditaments and premises, hereby granted, or mentioned, or intended so to be, with the appurtenances, unto the said party of the second part, and their Assigns, to and for the only proper use and behalf of the said party of the second part and their Assigns forever, And the said parties of the first part for themselves, their Heirs, Executors and Administrators Do by these Presents covenant grant and agree to and with the said party of the Second part, and their Assigns, that they, the said parties of the first part their Heirs, all and singular the hereditaments and premises herein above described and granted, or mentioned, or intended so to be, with the appurtenances, unto the said party of the second part, and their Assigns, against them the said parties of the first part, their Heirs, and against all and every other Person or Persons Whomsoever lawfully claiming or to claim the same or any part thereof, by, from, or under them shall and will by these presents Warrant and forever Defend. In Witness Whereof the said parties of the first part have hereunto set their Hands and Seals. Dated the day and year first above written.

Sealed and Delivered In the presence of Mrs. J. W. Eisenhower Eleanor T. McCall	Alfred R. Haig Cornelia E.B. Haig James Alfred Smith Adaline Smith	seal seal seal seal

State of Pennsylvania

Philadelphia County

Eleanor T. McCall

Notary Public

Philadelphia, Pa

ss Be it Remembered That on this 16th day of November in the year of our Lord one thousand nine hundred nine hundred and eight personally came before me Eleanor T. McCall, Notary Public for the State of Pennsylvania, Alfred R. Haig, and Cornelia E.B. Haig his wife and James Alfred Smith and Adaline Smith his wife, parties to this Indenture known to me personally to be such, and severally acknowledged this Indenture to be their Deed. And the said Cornelia E.B. Haig and Adaline Smith being at the same time privately examined by me apart from their husbands, acknowledged that they executed the said Indenture willingly, without compulsion or threats or fear of their husbands.

River Road Training Site

1197 River Road

New Castle, DE 19720

Inquiry Number: 5765905.5

August 27, 2019

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

08/27/19

Site Name:

River Road Training Site
1197 River Road
New Castle, DE 19720
EDR Inquiry # 5765905.5

Client Name:

AECOM
12120 Shamrock Plaza
Omaha, NE 68154
Contact: Hans Sund

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	***Scale***	***Details***	***Source***
2017	1"=750'	Flight Year: 2017	USDA/NAIP
2013	1"=750'	Flight Year: 2013	USDA/NAIP
2010	1"=750'	Flight Year: 2010	USDA/NAIP
2006	1"=750'	Flight Year: 2006	USDA/NAIP
1998	1"=750'	Flight Date: February 26, 1998	USGS
1992	1"=750'	Acquisition Date: March 16, 1992	USGS/DOQQ
1982	1"=750'	Flight Date: March 28, 1982	NHAP
1970	1"=750'	Flight Date: February 22, 1970	USGS
1965	1"=750'	Flight Date: March 14, 1965	USGS
1954	1"=750'	Flight Date: July 12, 1954	USDA
1951	1"=750'	Flight Date: April 23, 1951	USGS

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INQUIRY #: 5765905.5

YEAR: 2017

= 750'

N

EDR

INQUIRY #: 5765905.5

YEAR: 2013

= 750'

N

EDR

INQUIRY #: 5765905.5

YEAR: 2010

= 750'

N

EDR

INQUIRY #: 5765905.5

YEAR: 2006

= 750'

N

EDR

INQUIRY #: 5765905.5
YEAR: 1998
= 750'
N
EDR

INQUIRY #: 5765905.5
YEAR: 1992
= 750'
N
EDR

INQUIRY #: 5765905.5

YEAR: 1982

= 750'

N

EDR

INQUIRY #: 5765905.5

YEAR: 1970

= 750'

N

EDR

INQUIRY #: 5765905.5

YEAR: 1965

= 750'

N

EDR

INQUIRY #: 5765905.5

YEAR: 1954

= 750'

N

EDR

INQUIRY #: 5765905.5

YEAR: 1951

= 750'

N

EDR

River Road Training Site

1197 River Road

New Castle, DE 19720

Inquiry Number: 5765905.3

August 26, 2019

Certified Sanborn® Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

08/26/19

Site Name:	Client Name:
River Road Training Site	AECOM
1197 River Road	12120 Shamrock Plaza
New Castle, DE 19720	Omaha, NE 68154
EDR Inquiry # 5765905.3	Contact: Hans Sund

The Sanborn Library has been searched by EDR and maps covering the target property location as provided by AECOM were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

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Certified Sanborn Results:

Certification # B79E-4D2D-8F4E

PO # NA

Project River Road Training Site

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

Sanborn® Library search results

Certification #: B79E-4D2D-8F4E

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✔ Library of Congress
- ✔ University Publications of America
- ✔ EDR Private Collection

The Sanborn Library LLC Since 1866™

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River Road Training Site
1197 River Road
New Castle, DE 19720

Inquiry Number: 5765905.2s
August 26, 2019

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
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www.edrnet.com

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GEOCHECK ADDENDUM

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Thank you for your business.
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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

1197 RIVER ROAD
NEW CASTLE, DE 19720

COORDINATES

Latitude (North):	39.6341130 - 39˚ 38' 2.80''
Longitude (West):	75.6066400 - 75˚ 36' 23.90''
Universal Tranverse Mercator:	Zone 18
UTM X (Meters):	447940.5
UTM Y (Meters):	4387115.0
Elevation:	4 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	6049807 WILMINGTON SOUTH, DE
Version Date:	2014
Southeast Map:	6049773 DELAWARE CITY, DE
Version Date:	2014
Southwest Map:	6049815 SAINT GEORGES, DE
Version Date:	2014
Northwest Map:	6049791 NEWARK EAST, DE
Version Date:	2014

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20150701
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
1197 RIVER ROAD
NEW CASTLE, DE 19720

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	NEW CASTLE RIFLE RAN	1197 RIVER ROAD	SEMS		TP
A2	DEARNG ARMY NATIONAL	1197 RIVER ROAD, BUI	DE UST		TP
A3	DELAWARE ARMY NATION	1197 RIVER ROAD	FINDS		TP
A4	US ARMY NATIONAL GUA	1197 RIVER RD	TRIS, FINDS, ECHO		TP
A5	DELAWARE ARMY NATION	1197 RIVER RD	RCRA-CESQG, FINDS, ECHO, PA MANIFEST, NY MANIFEST,...		TP
A6	NEW CASTLE RIFLE RAN	1197 RIVER RD	DE LUST, DE AIRS, DE TIER 2		TP
A7	FORMER SMALL ARMS RA	1197 RIVER ROAD	UXO		TP
A8	DELAWARE ARMY NATION	1197 RIVER RD	DE TIER 2		TP
A9	FORMER SMALL ARMS RA	1197 RIVER ROAD	UXO		TP
A10	NEW CASTLE RIFLE RAN	1197 RIVER ROAD	FINDS		TP
A11	DEARNG FIELD MAINTEN	1197 RIVER ROAD	DE AST		TP
Reg	ARMY CREEK LANDFILL	RTE 13 + RTE 40	NPL, SEMS, US ENG CONTROLS, ROD, PRP, CONSENT	Same	4341, 0.822, North
Reg	DELAWARE SAND & GRAV	229 GRANTHAM LANE	NPL, SEMS, US ENG CONTROLS, US INST CONTROL, DE...	Same	3924, 0.743, NNE
12	DELAWARE ARMY NATION	1191 RIVER RD	RCRA-CESQG, FINDS, ECHO, NJ MANIFEST	Higher	1 ft.
13	NG NEW CASTLE TS RIF	1199 RIVER ROAD	DE SHWS	Higher	1 ft.
B14	DE ARNG USPFO	1161 RIVER ROAD	PA MANIFEST	Higher	1 ft.
B15	DELAWARE ARMY NATION	1161 RIVER RD	RCRA-CESQG, ECHO, NY MANIFEST, NJ MANIFEST	Higher	1 ft.
16	DELAWARE BRICK PIT	1136 RIVER ROAD	DE SHWS	Higher	130, 0.025, North
17	OMMELANDEN HUNTER ED	1220 RIVER ROAD	DE SHWS	Higher	961, 0.182, WSW
18	DELAWARE BRICK COMPA		US MINES	Higher	1089, 0.206, North
19	DENTON LANDFILL	ROUTE 9	DE SHWS, DE INST CONTROL	Higher	1695, 0.321, NE
20	DP AND L, OSTERHELD	1079 RIVER ROAD	DE LUST	Higher	1756, 0.333, NNE
21	RT 9 TCE	1040 RIVER ROAD	DE SHWS	Higher	2607, 0.494, NNE
22	INDUSTRIAL PROD	RTE 9TH GRANTHAM RD	SEMS-ARCHIVE, DE SHWS, DE INST CONTROL	Higher	3421, 0.648, NE
23	PETRILLO PROPERTY	758 GRANTHAM LANE	DE SHWS, DE INST CONTROL, DE BROWNFIELDS	Higher	3998, 0.757, North
24	MOTIVA NRDA HABITAT		DE SHWS	Higher	4324, 0.819, SSW
25	FORMER AMOCO FILM PL	955 RIVER ROAD	DE SHWS, DE INST CONTROL	Higher	4706, 0.891, NNE
26	ARMY CREEK LANDFILL	0 OFF SOUTH DUPONT H	DE SHWS, DE INST CONTROL	Higher	5100, 0.966, North

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was identified in the following records. For more information on this property see page 8 of the attached EDR Radius Map report:

Site	Database(s)	EPA ID
NEW CASTLE RIFLE RAN 1197 RIVER ROAD NEW CASTLE, DE 19720	SEMS Site ID: 0306777 EPA Id: DEN000306777	DEN000306777
DEARNG ARMY NATIONAL 1197 RIVER ROAD, BUI NEW CASTLE, DE 19720	DE UST Tank Status: Removed Tank Status: Closed in Place Prog Id: 3-000728 Prog Id: 3-000730 Prog Id: 3-000734	N/A
DELAWARE ARMY NATION 1197 RIVER ROAD NEW CASTLE, DE 19720	FINDS Registry ID:: 110054391831	N/A
US ARMY NATIONAL GUA 1197 RIVER RD NEW CASTLE, DE 19720	TRIS TRIS ID: 1972WRVRRD1197R FINDS Registry ID:: 110067662862 ECHO Registry ID: 110067662862	1972WRVRRD1197R
DELAWARE ARMY NATION 1197 RIVER RD NEW CASTLE, DE 19720	RCRA-CESQG EPA ID:: DED982572513 FINDS Registry ID:: 110002508643 ECHO Registry ID: 110002508643 PA MANIFEST Generator EPA Id: DED982572513 NY MANIFEST EPA ID: DED982572513 NJ MANIFEST EPA Id: DED982572513	DED982572513
NEW CASTLE RIFLE RAN 1197 RIVER RD NEW CASTLE, DE 19720	DE LUST Closure: 01/30/1992	N/A

	Closure: 01/21/1994 Closure: 04/07/1994 Closure: 05/17/2001 Closure: 07/12/1996 **Additional key fields are available in the Map Findings section* Facility Id: 10024367 Prog ID: 3-000734 Prog ID: 3-000730 Prog ID: 3-000728 Status: Inactive DE AIRS Facility Id: 10024367 DE TIER 2 Facility Status: ACTIVE Facility Id: 745	
FORMER SMALL ARMS RA 1197 RIVER ROAD NEW CASTLE, DE	UXO	N/A
DELAWARE ARMY NATION 1197 RIVER RD NEW CASTLE, DE 19720	DE TIER 2	N/A
FORMER SMALL ARMS RA 1197 RIVER ROAD NEW CASTLE, DE	UXO	N/A
NEW CASTLE RIFLE RAN 1197 RIVER ROAD NEW CASTLE, DE 19720	FINDS Registry ID:: 110044766713	N/A
DEARNG FIELD MAINTEN 1197 RIVER ROAD NEW CASTLE, DE 19720	DE AST Prog Id: 7-000554 Facility Id: 10024367	N/A

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

Proposed NPL..... Proposed National Priority List Sites

EXECUTIVE SUMMARY

NPL LIENS..... Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL..... National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY..... Federal Facility Site Information listing

Federal RCRA CORRACTS facilities list

CORRACTS..... Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF..... RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG..... RCRA - Large Quantity Generators
RCRA-SQG..... RCRA - Small Quantity Generators

Federal institutional controls / engineering controls registries

LUCIS..... Land Use Control Information System

Federal ERNS list

ERNS..... Emergency Response Notification System

State and tribal landfill and/or solid waste disposal site lists

DE SWF/LF..... Solid Waste Facilities

State and tribal leaking storage tank lists

DE LAST..... Leaking Aboveground Storage Tank Sites
INDIAN LUST..... Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

FEMA UST..... Underground Storage Tank Listing
INDIAN UST..... Underground Storage Tanks on Indian Land

State and tribal voluntary cleanup sites

DE VCP..... Voluntary Cleanup Program Sites
INDIAN VCP..... Voluntary Cleanup Priority Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS..... A Listing of Brownfields Sites

EXECUTIVE SUMMARY

Local Lists of Landfill / Solid Waste Disposal Sites

DE SWRCY	Recyclers Directory
INDIAN ODI	Report on the Status of Open Dumps on Indian Lands
DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations
ODI	Open Dump Inventory
IHS OPEN DUMPS	Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL	Delisted National Clandestine Laboratory Register
US CDL	National Clandestine Laboratory Register

Local Land Records

LIENS 2	CERCLA Lien Information

Records of Emergency Release Reports

HMIRS	Hazardous Materials Information Reporting System
DE SPILLS	Environmental Release Notification System

Other Ascertainable Records

RCRA NonGen / NLR	RCRA - Non Generators / No Longer Regulated
FUDS	Formerly Used Defense Sites
DOD	Department of Defense Sites
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
2020 COR ACTION	2020 Corrective Action Program List
TSCA	Toxic Substances Control Act
SSTS	Section 7 Tracking Systems
RMP	Risk Management Plans
RAATS	RCRA Administrative Action Tracking System
PADS	PCB Activity Database System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
ABANDONED MINES	Abandoned Mines
DOCKET HWC	Hazardous Waste Compliance Docket Listing
FUELS PROGRAM	EPA Fuels Program Registered Listing
DE DRYCLEANERS	Drycleaner Facility Listing

EXECUTIVE SUMMARY

DE ENF..... Notice of Violations
DE Financial Assurance..... Financial Assurance Information Listing
DE NPDES..... Wastewater Permit Listing
DE UIC..... Underground Injection Wells Inventory Listing

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP..... EDR Proprietary Manufactured Gas Plants
EDR Hist Auto..... EDR Exclusive Historical Auto Stations
EDR Hist Cleaner..... EDR Exclusive Historical Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

DE RGA HWS..... Recovered Government Archive State Hazardous Waste Facilities List
DE RGA LF..... Recovered Government Archive Solid Waste Facilities List

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: Also known as Superfund, the National Priority List database is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund program. The source of this database is the U.S. EPA.

A review of the NPL list, as provided by EDR, and dated 04/11/2019 has revealed that there are 2 NPL sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
ARMY CREEK LANDFILL Cerclis ID:: 300086 EPA Id: DED980494496	***RTE 13 + RTE 40***	***N 1/2 - 1 (0.822 mi.)***	***0***	***47***
DELAWARE SAND & GRAV Cerclis ID:: 300034	***229 GRANTHAM LANE***	***NNE 1/2 - 1 (0.743 mi.)***	***0***	***64***

EPA Id: DED000605972

Federal RCRA generators list

RCRA-CESQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

A review of the RCRA-CESQG list, as provided by EDR, and dated 03/25/2019 has revealed that there are 2 RCRA-CESQG sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DELAWARE ARMY NATION EPA ID:: DED982661365	***1191 RIVER RD***	***0 - 1/8 (0.000 mi.)***	***12***	***90***
DELAWARE ARMY NATION EPA ID:: DED984076372	***1161 RIVER RD***	***0 - 1/8 (0.000 mi.)***	***B15***	***102***

State- and tribal - equivalent CERCLIS

DE SHWS: Hazardous Substance Release Sites.

A review of the DE SHWS list, as provided by EDR, and dated 05/17/2019 has revealed that there are 11 DE SHWS sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DELAWARE SAND & GRAV Facility Id: 10055919 Prog ID: DE-0017	***229 GRANTHAM LANE***	***NNE 1/2 - 1 (0.743 mi.)***	***0***	***64***
NG NEW CASTLE TS RIF Facility Id: 10711954 Prog ID: DE-0333	1199 RIVER ROAD	0 - 1/8 (0.000 mi.)	13	94
DELAWARE BRICK PIT Prog ID: DE-1151	1136 RIVER ROAD	N 0 - 1/8 (0.025 mi.)	16	106
OMMELANDEN HUNTER ED Facility Id: 10057901 Prog ID: DE-1457	1220 RIVER ROAD	WSW 1/8 - 1/4 (0.182 mi.)	17	107
DENTON LANDFILL Facility Id: 10056192 Prog ID: DE-0015	***ROUTE 9***	***NE 1/4 - 1/2 (0.321 mi.)***	***19***	***108***
RT 9 TCE Facility Id: 10056240 Prog ID: DE-1271	1040 RIVER ROAD	NNE 1/4 - 1/2 (0.494 mi.)	21	110
INDUSTRIAL PROD	***RTE 9TH GRANTHAM RD***	***NE 1/2 - 1 (0.648 mi.)***	***22***	***111***

Facility Id: 10056249 Prog ID: DE-0030				
PETRILLO PROPERTY Facility Id: 10056394 Prog ID: DE-1281	***758 GRANTHAM LANE***	***N 1/2 - 1 (0.757 mi.)***	***23***	***113***
MOTIVA NRDA HABITAT Facility Id: 10062968 Prog ID: DE-1373		SSW 1/2 - 1 (0.819 mi.)	24	116
FORMER AMOCO FILM PL Facility Id: 10054470 Prog ID: DE-1152	***955 RIVER ROAD***	***NNE 1/2 - 1 (0.891 mi.)***	***25***	***117***
ARMY CREEK LANDFILL Facility Id: 10056493 Prog ID: DE-0001	***0 OFF SOUTH DUPONT H***	***N 1/2 - 1 (0.966 mi.)***	***26***	***118***

State and tribal leaking storage tank lists

DE LUST: Leaking Underground Storage Tanks - Active/Inactivated Sites.

A review of the DE LUST list, as provided by EDR, and dated 04/15/2019 has revealed that there is 1 DE LUST site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DP AND L, OSTERHELD Closure: 07/15/1992 Facility Id: 10025041 Prog ID: 3-001453 Status: Inactive	1079 RIVER ROAD	NNE 1/4 - 1/2 (0.333 mi.)	20	109

State and tribal institutional control / engineering control registries

DE INST CONTROL: All Sites with Deed Restrictions from the Department of Natural Resources & Environmental Control.

A review of the DE INST CONTROL list, as provided by EDR, and dated 02/11/2019 has revealed that there is 1 DE INST CONTROL site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DENTON LANDFILL Facility Id: DE-0015	***ROUTE 9***	***NE 1/4 - 1/2 (0.321 mi.)***	***19***	***108***

EXECUTIVE SUMMARY

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

ROD: Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid the cleanup.

A review of the ROD list, as provided by EDR, and dated 04/11/2019 has revealed that there are 2 ROD sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
ARMY CREEK LANDFILL EPA ID:: DED980494496	***RTE 13 + RTE 40***	***N 1/2 - 1 (0.822 mi.)***	***0***	***47***
DELAWARE SAND & GRAV EPA ID:: DED000605972	***229 GRANTHAM LANE***	***NNE 1/2 - 1 (0.743 mi.)***	***0***	***64***

CONSENT: Major Legal settlements that establish responsibility and standards for cleanup at NPL (superfund) sites. Released periodically by U.S. District Courts after settlement by parties to litigation matters.

A review of the CONSENT list, as provided by EDR, and dated 03/31/2019 has revealed that there are 2 CONSENT sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
ARMY CREEK LANDFILL	***RTE 13 + RTE 40***	***N 1/2 - 1 (0.822 mi.)***	***0***	***47***
DELAWARE SAND & GRAV	***229 GRANTHAM LANE***	***NNE 1/2 - 1 (0.743 mi.)***	***0***	***64***

US MINES: Mines Master Index File. The source of this database is the Dept. of Labor, Mine Safety and Health Administration.

A review of the US MINES list, as provided by EDR, has revealed that there is 1 US MINES site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DELAWARE BRICK COMPA Database: US MINES, Date of Government Version: 11/27/2018 Mine ID:: 0700012		N 1/8 - 1/4 (0.206 mi.)	18	107

NJ MANIFEST: Hazardous waste manifest information.

A review of the NJ MANIFEST list, as provided by EDR, and dated 12/31/2018 has revealed that there are 2 NJ MANIFEST sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DELAWARE ARMY NATION EPA Id: DED982661365	***1191 RIVER RD***	***0 - 1/8 (0.000 mi.)***	***12***	***90***
DELAWARE ARMY NATION	***1161 RIVER RD***	***0 - 1/8 (0.000 mi.)***	***B15***	***102***

EXECUTIVE SUMMARY

EPA Id: DED984076372

NY MANIFEST: Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

A review of the NY MANIFEST list, as provided by EDR, and dated 01/01/2019 has revealed that there is 1 NY MANIFEST site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DELAWARE ARMY NATION	***1161 RIVER RD***	***0 - 1/8 (0.000 mi.)***	***B15***	***102***
EPA ID: DED984076372				

PA MANIFEST: Hazardous waste manifest information.

A review of the PA MANIFEST list, as provided by EDR, and dated 12/31/2017 has revealed that there is 1 PA MANIFEST site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DE ARNG USPFO	1161 RIVER ROAD	0 - 1/8 (0.000 mi.)	B14	97
Generator EPA Id: DED984076372				

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 2 records.

Site Name	Database(s)
AMOCO CHEMICAL CORP - POLYMER PLAN	SEMS-ARCHIVE, RCRA NonGen / NLR
RIVERBEND SUBDIVISION - RIVER ROAD	FINDS

OVERVIEW MAP - 5765905.2S

Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

National Priority List Sites

Dept. Defense Sites

0 1/4 1/2 1 Miles

Indian Reservations BIA

Power transmission lines

100-year flood zone

500-year flood zone

National Wetland Inventory

State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: River Road Training Site ADDRESS: 1197 River Road New Castle DE 19720 LAT/LONG: 39.634113 / 75.60664	CLIENT: AECOM CONTACT: Hans Sund INQUIRY #: 5765905.2s DATE: August 26, 2019 12:54 pm

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DETAIL MAP - 5765905.2S

Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

Sensitive Receptors

National Priority List Sites

Dept. Defense Sites

0 1/8 1/4 1/2 Miles

Indian Reservations BIA

100-year flood zone

500-year flood zone

National Wetland Inventory

State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: River Road Training Site	CLIENT: AECOM
ADDRESS: 1197 River Road New Castle DE 19720	CONTACT: Hans Sund
LAT/LONG: 39.634113 / 75.60664	INQUIRY #: 5765905.2s DATE: August 26, 2019 12:54 pm

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MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	2	NR	2
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	1.000		0	0	0	0	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500	1	0	0	0	NR	NR	1
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250	1	2	0	NR	NR	NR	3
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
DE SHWS	1.000		2	1	2	6	NR	11
State and tribal landfill and/or solid waste disposal site lists								
DE SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
DE LAST	0.500		0	0	0	NR	NR	0
DE LUST	0.500	1	0	0	1	NR	NR	2
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
DE UST	0.250	1	0	0	NR	NR	NR	1
DE AST	0.250	1	0	0	NR	NR	NR	1
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
DE INST CONTROL	0.500		0	0	1	NR	NR	1
State and tribal voluntary cleanup sites								
DE VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
DE BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DE SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
DE SPILLS	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP	1	NR	NR	NR	NR	NR	1

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	2	NR	2
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	2	NR	2
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	1	NR	NR	NR	1
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP	4	NR	NR	NR	NR	NR	4
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
ECHO	TP	2	NR	NR	NR	NR	NR	2
UXO	1.000	2	0	0	0	0	NR	2
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
DE AIRS	TP	1	NR	NR	NR	NR	NR	1
DE DRYCLEANERS	0.250		0	0	NR	NR	NR	0
DE ENF	TP		NR	NR	NR	NR	NR	0
DE Financial Assurance	TP		NR	NR	NR	NR	NR	0
NJ MANIFEST	0.250	1	2	0	NR	NR	NR	3
NY MANIFEST	0.250	1	1	0	NR	NR	NR	2
PA MANIFEST	0.250	1	1	0	NR	NR	NR	2
DE NPDES	TP		NR	NR	NR	NR	NR	0
DE TIER 2	TP	2	NR	NR	NR	NR	NR	2
DE UIC	TP		NR	NR	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
DE RGA HWS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
DE RGA LF	TP		NR	NR	NR	NR	NR	0
- Totals --		20	8	2	4	12	0	46

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

A1 Target Property | **NEW CASTLE RIFLE RANGE TRAINING SITE** | **SEMS** | **1015730800**
1197 RIVER ROAD | **DEN000306777**
NEW CASTLE, DE 19720

Site 1 of 11 in cluster A

Actual: 4 ft.

SEMS:

Site ID:	0306777
EPA ID:	DEN000306777
Cong District:	01
FIPS Code:	10003
Latitude:	Not reported
Longitude:	Not reported
FF:	Y
NPL:	Not on the NPL
Non NPL Status:	Fed Fac Site Inspection Review Start Needed

SEMS Detail:

Region:	03
Site ID:	0306777
EPA ID:	DEN000306777
Site Name:	NEW CASTLE RIFLE RANGE TRAINING SITE
NPL:	N
FF:	Y
OU:	00
Action Code:	RX
Action Name:	FF PA
SEQ:	1
Start Date:	2011-11-10 05:00:00
Finish Date:	11/22/2011 5:00:00 AM
Qual:	L
Current Action Lead:	EPA Perf In-Hse

Region:	03
Site ID:	0306777
EPA ID:	DEN000306777
Site Name:	NEW CASTLE RIFLE RANGE TRAINING SITE
NPL:	N
FF:	Y
OU:	00
Action Code:	DS
Action Name:	DISCVRY
SEQ:	1
Start Date:	1995-04-11 04:00:00
Finish Date:	4/11/1995 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf In-Hse

A2 Target Property | **DEARNG ARMY NATIONAL GUARD OMS #3** | **DE UST** | **U003962974**
1197 RIVER ROAD, BUILDING 16 | **N/A**
NEW CASTLE, DE 19720

Site 2 of 11 in cluster A

Actual: 4 ft.

UST:

Facility Id:	10024367
PI Id:	18355
Prog Id:	3-000734
Tax Id:	Not reported

DEARNG ARMY NATIONAL GUARD OMS #3 (Continued) **U003962974**

Additional Info:	Not reported
Care Of:	Not reported
PO Name:	New Castle
Sewer District:	Not reported
Flood Plain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Water District:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC Basin:	Yes
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Mod Grid:	Not reported
Reference Pt:	Unknown
Horizontal Method:	GPS-Differentially Corrected
X Coordinate Na D83 Meters:	183264.6
Y Coordinate Na D83 Meters:	181385.2
Latitude Dec:	39.63376
Longitude Dec:	-75.6116
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	1.5684
Longitude Degrees:	-75
Longitude Minutes:	36
Longitude Seconds:	41.7888
Owner:	DEARNG Army National Guard
Owner Address:	First Regiment Road, Wilmington, DE 19808 US

Tank Info:

Tank Id:	1
Alt Tank Id:	1
Tank Status:	Removed
Capacity:	6000
Tank Substance:	Diesel
Compartment:	N
Close Date:	09/17/1991
Install Date:	04/15/1985

Tank Id:	1
Alt Tank Id:	1
Tank Status:	Removed
Capacity:	4000
Tank Substance:	Gasoline
Compartment:	N
Close Date:	10/07/1992
Install Date:	04/15/1967

Tank Id:	1
Alt Tank Id:	1

DEARNG ARMY NATIONAL GUARD OMS #3 (Continued) **U003962974**

Tank Status:	Removed
Capacity:	4000
Tank Substance:	Gasoline
Compartment:	N
Close Date:	08/24/1989
Install Date:	04/15/1967

Tank Id:	2
Alt Tank Id:	2
Tank Status:	Removed
Capacity:	500
Tank Substance:	Used Oil
Compartment:	N
Close Date:	02/28/1996
Install Date:	04/15/1985

Tank Id:	2
Alt Tank Id:	2
Tank Status:	Removed
Capacity:	2000
Tank Substance:	Heating Oil
Compartment:	N
Close Date:	10/07/1992
Install Date:	04/15/1967

Tank Id:	2
Alt Tank Id:	2
Tank Status:	Removed
Capacity:	2000
Tank Substance:	Diesel
Compartment:	N
Close Date:	08/24/1989
Install Date:	04/15/1967

Tank Id:	3
Alt Tank Id:	3
Tank Status:	Removed
Capacity:	1000
Tank Substance:	Heating Oil
Compartment:	N
Close Date:	10/07/1992
Install Date:	Not reported

Tank Id:	3
Alt Tank Id:	3
Tank Status:	Closed in Place
Capacity:	500
Tank Substance:	Used Oil
Compartment:	N
Close Date:	10/27/1993
Install Date:	04/15/1967

DEARNG ARMY NATIONAL GUARD OMS #3 (Continued) **U003962974**

Tank Id:	4
Alt Tank Id:	4
Tank Status:	Removed
Capacity:	10000
Tank Substance:	Heating Oil
Compartment:	N
Close Date:	04/22/1996
Install Date:	Not reported

A3 Target Property **DELAWARE ARMY NATIONAL GUARD** **FINDS** **1015871048**
1197 RIVER ROAD **N/A**
NEW CASTLE, DE 19720

Site 3 of 11 in cluster A

Actual: 4 ft.

FINDS:

Registry ID: 110054391831

Environmental Interest/Information System
STATE MASTER

Click this hyperlink while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

A4 Target Property **US ARMY NATIONAL GUARD RIVER ROAD TRAINING SITE RA** **TRIS** **1018373937**
1197 RIVER RD **FINDS** **1972WRVRRD1197R**
NEW CASTLE, DE 19720 **ECHO**

Site 4 of 11 in cluster A

Actual: 4 ft.

TRIS:

Click this hyperlink while viewing on your computer to access 1 additional US_TRIS: record(s) in the EDR Site Report.

FINDS:

Registry ID: 110067662862

Environmental Interest/Information System
US EPA TRIS (Toxics Release Inventory System) contains information from facilities on the amounts of over 300 listed toxic chemicals that these facilities release directly to air, water, land, or that are transported off-site.

Click this hyperlink while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid:	1018373937
Registry ID:	110067662862
DFR URL:	http://echo.epa.gov/detailed-facility-report?fid=110067662862

A5 Target Property | **DELAWARE ARMY NATIONAL GUARD CSMS 09**
1197 RIVER RD
NEW CASTLE, DE 19720

Site 5 of 11 in cluster A

Actual: 4 ft.

RCRA-CESQG
FINDS
ECHO
PA MANIFEST
NY MANIFEST
NJ MANIFEST

1000106297
DED982572513

RCRA-CESQG:

Date form received by agency:	09/01/1988
Facility name:	DELAWARE ARMY NATIONAL GUARD CSMS 09
Facility address:	1197 RIVER RD BLDG 16 NEW CASTLE, DE 19720
EPA ID:	DED982572513
Contact:	MICHAEL KITTS
Contact address:	1197 RIVER RD BLDG 16 NEW CASTLE, DE 19720
Contact country:	US
Contact telephone:	302-324-7349
Contact email:	Not reported
EPA Region:	03
Land type:	State
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:

Owner/operator name:	DE ARMY NATL GUARD
Owner/operator address:	FIRST REGIMENT RD WILMINGTON, DE 19808
Owner/operator country:	Not reported
Owner/operator telephone:	302-324-7023
Owner/operator email:	Not reported
Owner/operator fax:	Not reported
Owner/operator extension:	Not reported
Legal status:	State
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Owner/operator name:	OPERNAME
Owner/operator address:	OPERSTREET OPERCITY, AK 99999
Owner/operator country:	Not reported
Owner/operator telephone:	215-555-1212
Owner/operator email:	Not reported
Owner/operator fax:	Not reported

DELAWARE ARMY NATIONAL GUARD CSMS 09 (Continued) **1000106297**

Owner/operator extension: Not reported
Legal status: State
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Hazardous Waste Summary:

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D002
. Waste name: CORROSIVE WASTE

Violation Status: No violations found

Evaluation Action Summary:
Evaluation date: 05/03/1993
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

FINDS:

Registry ID: 110002508643

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

Click this hyperlink while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

DELAWARE ARMY NATIONAL GUARD CSMS 09 (Continued) **1000106297**

ECHO:

Envid:	1000106297
Registry ID:	110002508643
DFR URL:	http://echo.epa.gov/detailed-facility-report?fid=110002508643

Manifest Details:

Year:	2009
Manifest Number:	004275286JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED982572513
Generator Date:	10/09/2009
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-324-2355
TSD EPA Id:	PAD085690592
TSD Date:	Not reported
TSD Facility Name:	REPUBLIC ENVIRONMENTAL SYSTEMS OF PA INC
TSD Facility Address:	2869 SANDSTONE DRIVE
TSD Facility City:	HATFIELD
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F005
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	30
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2009
Manifest Number:	004275286JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED982572513
Generator Date:	10/09/2009
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-324-2355
TSD EPA Id:	PAD085690592
TSD Date:	Not reported
TSD Facility Name:	REPUBLIC ENVIRONMENTAL SYSTEMS OF PA INC
TSD Facility Address:	2869 SANDSTONE DRIVE
TSD Facility City:	HATFIELD
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D035
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	30
Unit:	Gallons (liquids only)

DELAWARE ARMY NATIONAL GUARD CSMS 09 (Continued) **1000106297**

Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2009
Manifest Number:	004275286JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED982572513
Generator Date:	10/09/2009
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-324-2355
TSD EPA Id:	PAD085690592
TSD Date:	Not reported
TSD Facility Name:	REPUBLIC ENVIRONMENTAL SYSTEMS OF PA INC
TSD Facility Address:	2869 SANDSTONE DRIVE
TSD Facility City:	HATFIELD
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F003
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	30
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2009
Manifest Number:	004275286JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED982572513
Generator Date:	10/09/2009
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-324-2355
TSD EPA Id:	PAD085690592
TSD Date:	Not reported
TSD Facility Name:	REPUBLIC ENVIRONMENTAL SYSTEMS OF PA INC
TSD Facility Address:	2869 SANDSTONE DRIVE
TSD Facility City:	HATFIELD
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D001
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	30
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

DELAWARE ARMY NATIONAL GUARD CSMS 09 (Continued) **1000106297**

Year:	2006
Manifest Number:	PAH322323
Manifest Type:	TSD Copy
Generator EPA Id:	DED982572513
Generator Date:	08/09/2006
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	Not reported
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	302-324-2355
Page Number:	1
Line Number:	1
Waste Number:	D001
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	30
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

NY MANIFEST:

Name:	COMBINED SUPPORT MAINT SHOP
Address:	1197 RIVER RD
City,State,Zip:	NEW CASTLE, DE 19720
Country:	USA
EPA ID:	DED982572513
Facility Status:	Not reported
Location Address 1:	1197 RIVER ROAD
Code:	BP
Location Address 2:	Not reported
Total Tanks:	Not reported
Location City:	NEW CASTLE
Location State:	DE
Location Zip:	19720
Location Zip 4:	Not reported

NY MANIFEST:

EPAID:	DED982572513
Mailing Name:	COMBINED SUPPORT MAINT SHOP
Mailing Contact:	COMBINED SUPPORT MAINT SHOP
Mailing Address 1:	1197 RIVER ROAD
Mailing Address 2:	Not reported
Mailing City:	NEW CASTLE
Mailing State:	DE
Mailing Zip:	19720
Mailing Zip 4:	Not reported
Mailing Country:	USA
Mailing Phone:	3023242349

DELAWARE ARMY NATIONAL GUARD CSMS 09 (Continued) **1000106297**

NY MANIFEST:

Document ID:	NYB8067798
Manifest Status:	C
seq:	Not reported
Year:	1996
Trans1 State ID:	MD001
Trans2 State ID:	Not reported
Generator Ship Date:	08/14/1996
Trans1 Recv Date:	08/14/1996
Trans2 Recv Date:	/ /
TSD Site Recv Date:	08/16/1996
Part A Recv Date:	08/29/1996
Part B Recv Date:	09/03/1996
Generator EPA ID:	DED982572513
Trans1 EPA ID:	MOD095038998
Trans2 EPA ID:	Not reported
TSDF ID 1:	NYD000632372
TSDF ID 2:	Not reported
Manifest Tracking Number:	Not reported
Import Indicator:	Not reported
Export Indicator:	Not reported
Discr Quantity Indicator:	Not reported
Discr Type Indicator:	Not reported
Discr Residue Indicator:	Not reported
Discr Partial Reject Indicator:	Not reported
Discr Full Reject Indicator:	Not reported
Manifest Ref Number:	Not reported
Alt Facility RCRA ID:	Not reported
Alt Facility Sign Date:	Not reported
MGMT Method Type Code:	Not reported
Waste Code:	D001 - NON-LISTED IGNITABLE WASTES
Waste Code:	Not reported
Waste Code:	Not reported
Waste Code:	Not reported
Waste Code:	Not reported
Waste Code:	Not reported
Quantity:	00010
Units:	P - Pounds
Number of Containers:	001
Container Type:	DF - Fiberboard or plastic drums (glass)
Handling Method:	B Incineration, heat recovery, burning.
Specific Gravity:	100

Click this hyperlink while viewing on your computer to access
-1 additional NY MANIFEST: record(s) in the EDR Site Report.

NJ MANIFEST:

EPA Id:	DED982572513
Mail Address:	GRIER BLDG 16H RIVER RD
Mail City/State/Zip:	NEW CASTLE 19720
Facility Phone:	3023247392
Emergency Phone:	3023247355
Contact:	Not reported
Comments:	Not reported
SIC Code:	Not reported

DELAWARE ARMY NATIONAL GUARD CSMS 09 (Continued) **1000106297**

County:	00
Municipal:	00
Previous EPA Id:	Not reported
Gen Flag:	X
Trans Flag:	Not reported
TSDF Flag:	Not reported
Name Change:	Not reported
Date Change:	000000

Manifest:

Manifest Number:	NJA5077592
EPA ID:	DED982572513
Date Shipped:	02/03/2005
TSDF EPA ID:	NJD002200046
Transporter EPA ID:	NJR000011528
Transporter 2 EPA ID:	Not reported
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	02/03/2005
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	02/04/2005
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	04150525
Was Load Rejected:	NEW CASTLE 19720
Reason Load Was Rejected:	Not reported

Manifest Number:	NJA5022522
EPA ID:	DED982572513
Date Shipped:	07/23/2004
TSDF EPA ID:	NJD980536593
Transporter EPA ID:	NJD080631369
Transporter 2 EPA ID:	NJD000692061
Transporter 3 EPA ID:	Not reported

DELAWARE ARMY NATIONAL GUARD CSMS 09 (Continued) **1000106297**

Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	07/23/2004
Date Trans2 Transported Waste:	07/29/2004
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	07/29/2004
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	08310422
Was Load Rejected:	NEW CASTLE 19720
Reason Load Was Rejected:	Not reported

Manifest Number:	NJA5224607
EPA ID:	DED982572513
Date Shipped:	07/06/2006
TSDF EPA ID:	NJD002200046
Transporter EPA ID:	NJR000011528
Transporter 2 EPA ID:	Not reported
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	07/06/2006
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported

DELAWARE ARMY NATIONAL GUARD CSMS 09 (Continued) **1000106297**

Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	07/11/2006
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	08300625
Was Load Rejected:	NEW CASTLE 19720
Reason Load Was Rejected:	Not reported

A6 **NEW CASTLE RIFLE RANGE** **DE LUST** **S107711080**
Target **1197 RIVER RD** **DE AIRS** **N/A**
Property **NEW CASTLE, DE 19720** **DE TIER 2**

Site 6 of 11 in cluster A

Actual:
4 ft.

LUST:

Facility ID:	10024367
Status:	Inactive
Date Closed:	**01/30/1992**
Project Number:	N9201025
Watershed:	Army Creek
Basin:	Delaware Bay
Latitude:	39.63376
Longitude:	-75.6116
Country Abv:	US
PI ID:	18355
Prog ID:	3-000734
Additional Info:	Not reported
Care Of:	Not reported
Reference Pt:	Unknown
Horizontal Method:	GPS-Differentially Corrected
Loc Type:	P
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
DRBC Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
Ag Pres District:	Not reported
Water District:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Mod Grid:	Not reported

Facility ID:	10024367
Status:	Inactive
Date Closed:	**01/21/1994**
Project Number:	N9301001
Watershed:	Army Creek
Basin:	Delaware Bay
Latitude:	39.63410
Longitude:	-75.6121
Country Abv:	US
PI ID:	18356
Prog ID:	3-000730
Additional Info:	Not reported
Care Of:	Not reported
Reference Pt:	Unknown
Horizontal Method:	GPS-Differentially Corrected
Loc Type:	P
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
DRBC Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
Ag Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

Facility ID:	10024367
Status:	Inactive
Date Closed:	**04/07/1994**
Project Number:	N9311194
Watershed:	Army Creek
Basin:	Delaware Bay
Latitude:	39.63410
Longitude:	-75.6121
Country Abv:	US
PI ID:	18354
Prog ID:	3-000728
Additional Info:	Not reported
Care Of:	Not reported
Reference Pt:	Unknown
Horizontal Method:	GPS-Differentially Corrected
Loc Type:	P
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
DRBC Basin:	Y

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
Ag Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

Facility ID:	10024367
Status:	Inactive
Date Closed:	**05/17/2001**
Project Number:	N9502038
Watershed:	Army Creek
Basin:	Delaware Bay
Latitude:	39.63376
Longitude:	-75.6116
Country Abv:	US
PI ID:	18355
Prog ID:	3-000734
Additional Info:	Not reported
Care Of:	Not reported
Reference Pt:	Unknown
Horizontal Method:	GPS-Differentially Corrected
Loc Type:	P
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
DRBC Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
Ag Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

Facility ID:	10024367
Status:	Inactive
Date Closed:	**07/12/1996**
Project Number:	N9607129
Watershed:	Army Creek
Basin:	Delaware Bay
Latitude:	39.63410
Longitude:	-75.6121
Country Abv:	US
PI ID:	18354
Prog ID:	3-000728
Additional Info:	Not reported
Care Of:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Reference Pt:	Unknown
Horizontal Method:	GPS-Differentially Corrected
Loc Type:	P
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
DRBC Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
Ag Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

Facility ID:	10024367
Status:	Inactive
Date Closed:	**07/16/1996**
Project Number:	N9607131
Watershed:	Army Creek
Basin:	Delaware Bay
Latitude:	39.63376
Longitude:	-75.6116
Country Abv:	US
PI ID:	18355
Prog ID:	3-000734
Additional Info:	Not reported
Care Of:	Not reported
Reference Pt:	Unknown
Horizontal Method:	GPS-Differentially Corrected
Loc Type:	P
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
DRBC Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
Ag Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

Facility ID:	10024367
Status:	Inactive
Date Closed:	**04/04/1997**
Project Number:	N9704048

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Watershed:	Army Creek
Basin:	Delaware Bay
Latitude:	39.63410
Longitude:	-75.6121
Country Abv:	US
PI ID:	18356
Prog ID:	3-000730
Additional Info:	Not reported
Care Of:	Not reported
Reference Pt:	Unknown
Horizontal Method:	GPS-Differentially Corrected
Loc Type:	P
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
DRBC Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
Ag Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

AIRS:

Name:	DELAWARE ARMY NAT GUARD, ARMY AVIATION SUPPORT FAC
Address:	1197 RIVER ROAD
City,State,Zip:	NEW CASTLE, DE 19720
Facility Id:	10024367
X Coordinate:	187486.450
Y Coordinate:	185029.700
Reference Point:	Unknown
Horizontal Method:	Client Supplied-Method Unknown
Latitude:	39.666666
Longitude:	-75.5625
Watershed:	Delaware River
Basin:	Delaware Bay
State House District:	17
Representative:	Representative Michael P Mulrooney
State Senate District:	12
Senator:	Senator Nicole Poore
School District:	Lake Forest
Quad:	WILMINGTON SOUTH
State Abbreviation:	Not reported
Town:	New Castle
PI ID:	24010
Prog ID:	1000300427
Additional Info:	Not reported
CareOf:	Not reported
ReferencePt:	Unknown
HorizontalMethod:	Client Supplied-Method Unknown
LocType:	P

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

LatitudeDec:	39.666666
LongitudeDec:	-75.5625
LatitudeDegrees:	39
LatitudeMinutes:	39
LatitudeSeconds:	59.9976
LongitudeDegrees:	-75
LongitudeMinutes:	33
LongitudeSeconds:	45
County:	NEW CASTLE
State:	Not reported
Town:	New Castle
PO Name:	New Castle
ZIP5:	19720
TaxID:	Not reported
SewerDistrict:	Not reported
Flood Plain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Delaware River
DRBC Basin:	Y
Quad:	WILMINGTON SOUTH
SenateDistrict:	12
Senator:	Senator Nicole Poore
House District:	17
Representative:	Representative Michael P Mulrooney
School District:	Lake Forest
GMZ Name:	Not reported
Ag Pres District:	Not reported
Water District:	Not reported
Mod Grid:	102-340

Name:	DELAWARE ARMY NATIONAL GUARD - RIVER ROAD
Address:	1197 RIVER ROAD
City,State,Zip:	NEW CASTLE, DE 19720
Facility Id:	10024367
X Coordinate:	Not reported
Y Coordinate:	Not reported
Reference Point:	Not reported
Horizontal Method:	Not reported
Latitude:	Not reported
Longitude:	Not reported
Watershed:	Not reported
Basin:	Not reported
State House District:	Not reported
Representative:	Not reported
State Senate District:	Not reported
Senator:	Not reported
School District:	Not reported
Quad:	Not reported
State Abbreviation:	Not reported
Town:	Not reported
PI ID:	434386
Prog ID:	1000300418
Additional Info:	Not reported
CareOf:	Not reported
ReferencePt:	Not reported
HorizontalMethod:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

LocType:	Not reported
LatitudeDec:	Not reported
LongitudeDec:	Not reported
LatitudeDegrees:	Not reported
LatitudeMinutes:	Not reported
LatitudeSeconds:	Not reported
LongitudeDegrees:	Not reported
LongitudeMinutes:	Not reported
LongitudeSeconds:	Not reported
County:	Not reported
State:	Not reported
Town:	Not reported
PO Name:	Not reported
ZIP5:	Not reported
TaxID:	Not reported
SewerDistrict:	Not reported
Flood Plain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Not reported
Watershed:	Not reported
DRBC Basin:	Not reported
Quad:	Not reported
SenateDistrict:	Not reported
Senator:	Not reported
House District:	Not reported
Representative:	Not reported
School District:	Not reported
GMZ Name:	Not reported
Ag Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

TIER 2:

Facility ID:	745
Tier II Report Yr:	2009
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	68476-30-2
Chemical:	HEATING OIL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2009
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	John P. Ewasko
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Compliance Contact Phone: 3023267491

Tier II Report Yr: 2009
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: 7439-92-1
Chemical: LEAD
Facility Status: ACTIVE
Is EHS: No
Is Containing EHS: Not reported

Detail:
Tier II Report Year: 2009
Owner Operator Name: DELAWARE ARMY NATIONAL GUARD
Owner Operator Address: Not reported
Owner Operator City/State/Zip: Not reported
Owner Operator Country: Not reported
Owner Operator Phone: 3023267489
Compliance Contact Company: John P. Ewasko
Compliance Contact Title: Not reported
Compliance Contact Address1: Not reported
Compliance Contact Address2: Not reported
Compliance Contact City/State/Zip: Not reported
Compliance Contact Country: Not reported
Compliance Contact Phone: 3023267491

Tier II Report Yr: 2009
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: N/a
Chemical: LUBRICATING OIL
Facility Status: ACTIVE
Is EHS: No
Is Containing EHS: Not reported

Detail:
Tier II Report Year: 2009
Owner Operator Name: DELAWARE ARMY NATIONAL GUARD
Owner Operator Address: Not reported
Owner Operator City/State/Zip: Not reported
Owner Operator Country: Not reported
Owner Operator Phone: 3023267489
Compliance Contact Company: John P. Ewasko
Compliance Contact Title: Not reported
Compliance Contact Address1: Not reported
Compliance Contact Address2: Not reported
Compliance Contact City/State/Zip: Not reported
Compliance Contact Country: Not reported
Compliance Contact Phone: 3023267491

Tier II Report Yr: 2009
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

CAS Number:	N/A
Chemical:	USED OIL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2009
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	John P. Ewasko
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	3023267491

Tier II Report Yr:	2014
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	OIL, [MOTOR] 80/90W
Facility Status:	ACTIVE
Is EHS:	Yes
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Compliance Contact City/State/Zip: Not reported
Compliance Contact Country: Not reported
Compliance Contact Phone: Not reported

Tier II Report Yr: 2014
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: Not reported
Chemical: USED OIL
Facility Status: ACTIVE
Is EHS: Yes
Is Containing EHS: Not reported

Detail:
Tier II Report Year: 2014
Owner Operator Name: DELAWARE ARMY NATIONAL GUARD
Owner Operator Address: Not reported
Owner Operator City/State/Zip: Not reported
Owner Operator Country: Not reported
Owner Operator Phone: 3023267489
Compliance Contact Company: Not reported
Compliance Contact Title: Not reported
Compliance Contact Address1: Not reported
Compliance Contact Address2: Not reported
Compliance Contact City/State/Zip: Not reported
Compliance Contact Country: Not reported
Compliance Contact Phone: Not reported

Tier II Report Year: 2014
Owner Operator Name: DELAWARE ARMY NATIONAL GUARD
Owner Operator Address: Not reported
Owner Operator City/State/Zip: Not reported
Owner Operator Country: Not reported
Owner Operator Phone: Not reported
Compliance Contact Company: Not reported
Compliance Contact Title: Not reported
Compliance Contact Address1: Not reported
Compliance Contact Address2: Not reported
Compliance Contact City/State/Zip: Not reported
Compliance Contact Country: Not reported
Compliance Contact Phone: Not reported

Tier II Report Yr: 2014
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: Not reported
Chemical: ANTI-FREEZE, [FLAMMABLE LIQUID]
Facility Status: ACTIVE
Is EHS: Yes
Is Containing EHS: Not reported

Detail:
Tier II Report Year: 2014
Owner Operator Name: DELAWARE ARMY NATIONAL GUARD

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2014
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	LEAD
Facility Status:	ACTIVE
Is EHS:	Yes
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2014
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	OIL, [MOTOR] 15/40W
Facility Status:	ACTIVE
Is EHS:	Yes
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2014
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	OIL, [MOTOR] 10W
Facility Status:	ACTIVE
Is EHS:	Yes
Is Containing EHS:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Detail:

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2014
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	BATTERY, EQUIPMENT (WET BATTERY)
Facility Status:	ACTIVE
Is EHS:	Yes
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2014
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	BATTERY, VEHICLE (WET BATTERY)
Facility Status:	ACTIVE
Is EHS:	Yes
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2014
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	HEATING OIL

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Facility Status:	ACTIVE
Is EHS:	Yes
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2014
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	Not reported
Facility Status:	ACTIVE
Is EHS:	Not reported
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Compliance Contact Phone:	Not reported

Tier II Report Year:	2014
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2010
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	USED OIL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	No

Detail:

Tier II Report Year:	2010
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	John P. Ewasko
Compliance Contact Title:	Environmental Protection Specialist
Compliance Contact Address1:	FIRST REGIMENT RD
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	WILMINGTON, DE 19808
Compliance Contact Country:	Not reported
Compliance Contact Phone:	3023267491

Tier II Report Yr:	2010
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	HEATING OIL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	No

Detail:

Tier II Report Year:	2010
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	John P. Ewasko
Compliance Contact Title:	Environmental Protection Specialist
Compliance Contact Address1:	FIRST REGIMENT RD
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	WILMINGTON, DE 19808
Compliance Contact Country:	Not reported
Compliance Contact Phone:	3023267491

Tier II Report Yr:	2010
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	LEAD
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	No

Detail:

Tier II Report Year:	2010
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	John P. Ewasko
Compliance Contact Title:	Environmental Protection Specialist
Compliance Contact Address1:	FIRST REGIMENT RD
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	WILMINGTON, DE 19808
Compliance Contact Country:	Not reported
Compliance Contact Phone:	3023267491

Tier II Report Yr:	2010
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	LUBRICATING OIL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	No

Detail:

Tier II Report Year:	2010
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	John P. Ewasko
Compliance Contact Title:	Environmental Protection Specialist
Compliance Contact Address1:	FIRST REGIMENT RD
Compliance Contact Address2:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Compliance Contact City/State/Zip: WILMINGTON, DE 19808
Compliance Contact Country: Not reported
Compliance Contact Phone: 3023267491

Tier II Report Yr: 2011
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: Not reported
Chemical: USED OIL
Facility Status: ACTIVE
Is EHS: Not reported
Is Containing EHS: Not reported

Detail:
Tier II Report Year: 2011
Owner Operator Name: DELAWARE ARMY NATIONAL GUARD
Owner Operator Address: Not reported
Owner Operator City/State/Zip: Not reported
Owner Operator Country: Not reported
Owner Operator Phone: Not reported
Compliance Contact Company: Not reported
Compliance Contact Title: Not reported
Compliance Contact Address1: Not reported
Compliance Contact Address2: Not reported
Compliance Contact City/State/Zip: Not reported
Compliance Contact Country: Not reported
Compliance Contact Phone: Not reported

Tier II Report Yr: 2011
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: Not reported
Chemical: HEATING OIL
Facility Status: ACTIVE
Is EHS: Not reported
Is Containing EHS: Not reported

Detail:
Tier II Report Year: 2011
Owner Operator Name: DELAWARE ARMY NATIONAL GUARD
Owner Operator Address: Not reported
Owner Operator City/State/Zip: Not reported
Owner Operator Country: Not reported
Owner Operator Phone: Not reported
Compliance Contact Company: Not reported
Compliance Contact Title: Not reported
Compliance Contact Address1: Not reported
Compliance Contact Address2: Not reported
Compliance Contact City/State/Zip: Not reported
Compliance Contact Country: Not reported
Compliance Contact Phone: Not reported

Tier II Report Yr: 2011

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	LEAD
Facility Status:	ACTIVE
Is EHS:	Not reported
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2011
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2011
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	LUBRICATING OIL
Facility Status:	ACTIVE
Is EHS:	Not reported
Is Containing EHS:	Not reported

Detail:

Tier II Report Year:	2011
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	Not reported
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2013
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	Not reported
Facility Status:	ACTIVE
Is EHS:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Is Containing EHS: Not reported

Detail:

Tier II Report Year:	2013
Owner Operator Name:	DELAWARE ARMY NATIONAL GUARD
Owner Operator Address:	Not reported
Owner Operator City/State/Zip:	Not reported
Owner Operator Country:	Not reported
Owner Operator Phone:	3023267489
Compliance Contact Company:	Not reported
Compliance Contact Title:	Not reported
Compliance Contact Address1:	Not reported
Compliance Contact Address2:	Not reported
Compliance Contact City/State/Zip:	Not reported
Compliance Contact Country:	Not reported
Compliance Contact Phone:	Not reported

Tier II Report Yr:	2016
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	111466
Chemical:	ANTI-FREEZE, [FLAMMABLE LIQUID]
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2017
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	111466
Chemical:	ANTI-FREEZE, [FLAMMABLE LIQUID]
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2016
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	BATTERY, EQUIPMENT (WET BATTERY)
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2017
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	BATTERY, EQUIPMENT (WET BATTERY)
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Tier II Report Yr:	2016
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	8002059
Chemical:	DIESEL FUEL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2017
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	8002059
Chemical:	DIESEL FUEL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2016
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	68476302
Chemical:	HEATING OIL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2017
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	68476302
Chemical:	HEATING OIL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2016
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	7439921
Chemical:	LEAD
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2017
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	7439921
Chemical:	LEAD
Facility Status:	ACTIVE
Is EHS:	No

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Is Containing EHS: Not reported

Tier II Report Yr: 2016
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: 67561
Chemical: Methanol
Facility Status: ACTIVE
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2017
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: 67561
Chemical: Methanol
Facility Status: ACTIVE
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2016
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: 8002059
Chemical: OIL, [COMBUSTIBLE, AUTOMATIC TRANSMISSION FLUID]
Facility Status: ACTIVE
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2017
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: 8002059
Chemical: OIL, [COMBUSTIBLE, AUTOMATIC TRANSMISSION FLUID]
Facility Status: ACTIVE
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2016
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: Not reported
Chemical: OIL, [MOTOR] 10W
Facility Status: ACTIVE
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2017
Facility Corporate Name: DELAWARE ARMY NATIONAL GUARD
EHS Year: Not reported
CAS Number: Not reported

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Chemical:	OIL, [MOTOR] 10W
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2016
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	68649423
Chemical:	OIL, [MOTOR] 15/40W
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2017
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	68649423
Chemical:	OIL, [MOTOR] 15/40W
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2016
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	OIL, [MOTOR] 80/90W
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2017
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	OIL, [MOTOR] 80/90W
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2016
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	7664939
Chemical:	Sulfuric acid
Facility Status:	ACTIVE
Is EHS:	Yes
Is Containing EHS:	Not reported

Tier II Report Yr:	2017

NEW CASTLE RIFLE RANGE (Continued) **S107711080**

Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	7664939
Chemical:	Sulfuric acid
Facility Status:	ACTIVE
Is EHS:	Yes
Is Containing EHS:	Not reported

Tier II Report Yr:	2016
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	USED OIL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

Tier II Report Yr:	2017
Facility Corporate Name:	DELAWARE ARMY NATIONAL GUARD
EHS Year:	Not reported
CAS Number:	Not reported
Chemical:	USED OIL
Facility Status:	ACTIVE
Is EHS:	No
Is Containing EHS:	Not reported

A7 Target Property **FORMER SMALL ARMS RANGE LAND AREA** **UXO** **1024717051**
1197 RIVER ROAD **N/A**
NEW CASTLE, DE

Site 7 of 11 in cluster A

Actual: 4 ft.

UXO:

DoD Component:	Army
Installation Name:	RIVER ROAD TRAINING SITE
Facility Address 2:	Not reported
Site ID:	NCDE-001-R-01
Site Type:	Small Arms Range
Latitude:	Not reported
Longitude:	Not reported

A8 Target Property **DELAWARE ARMY NATIONAL GUARD** **DE TIER 2** **S119779946**
1197 RIVER RD **N/A**
NEW CASTLE, DE 19720

Site 8 of 11 in cluster A

Actual: 4 ft.

TIER 2:

Facility ID:	Not reported
Tier II Report Yr:	2015
Facility Corporate Name:	Not reported
EHS Year:	Not reported
CAS Number:	111466

DELAWARE ARMY NATIONAL GUARD (Continued) **S119779946**

Chemical: ANTI-FREEZE, [FLAMMABLE LIQUID]
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2015
Facility Corporate Name: Not reported
EHS Year: Not reported
CAS Number: 67561
Chemical: Methanol
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2015
Facility Corporate Name: Not reported
EHS Year: Not reported
CAS Number: 68476302
Chemical: HEATING OIL
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2015
Facility Corporate Name: Not reported
EHS Year: Not reported
CAS Number: 68649423
Chemical: OIL, [MOTOR] 15/40W
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2015
Facility Corporate Name: Not reported
EHS Year: Not reported
CAS Number: 7439921
Chemical: LEAD
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2015
Facility Corporate Name: Not reported
EHS Year: Not reported
CAS Number: 8002059
Chemical: DIESEL FUEL
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2015

DELAWARE ARMY NATIONAL GUARD (Continued) **S119779946**

Facility Corporate Name: Not reported
EHS Year: Not reported
CAS Number: 8002059
Chemical: OIL, [COMBUSTIBLE, AUTOMATIC TRANSMISSION FLUID]
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2015
Facility Corporate Name: Not reported
EHS Year: Not reported
CAS Number: N/A
Chemical: BATTERY, EQUIPMENT (WET BATTERY)
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2015
Facility Corporate Name: Not reported
EHS Year: Not reported
CAS Number: N/A
Chemical: OIL, [MOTOR] 10W
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2015
Facility Corporate Name: Not reported
EHS Year: Not reported
CAS Number: N/A
Chemical: OIL, [MOTOR] 80/90W
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

Tier II Report Yr: 2015
Facility Corporate Name: Not reported
EHS Year: Not reported
CAS Number: N/A
Chemical: USED OIL
Facility Status: Not reported
Is EHS: No
Is Containing EHS: Not reported

A9 Target Property | **FORMER SMALL ARMS RANGE WATER AREA** | **UXO** | **1024717052**
1197 RIVER ROAD | **N/A**
NEW CASTLE, DE

Site 9 of 11 in cluster A

Actual: 4 ft.

UXO:

DoD Component:	Army
Installation Name:	RIVER ROAD TRAINING SITE
Facility Address 2:	Not reported
Site ID:	NCDE-002-R-01
Site Type:	Small Arms Range
Latitude:	39.617983000000002
Longitude:	-75.601489000000001

A10 Target Property | **NEW CASTLE RIFLE RANGE TRAINING SITE** | **FINDS** | **1015852268**
1197 RIVER ROAD | **N/A**
NEW CASTLE, DE 19720

Site 10 of 11 in cluster A

Actual: 4 ft.

FINDS:

Registry ID: 110044766713

Environmental Interest/Information System
FEDERAL FACILITY HAZARDOUS WASTE DOCKET

STATE MASTER

SUPERFUND (NON-NPL)

Click this hyperlink while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

A11 Target Property | **DEARNG FIELD MAINTENANCE SHOP #3** | **DE AST** | **A100320070**
1197 RIVER ROAD | **N/A**
NEW CASTLE, DE 19720

Site 11 of 11 in cluster A

Actual: 4 ft.

AST:

Name:	DEARNG FIELD MAINTENANCE SHOP #3
Address:	1197 RIVER ROAD
City,State,Zip:	NEW CASTLE, DE 19720
Facility Id:	10024367
PI Id:	358855
Prog Id:	7-000554
Additional Info:	Not reported
Country Abv:	US
Careof:	Not reported
Loc Type:	P
County:	NEW CASTLE
Town:	Not reported
PO Name:	New Castle
Tax Id:	Not reported
Sewer District:	Not reported

DEARNG FIELD MAINTENANCE SHOP #3 (Continued) **A100320070**

DRBC Basin:	Not reported
Quad:	WILMINGTON SOUTH
Watershed:	Army Creek
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
MOD Grid:	092-330
Latitude:	39.633903
Longitude:	-75.612232
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	2.0508
Longitude Degrees:	-75
Longitude Minutes:	36
Longitude Seconds:	44.0352
Reference Point:	Facility Entance(General)
Horizontal Method:	Unknown
XCoord:	183211.2
Horizontal Method:	Unknown

NPL
Region
North
1/2-1
4341 ft.

ARMY CREEK LANDFILL
RTE 13 + RTE 40
NEW CASTLE, DE 19720

NPL **1000439870**
SEMS **DED980494496**
US ENG CONTROLS
ROD
PRP
CONSENT

NPL:

EPA ID:	DED980494496
Cerclis ID:	300086
EPA Region:	3
Federal:	N
Final Date:	1983-09-08 00:00:00
Site Score:	69.920000000000002
Latitude:	39.653061000000001
Longitude:	-75.608331000000007

Category Details:

NPL Status:	Currently on the Final NPL
Category Description:	Depth To Aquifer-<= 10 Feet
Category Value:	1
NPL Status:	Currently on the Final NPL
Category Description:	Distance To Nearest Population-> 0 And <= 1/4 Mile
Category Value:	600

Site Details:

Site Name:	ARMY CREEK LANDFILL
Site Status:	Final
Site Zip:	19720
Site City:	NEW CASTLE
Site State:	DE

ARMY CREEK LANDFILL (Continued) **1000439870**

Federal Site: No
Site County: NEW CASTLE
EPA Region: 03
Date Proposed: 12/30/82
Date Deleted: Not reported
Date Finalized: 09/08/83

Substance Details:

NPL Status: Currently on the Final NPL
Substance ID: Not reported
Substance: Not reported
CAS #: Not reported
Pathway: Not reported
Scoring: Not reported

NPL Status: Currently on the Final NPL
Substance ID: A020
Substance: CHROMIUM AND COMPOUNDS
CAS #: Not reported
Pathway: GROUND WATER PATHWAY
Scoring: 2

NPL Status: Currently on the Final NPL
Substance ID: A020
Substance: CHROMIUM AND COMPOUNDS
CAS #: Not reported
Pathway: SURFACE WATER PATHWAY
Scoring: 2

NPL Status: Currently on the Final NPL
Substance ID: D005
Substance: BARIUM
CAS #: 7440-39-3
Pathway: GROUND WATER PATHWAY
Scoring: 2

NPL Status: Currently on the Final NPL
Substance ID: D005
Substance: BARIUM
CAS #: 7440-39-3
Pathway: SURFACE WATER PATHWAY
Scoring: 2

NPL Status: Currently on the Final NPL
Substance ID: D006
Substance: CADMIUM (CD)
CAS #: 7440-43-9
Pathway: GROUND WATER PATHWAY
Scoring: 2

NPL Status: Currently on the Final NPL
Substance ID: D006
Substance: CADMIUM (CD)
CAS #: 7440-43-9
Pathway: SURFACE WATER PATHWAY
Scoring: 2

ARMY CREEK LANDFILL (Continued) **1000439870**

NPL Status: Currently on the Final NPL
Substance ID: D008
Substance: LEAD (PB)
CAS #: 7439-92-1
Pathway: GROUND WATER PATHWAY
Scoring: 4

NPL Status: Currently on the Final NPL
Substance ID: D008
Substance: LEAD (PB)
CAS #: 7439-92-1
Pathway: SURFACE WATER PATHWAY
Scoring: 4

NPL Status: Currently on the Final NPL
Substance ID: U025
Substance: BIS(2-CHLOROETHYL)ETHER
CAS #: 111-44-4
Pathway: AIR PATHWAY
Scoring: 3

NPL Status: Currently on the Final NPL
Substance ID: W002
Substance: VOLATILE ORGANICS
CAS #: Not reported
Pathway: AIR PATHWAY
Scoring: 2

Summary Details:

Conditions at listing October 1981): The Army Creek Landfill covers 47 acres in New Castle County, Delaware. It is adjacent to the Delaware Sand Gravel Landfill and was owned and operated by the county as a municipal and ha ardous waste disposal facility until it reached capacity in 1970. The site holds 1.9 million cubic yards of refuse. Since 1972, the county has spent 3 million to control the migration of contaminants, including lead, chromium, arsenic, and a variety of organic compounds, to an aquifer that supplies water to over 100,000 people. This site was first listed under the name Delaware Sand Gravel - Llangollen Army Creek Landfills. Status July 1983): The State is drafting a National Pollutant Discharge Elimination System permit for the discharge of the ground water to Army Creek. EPA recently completed a Remedial Action Master Plan outlining the investigations needed to determine the full extent of cleanup required at thesite. It will guide further actions at the site.

Site Status Details:
NPL Status: Final
Proposed Date: 12/30/1982
Final Date: 09/08/1983
Deleted Date: Not reported

Narratives Details:
NPL Name: ARMY CREEK LANDFILL
City: NEW CASTLE
State: DE

ARMY CREEK LANDFILL (Continued) **1000439870**

SEMS:

Site ID:	0300086
EPA ID:	DED980494496
Cong District:	01
FIPS Code:	10003
Latitude:	39.653061
Longitude:	-75.608331
FF:	N
NPL:	Currently on the Final NPL
Non NPL Status:	Not reported

SEMS Detail:

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	FE
Action Name:	5 YEAR
SEQ:	4
Start Date:	2014-01-06 05:00:00
Finish Date:	9/8/2014 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf In-Hse

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	RO
Action Name:	ROD
SEQ:	1
Start Date:	1986-09-30 04:00:00
Finish Date:	9/30/1986 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	PA
Action Name:	PA
SEQ:	1
Start Date:	1981-08-01 04:00:00
Finish Date:	8/1/1981 4:00:00 AM
Qual:	L
Current Action Lead:	EPA Perf

ARMY CREEK LANDFILL (Continued) **1000439870**

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	RS
Action Name:	RV ASSESS
SEQ:	3
Start Date:	1993-06-10 04:00:00
Finish Date:	6/30/1993 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	CM
Action Name:	PCOR
SEQ:	1
Start Date:	1994-04-29 04:00:00
Finish Date:	4/29/1994 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	02
Action Code:	AR
Action Name:	ADMIN REC
SEQ:	1
Start Date:	1990-03-16 05:00:00
Finish Date:	3/16/1990 5:00:00 AM
Qual:	E
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	CR
Action Name:	CI
SEQ:	1
Start Date:	1990-02-27 05:00:00
Finish Date:	Not reported

ARMY CREEK LANDFILL (Continued) **1000439870**

Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	RS
Action Name:	RV ASSESS
SEQ:	1
Start Date:	1990-04-21 04:00:00
Finish Date:	4/21/1990 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	TA
Action Name:	TECH ASSIST
SEQ:	1
Start Date:	1990-02-16 05:00:00
Finish Date:	Not reported
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	ED
Action Name:	R/H ASMT
SEQ:	1
Start Date:	1990-01-01 05:00:00
Finish Date:	1/1/1990 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	NP
Action Name:	PROPOSED

ARMY CREEK LANDFILL (Continued) **1000439870**

SEQ:	1
Start Date:	1982-12-30 05:00:00
Finish Date:	12/30/1982 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	RD
Action Name:	RD
SEQ:	1
Start Date:	1988-03-31 05:00:00
Finish Date:	8/8/1989 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	02
Action Code:	RO
Action Name:	ROD
SEQ:	2
Start Date:	1990-06-29 04:00:00
Finish Date:	6/29/1990 4:00:00 AM
Qual:	R
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	RV
Action Name:	RMVL
SEQ:	1
Start Date:	1986-03-24 05:00:00
Finish Date:	3/26/1986 5:00:00 AM
Qual:	S
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N

ARMY CREEK LANDFILL (Continued) **1000439870**

OU:	00
Action Code:	RS
Action Name:	RV ASSESS
SEQ:	2
Start Date:	1991-06-28 04:00:00
Finish Date:	6/28/1991 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	FE
Action Name:	5 YEAR
SEQ:	1
Start Date:	1998-09-25 04:00:00
Finish Date:	11/25/1998 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	02
Action Code:	CO
Action Name:	RI/FS
SEQ:	1
Start Date:	1989-08-09 04:00:00
Finish Date:	6/29/1990 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	FE
Action Name:	5 YEAR
SEQ:	5
Start Date:	2018-09-21 05:00:00
Finish Date:	Not reported
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496

ARMY CREEK LANDFILL (Continued) **1000439870**

Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	DS
Action Name:	DISCVRY
SEQ:	1
Start Date:	1979-12-01 05:00:00
Finish Date:	12/1/1979 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	SI
Action Name:	SI
SEQ:	1
Start Date:	1981-08-01 04:00:00
Finish Date:	8/1/1981 4:00:00 AM
Qual:	H
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	TA
Action Name:	TECH ASSIST
SEQ:	2
Start Date:	2011-07-13 05:00:00
Finish Date:	12/18/2013 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	CR
Action Name:	CI
SEQ:	2
Start Date:	2004-05-24 04:00:00
Finish Date:	Not reported
Qual:	Not reported
Current Action Lead:	EPA Perf

ARMY CREEK LANDFILL (Continued) **1000439870**

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	AR
Action Name:	ADMIN REC
SEQ:	2
Start Date:	1990-04-17 04:00:00
Finish Date:	4/17/1990 4:00:00 AM
Qual:	E
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	HR
Action Name:	HAZRANK
SEQ:	1
Start Date:	1982-12-01 05:00:00
Finish Date:	12/1/1982 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	FE
Action Name:	5 YEAR
SEQ:	2
Start Date:	2004-01-05 05:00:00
Finish Date:	9/30/2004 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	FE
Action Name:	5 YEAR
SEQ:	3
Start Date:	2009-01-08 05:00:00
Finish Date:	9/28/2009 4:00:00 AM

ARMY CREEK LANDFILL (Continued) **1000439870**

Qual: Not reported
Current Action Lead: EPA Perf

Region: 03
Site ID: 0300086
EPA ID: DED980494496
Site Name: ARMY CREEK LANDFILL
NPL: F
FF: N
OU: 00
Action Code: NF
Action Name: NPL FINL
SEQ: 1
Start Date: 1983-09-08 04:00:00
Finish Date: 9/8/1983 4:00:00 AM
Qual: Not reported
Current Action Lead: EPA Perf

Region: 03
Site ID: 0300086
EPA ID: DED980494496
Site Name: ARMY CREEK LANDFILL
NPL: F
FF: N
OU: 02
Action Code: BF
Action Name: PRP RA
SEQ: 2
Start Date: 1991-07-23 04:00:00
Finish Date: 9/29/1995 4:00:00 AM
Qual: Not reported
Current Action Lead: EPA Ovrsght

Region: 03
Site ID: 0300086
EPA ID: DED980494496
Site Name: ARMY CREEK LANDFILL
NPL: F
FF: N
OU: 02
Action Code: ME
Action Name: PRP LR
SEQ: 1
Start Date: 1995-09-29 04:00:00
Finish Date: Not reported
Qual: Not reported
Current Action Lead: EPA Ovrsght

Region: 03
Site ID: 0300086
EPA ID: DED980494496
Site Name: ARMY CREEK LANDFILL
NPL: F
FF: N
OU: 01
Action Code: BF
Action Name: PRP RA

ARMY CREEK LANDFILL (Continued) **1000439870**

SEQ:	1
Start Date:	1990-09-28 04:00:00
Finish Date:	11/1/1994 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	02
Action Code:	BE
Action Name:	PRP RD
SEQ:	1
Start Date:	1990-10-01 04:00:00
Finish Date:	7/23/1991 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	BD
Action Name:	PRP RI/FS
SEQ:	1
Start Date:	1984-08-11 05:00:00
Finish Date:	9/30/1986 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300086
EPA ID:	DED980494496
Site Name:	ARMY CREEK LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	OM
Action Name:	OM
SEQ:	2
Start Date:	1994-11-01 05:00:00
Finish Date:	Not reported
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

US ENG CONTROLS:

EPA ID:	DED980494496
Site ID:	0300086
Name:	ARMY CREEK LANDFILL
Address:	RTE 13 + RTE 40

ARMY CREEK LANDFILL (Continued) **1000439870**

NEW CASTLE, DE 19720
EPA Region: 03
County: NEW CASTLE
Event Code: Not reported
Actual Date: 06/30/1990
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 09/30/1986
Operable Unit: 01
Contaminated Media : Groundwater
Engineering Control: Discharge
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 09/30/1986
Operable Unit: 01
Contaminated Media : Groundwater
Engineering Control: Extraction
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 09/30/1986
Operable Unit: 01
Contaminated Media : Groundwater
Engineering Control: Flocculation
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 09/30/1986
Operable Unit: 01
Contaminated Media : Groundwater
Engineering Control: Hydraulic Control
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 09/30/1986
Operable Unit: 01
Contaminated Media : Groundwater
Engineering Control: Monitoring
Contact Name: Not reported
Contact Phone and Ext: Not reported

ARMY CREEK LANDFILL (Continued) **1000439870**

Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 09/30/1986
Operable Unit: 01
Contaminated Media : Groundwater
Engineering Control: Operations & Maintenance (O&M)
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 09/30/1986
Operable Unit: 01
Contaminated Media : Solid Waste
Engineering Control: Cap
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 09/30/1986
Operable Unit: 01
Contaminated Media : Solid Waste
Engineering Control: Operations & Maintenance (O&M)
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 002
Action Name: RECORD OF DECISION
Action Completion date: 06/29/1990
Operable Unit: 02
Contaminated Media : Groundwater
Engineering Control: Aeration
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 002
Action Name: RECORD OF DECISION
Action Completion date: 06/29/1990
Operable Unit: 02
Contaminated Media : Groundwater
Engineering Control: Discharge
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 002
Action Name: RECORD OF DECISION
Action Completion date: 06/29/1990
Operable Unit: 02
Contaminated Media : Groundwater

ARMY CREEK LANDFILL (Continued) **1000439870**

Engineering Control: Filtration
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 002
Action Name: RECORD OF DECISION
Action Completion date: 06/29/1990
Operable Unit: 02
Contaminated Media : Groundwater
Engineering Control: Monitoring
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 002
Action Name: RECORD OF DECISION
Action Completion date: 06/29/1990
Operable Unit: 02
Contaminated Media : Groundwater
Engineering Control: Precipitation
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 002
Action Name: RECORD OF DECISION
Action Completion date: 06/29/1990
Operable Unit: 02
Contaminated Media : Groundwater
Engineering Control: Recovery Wells
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 002
Action Name: RECORD OF DECISION
Action Completion date: 06/29/1990
Operable Unit: 02
Contaminated Media : Groundwater
Engineering Control: Sedimentation
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 002
Action Name: RECORD OF DECISION
Action Completion date: 06/29/1990
Operable Unit: 02
Contaminated Media : Sediment
Engineering Control: Monitoring
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 002
Action Name: RECORD OF DECISION

ARMY CREEK LANDFILL (Continued) **1000439870**

Action Completion date: 06/29/1990
Operable Unit: 02
Contaminated Media : Surface Water
Engineering Control: Monitoring
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

ROD:

EPA ID: DED980494496
RG: 3
Site ID: 300086
Name: ARMY CREEK LANDFILL
Action: GOVT Decision Document (ROD)
Operable Unit Number: TREATMENT PLANT
SEQ ID: 2
Action Completion: 1990-06-29 00:00:00
NPL Status: Final
Non NPL Status: Not reported

EPA ID: DED980494496
RG: 3
Site ID: 300086
Name: ARMY CREEK LANDFILL
Action: GOVT ROD for PRP Remedy
Operable Unit Number: CAP ROD
SEQ ID: 1
Action Completion: 1986-09-30 00:00:00
NPL Status: Final
Non NPL Status: Not reported

PRP:

PRP Name: ALLIED CHEMICAL CORP
ALLIED CHEMICAL CORP
AMETEK INC
ATLANTIC AVIATION CORP.
AVON PRODUCTS INC
AVON PRODUCTS INC
B P AMERICA INC
BUDD CO.
BUDD CO.
CANTERA, DOMINIC & MARIANNE
CANTERA, DOMINIC & MARIANNE
CHAMPLAIN CABLE CORP
CHAMPLAIN CABLE CORP
CHAMPLAIN CABLE CORP
CHRYSLER CORP
CHRYSLER CORP
CHRYSLER CORP
CONSOLIDATED RAIL CORP (CONRAIL)
DAY INTERNATIONAL CORP
DELAWARE SAND & GRAVEL
E. I. DU PONT DE NEMOURS AND COMPANY
E. I. DU PONT DE NEMOURS AND COMPANY
E. I. DU PONT DE NEMOURS AND COMPANY

ARMY CREEK LANDFILL (Continued) **1000439870**

ELECTRIC HOSE & RUBBER CO
F M C CORP
F M C CORP
F M C CORP
F M C CORP
GATES ENGINEERING CO.
GATES ENGINEERING CO.
GEC INDUSTRIES, INC.
GENE BANTA INC
GENERAL MOTORS CORP.
GENERAL MOTORS CORP.
GENERAL MOTORS CORP.
GENERAL MOTORS CORP.
GENERAL MOTORS CORP.
HARVEY & HARVEY, INC.
HARVEY & HARVEY, INC.
HARVEY & HARVEY, INC.
HARVEY, EDGAR T.
HERCULES INC
HERCULES INC
HERCULES INC
ICI AMERICAS, INC.
ICI AMERICAS, INC.
ICI AMERICAS, INC.
KAUMAGRAPH CORP
KNOTTS, INC.
KNOTTS, INC.
LANDFILL, INC.
LUDLOW CORP
M. A. HANNA PLASTICS GROUP, INC
MATERIAL TRANSIT, INC.
MATERIAL TRANSIT, INC.
MATERIAL TRANSIT, INC.
MICUCIO BROTHERS INC
MOORE, HARRY C.
MOTOR WHEEL CORP
MOTOR WHEEL CORP

Click this hyperlink while viewing on your computer to access
25 additional PRP: record(s) in the EDR Site Report.

CONSENT:

EPA ID:	DED980494496
Site ID:	Not reported
Case Title:	IN RE: GEC INDUSTRIES
Court Num:	89-44
District:	Delaware
Entered Date:	19930722
Name:	ARMY CREEK LANDFILL SITE
Address:	RTE 13 + RTE 40
City:	NEW CASTLE
County:	NEW CASTLE
State:	DE
Zip:	19720

NPL	**DELAWARE SAND & GRAVEL LANDFILL**	**NPL**	**1000160500**
Region	**229 GRANTHAM LANE**	**SEMS**	**DED000605972**
NNE	**NEW CASTLE, DE 19720**	**US ENG CONTROLS**	
1/2-1		**US INST CONTROL**	
3924 ft.		**DE SHWS**	
		DE INST CONTROL	
		ROD	
		PRP	
		ICIS	
		CONSENT	
		ECHO	

NPL:

EPA ID:	DED000605972
Cerclis ID:	300034
EPA Region:	3
Federal:	N
Final Date:	1983-09-08 00:00:00
Site Score:	46.600000000000001
Latitude:	39.651389000000002
Longitude:	-75.602780999999993

Category Details:

NPL Status:	Currently on the Final NPL
Category Description:	Depth To Aquifer-> 25 And <= 50 Feet
Category Value:	37 FTBGS

NPL Status:	Currently on the Final NPL
Category Description:	Distance To Nearest Population-> 1/2 And <= 1 Mile
Category Value:	4752

Site Details:

Site Name:	DELAWARE SAND & GRAVEL LANDFILL
Site Status:	Final
Site Zip:	19720
Site City:	NEW CASTLE
Site State:	DE
Federal Site:	No
Site County:	NEW CASTLE
EPA Region:	03
Date Proposed:	12/30/82
Date Deleted:	Not reported
Date Finalized:	09/08/83

Substance Details:

NPL Status:	Currently on the Final NPL
Substance ID:	Not reported
Substance:	Not reported
CAS #:	Not reported
Pathway:	Not reported
Scoring:	Not reported

NPL Status:	Currently on the Final NPL
Substance ID:	A046
Substance:	POLYCHLORINATED BIPHENYLS
CAS #:	1336-36-3
Pathway:	NO PATHWAY INDICATED
Scoring:	1

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

NPL Status: Currently on the Final NPL
Substance ID: D008
Substance: LEAD (PB)
CAS #: 7439-92-1
Pathway: DIRECT CONTACT PATHWAY
Scoring: 3

NPL Status: Currently on the Final NPL
Substance ID: D008
Substance: LEAD (PB)
CAS #: 7439-92-1
Pathway: GROUND WATER PATHWAY
Scoring: 4

NPL Status: Currently on the Final NPL
Substance ID: D008
Substance: LEAD (PB)
CAS #: 7439-92-1
Pathway: SURFACE WATER PATHWAY
Scoring: 3

NPL Status: Currently on the Final NPL
Substance ID: U019
Substance: BENZENE
CAS #: 71-43-2
Pathway: GROUND WATER PATHWAY
Scoring: 2

NPL Status: Currently on the Final NPL
Substance ID: U077
Substance: DICHLOROETHANE, 1,2-
CAS #: 107-06-2
Pathway: GROUND WATER PATHWAY
Scoring: 2

NPL Status: Currently on the Final NPL
Substance ID: U188
Substance: PHENOL
CAS #: 108-95-2
Pathway: NO PATHWAY INDICATED
Scoring: 1

NPL Status: Currently on the Final NPL
Substance ID: U220
Substance: TOLUENE
CAS #: 108-88-3
Pathway: GROUND WATER PATHWAY
Scoring: 2

NPL Status: Currently on the Final NPL
Substance ID: U228
Substance: TRICHLOROETHYLENE (TCE)
CAS #: 79-01-6
Pathway: GROUND WATER PATHWAY
Scoring: 2

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Summary Details:

Conditions at listing October 1981): The Delaware Sand Gravel Landfill covers 10 acres adjacent to the Army Creek Landfill in New Castle County, Delaware. Both landfills accepted municipal and ha ardous waste. According to reports EPA received, about 7,500 drums of liquid waste were opened and emptied into an unlined trench on the Delaware Sand Gravel Landfill, which is privately owned. The underlying aquifer and surrounding surface waters are contaminated by a variety of organic and inorganic ha ardous substances from both sites. The site closed in 1976 when the State filed suit against the owners for improper operating procedures. The landfill was covered with sand and gravel, which are very permeable.This site was first listed under the name Delaware Sand Gravel-Llangollen Army Creek Landfills. Status July 1983): EPA recently completed a Remedial Action Master Plan outlining the investigations needed to determine the full extent ofcleanup required at the site. Any measures taken at the site will be in conjunction with activities proposed at the Army Creek site. The State suit against the site owner is not yet resolved.

Site Status Details:

NPL Status:	Final
Proposed Date:	12/30/1982
Final Date:	09/08/1983
Deleted Date:	Not reported

Narratives Details:

NPL Name:	DELAWARE SAND & GRAVEL LANDFILL
City:	NEW CASTLE
State:	DE

SEMS:

Site ID:	0300034
EPA ID:	DED000605972
Cong District:	01
FIPS Code:	10003
Latitude:	39.651389
Longitude:	-75.602781
FF:	N
NPL:	Currently on the Final NPL
Non NPL Status:	Not reported

SEMS Detail:

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	AR
Action Name:	ADMIN REC
SEQ:	7
Start Date:	2007-05-11 04:00:00
Finish Date:	5/11/2007 4:00:00 AM
Qual:	OR
Current Action Lead:	EPA Perf

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	NF
Action Name:	NPL FINL
SEQ:	1
Start Date:	1983-09-08 04:00:00
Finish Date:	9/8/1983 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	CR
Action Name:	CI
SEQ:	1
Start Date:	1983-09-15 04:00:00
Finish Date:	Not reported
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	02
Action Code:	RA
Action Name:	RA
SEQ:	2
Start Date:	1989-06-30 04:00:00
Finish Date:	9/30/1991 4:00:00 AM
Qual:	L
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	NP
Action Name:	PROPOSED
SEQ:	1
Start Date:	1982-12-30 05:00:00
Finish Date:	12/30/1982 5:00:00 AM

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	PA
Action Name:	PA
SEQ:	1
Start Date:	1981-09-01 04:00:00
Finish Date:	9/1/1981 4:00:00 AM
Qual:	L
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	CM
Action Name:	PCOR
SEQ:	1
Start Date:	1997-08-12 04:00:00
Finish Date:	8/12/1997 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	RD
Action Name:	RD
SEQ:	1
Start Date:	1988-08-26 04:00:00
Finish Date:	6/30/1989 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	SI
Action Name:	SI

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

SEQ:	1
Start Date:	1981-11-01 05:00:00
Finish Date:	12/1/1981 5:00:00 AM
Qual:	H
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	RA
Action Name:	RA
SEQ:	1
Start Date:	1989-06-30 04:00:00
Finish Date:	9/30/1991 4:00:00 AM
Qual:	L
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	RS
Action Name:	RV ASSESS
SEQ:	2
Start Date:	1991-10-16 04:00:00
Finish Date:	10/16/1991 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	FE
Action Name:	5 YEAR
SEQ:	2
Start Date:	1999-06-01 04:00:00
Finish Date:	9/30/1999 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

OU:	00
Action Code:	HR
Action Name:	HAZRANK
SEQ:	1
Start Date:	1982-12-01 05:00:00
Finish Date:	12/1/1982 5:00:00 AM
Qual:	O
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	AR
Action Name:	ADMIN REC
SEQ:	1
Start Date:	1988-02-10 05:00:00
Finish Date:	2/10/1988 5:00:00 AM
Qual:	E
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	FE
Action Name:	5 YEAR
SEQ:	1
Start Date:	1994-09-23 04:00:00
Finish Date:	9/30/1994 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	RV
Action Name:	RMVL
SEQ:	1
Start Date:	1984-03-01 05:00:00
Finish Date:	5/31/1984 5:00:00 AM
Qual:	S
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	AR
Action Name:	ADMIN REC
SEQ:	4
Start Date:	1994-06-15 04:00:00
Finish Date:	6/15/1994 4:00:00 AM
Qual:	E
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	DS
Action Name:	DISCVRY
SEQ:	1
Start Date:	1981-09-01 04:00:00
Finish Date:	9/1/1981 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	FE
Action Name:	5 YEAR
SEQ:	5
Start Date:	2014-09-10 05:00:00
Finish Date:	8/28/2015 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	06
Action Code:	RO
Action Name:	ROD
SEQ:	2
Start Date:	2017-12-12 05:00:00
Finish Date:	12/12/2017 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	FE
Action Name:	5 YEAR
SEQ:	4
Start Date:	2009-09-29 04:00:00
Finish Date:	9/16/2010 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	CR
Action Name:	CI
SEQ:	2
Start Date:	2004-05-24 04:00:00
Finish Date:	Not reported
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	AR
Action Name:	ADMIN REC
SEQ:	3
Start Date:	1994-04-29 04:00:00
Finish Date:	4/29/1994 4:00:00 AM
Qual:	V
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	02
Action Code:	AR
Action Name:	ADMIN REC
SEQ:	2
Start Date:	1993-07-29 04:00:00
Finish Date:	7/29/1993 4:00:00 AM

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Qual:	E
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	RO
Action Name:	ROD
SEQ:	1
Start Date:	1988-04-23 04:00:00
Finish Date:	4/23/1988 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	AR
Action Name:	ADMIN REC
SEQ:	6
Start Date:	2006-11-01 05:00:00
Finish Date:	11/1/2006 5:00:00 AM
Qual:	OR
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	AR
Action Name:	ADMIN REC
SEQ:	5
Start Date:	1999-10-05 04:00:00
Finish Date:	10/5/1999 4:00:00 AM
Qual:	OR
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	FE
Action Name:	5 YEAR

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

SEQ:	3
Start Date:	2004-08-09 04:00:00
Finish Date:	9/21/2005 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	RS
Action Name:	RV ASSESS
SEQ:	1
Start Date:	1990-04-21 04:00:00
Finish Date:	4/21/1990 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	04
Action Code:	BE
Action Name:	PRP RD
SEQ:	3
Start Date:	1994-12-15 05:00:00
Finish Date:	6/29/1995 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	03
Action Code:	BE
Action Name:	PRP RD
SEQ:	1
Start Date:	1992-06-26 04:00:00
Finish Date:	7/28/1993 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

OU:	04
Action Code:	BF
Action Name:	PRP RA
SEQ:	2
Start Date:	1995-06-29 04:00:00
Finish Date:	9/27/1996 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	05
Action Code:	BE
Action Name:	PRP RD
SEQ:	2
Start Date:	1994-12-15 05:00:00
Finish Date:	7/24/1996 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	03
Action Code:	BF
Action Name:	PRP RA
SEQ:	1
Start Date:	1993-07-28 04:00:00
Finish Date:	9/30/1997 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	05
Action Code:	OM
Action Name:	OM
SEQ:	3
Start Date:	1997-09-30 04:00:00
Finish Date:	4/16/2009 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	BB
Action Name:	PRP RV
SEQ:	2
Start Date:	1992-06-12 04:00:00
Finish Date:	2/23/1995 5:00:00 AM
Qual:	S
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	BB
Action Name:	PRP RV
SEQ:	1
Start Date:	1991-10-18 04:00:00
Finish Date:	11/26/1991 5:00:00 AM
Qual:	S
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	06
Action Code:	BE
Action Name:	PRP RD
SEQ:	5
Start Date:	2018-05-22 04:00:00
Finish Date:	Not reported
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	05
Action Code:	BF
Action Name:	PRP RA
SEQ:	6
Start Date:	2009-05-04 04:00:00
Finish Date:	Not reported
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	06
Action Code:	NK
Action Name:	PRP FS
SEQ:	1
Start Date:	2011-09-28 04:00:00
Finish Date:	12/12/2017 5:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	05
Action Code:	BF
Action Name:	PRP RA
SEQ:	3
Start Date:	1996-07-24 04:00:00
Finish Date:	8/12/1997 4:00:00 AM
Qual:	Not reported
Current Action Lead:	EPA Ovrsght

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	01
Action Code:	CO
Action Name:	RI/FS
SEQ:	1
Start Date:	1983-09-15 04:00:00
Finish Date:	4/23/1988 4:00:00 AM
Qual:	Not reported
Current Action Lead:	St Perf

Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	MA
Action Name:	ST COOP
SEQ:	2
Start Date:	1991-01-24 05:00:00
Finish Date:	Not reported

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Qual:	Not reported
Current Action Lead:	St Perf
Region:	03
Site ID:	0300034
EPA ID:	DED000605972
Site Name:	DELAWARE SAND & GRAVEL LANDFILL
NPL:	F
FF:	N
OU:	00
Action Code:	MA
Action Name:	ST COOP
SEQ:	1
Start Date:	1988-12-22 05:00:00
Finish Date:	12/28/1988 5:00:00 AM
Qual:	Not reported
Current Action Lead:	St Perf

US ENG CONTROLS:

EPA ID:	DED000605972
Site ID:	0300034
Name:	DELAWARE SAND & GRAVEL LANDFILL
Address:	229 GRANTHAM LANE NEW CASTLE, DE 19720
EPA Region:	03
County:	NEW CASTLE
Event Code:	Not reported
Actual Date:	09/30/1993
Contact Name:	Not reported
Contact Phone and Ext:	Not reported
Event Code Description:	Not reported
Action ID:	001
Action Name:	RECORD OF DECISION
Action Completion date:	04/23/1988
Operable Unit:	01
Contaminated Media :	Debris
Engineering Control:	Disposal
Contact Name:	Not reported
Contact Phone and Ext:	Not reported
Event Code Description:	Not reported
Action ID:	001
Action Name:	RECORD OF DECISION
Action Completion date:	04/23/1988
Operable Unit:	01
Contaminated Media :	Groundwater
Engineering Control:	Discharge
Contact Name:	Not reported
Contact Phone and Ext:	Not reported
Event Code Description:	Not reported
Action ID:	001
Action Name:	RECORD OF DECISION
Action Completion date:	04/23/1988
Operable Unit:	01

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Contaminated Media : Groundwater
Engineering Control: Pump And Treat
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 04/23/1988
Operable Unit: 01
Contaminated Media : Soil
Engineering Control: Incineration
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 04/23/1988
Operable Unit: 01
Contaminated Media : Solid Waste
Engineering Control: Cap
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: RECORD OF DECISION
Action Completion date: 04/23/1988
Operable Unit: 01
Contaminated Media : Solid Waste
Engineering Control: Incineration
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Debris
Engineering Control: Disposal
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Groundwater
Engineering Control: Discharge
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Groundwater
Engineering Control: Extraction
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Groundwater
Engineering Control: Slurry Wall
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Groundwater
Engineering Control: Treatment, (N.O.S.)
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Soil
Engineering Control: Bioremediation (In-Situ)
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Soil
Engineering Control: Cap
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Soil
Engineering Control: Consolidate
Contact Name: Not reported
Contact Phone and Ext: Not reported

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Soil
Engineering Control: Excavation
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Soil
Engineering Control: Soil Cover
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Soil
Engineering Control: Soil Vapor Extraction (in-situ)
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Soil
Engineering Control: Storage - Temporary
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

Action ID: 001
Action Name: ROD Amendment
Action Completion date: 09/30/1993
Operable Unit: 01
Contaminated Media : Solid Waste
Engineering Control: Disposal
Contact Name: Not reported
Contact Phone and Ext: Not reported
Event Code Description: Not reported

US INST CONTROL:
EPA ID: DED000605972
Site ID: 0300034
Name: DELAWARE SAND & GRAVEL LANDFILL

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Action Name:	Explanation Of Significant Differences
Address:	229 GRANTHAM LANE NEW CASTLE, DE 19720
EPA Region:	03
County:	NEW CASTLE
Event Code:	Not reported
Inst. Control:	Covenant
Actual Date:	Not reported
Complet. Date:	07/08/2003
Operable Unit:	01
Contaminated Media :	Groundwater
Contact Name :	Not reported
Contact Phone and Ext :	Not reported
Event Code Description:	Not reported

EPA ID:	DED000605972
Site ID:	0300034
Name:	DELAWARE SAND & GRAVEL LANDFILL
Action Name:	ROD Amendment
Address:	229 GRANTHAM LANE NEW CASTLE, DE 19720
EPA Region:	03
County:	NEW CASTLE
Event Code:	Not reported
Inst. Control:	Deed Restriction
Actual Date:	09/30/1993
Complet. Date:	09/30/1993
Operable Unit:	01
Contaminated Media :	Groundwater
Contact Name :	Not reported
Contact Phone and Ext :	Not reported
Event Code Description:	Not reported

EPA ID:	DED000605972
Site ID:	0300034
Name:	DELAWARE SAND & GRAVEL LANDFILL
Action Name:	ROD Amendment
Address:	229 GRANTHAM LANE NEW CASTLE, DE 19720
EPA Region:	03
County:	NEW CASTLE
Event Code:	Not reported
Inst. Control:	Deed Restriction
Actual Date:	09/30/1993
Complet. Date:	09/30/1993
Operable Unit:	01
Contaminated Media :	Soil
Contact Name :	Not reported
Contact Phone and Ext :	Not reported
Event Code Description:	Not reported

SHWS:

Facility ID:	10055919
Site Type:	Landfill-Municipal/Industrial
Care Of:	Not reported
PI ID:	27292
Prog ID:	DE-0017

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Additional Info:	NPL
Reference Pt:	Unknown
Horizontal Method:	Unknown
Loc Type:	P
XCoordinate NAD83 Meters:	183907.82
YCoordinate NAD83 Meters:	183463.52
Latitude Dec:	39.6525
Longitude Dec:	-75.604162
Latitude Degrees:	39
Latitude Minutes:	39
Latitude Seconds:	9
Longitude Degrees:	-75
Longitude Minutes:	36
Longitude Seconds:	14.9832
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

Inst Control:

Facility ID:	DE-0017
Report Title:	GMZ Sites
Site Type:	NPL
Deed Restriction Date:	02/08/2006

Restrictions: 1. A GMZ shall be established to include the sites and surrounding areas as defined both in the text and on the attached maps, Attachments 1, 2 and 3. 2. No new public or domestic water supply wells will be allowed or permitted in the unconfined Columbia aquifer and any hydraulically interconnected or confined Potomac aquifer units within the GMZ Area A. 3. No new public or domestic water supply wells or non-potable wells will be allowed in the unconfined Columbia aquifer and any hydraulically interconnected Potomac aquifer units within the GMZ Area B without demonstrating that well construction will likely prevent the movement of potential contaminants into the well. The potentially contaminated groundwater will be sufficiently treated to applicable use standards; and following joint review and approval by both DWR and DAWM. 4. Monitoring, observation, and contaminant recovery wells may be installed in the GMZ Areas A and B following joint review and approval by DWR and DAWM. 5. Permits for any wells in the GMZ Areas A and B may be issued by DWR following joint review and approval by both DWR and DAWM.

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

ROD:

EPA ID:	DED000605972
RG:	3
Site ID:	300034
Name:	DELAWARE SAND & GRAVEL LANDFILL
Action:	GOVT Decision Document (ROD)
Operable Unit Number:	GRANTHAM SOUTH AREA
SEQ ID:	1
Action Completion:	1988-04-23 00:00:00
NPL Status:	Final
Non NPL Status:	Not reported

EPA ID:	DED000605972
RG:	3
Site ID:	300034
Name:	DELAWARE SAND & GRAVEL LANDFILL
Action:	GOVT ESD
Operable Unit Number:	GRANTHAM SOUTH AREA
SEQ ID:	3
Action Completion:	2003-07-08 00:00:00
NPL Status:	Final
Non NPL Status:	Not reported

EPA ID:	DED000605972
RG:	3
Site ID:	300034
Name:	DELAWARE SAND & GRAVEL LANDFILL
Action:	GOVT ROD Amendment
Operable Unit Number:	GRANTHAM SOUTH AREA
SEQ ID:	1
Action Completion:	1993-09-30 00:00:00
NPL Status:	Final
Non NPL Status:	Not reported

EPA ID:	DED000605972
RG:	3
Site ID:	300034
Name:	DELAWARE SAND & GRAVEL LANDFILL
Action:	GOVT ROD for PRP Remedy
Operable Unit Number:	DDA SOURCE & GW
SEQ ID:	2
Action Completion:	2017-12-12 00:00:00
NPL Status:	Final
Non NPL Status:	Not reported

PRP Name: AKZO NOBEL INC
ALLIED SIGNAL INC
ALLIED SIGNAL INC
ALLIED SIGNAL INC
ALLIED SIGNAL INC
ALLIED SIGNAL INC
ALLIED SIGNAL INC
ALLIED SIGNAL INC
ALLIED-SIGNAL INC.
ALLIEDSIGNAL INC
ALLIEDSIGNAL INC
AMERICAN CAN CO

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

AMERICAN CAN CO
AMERICAN CYANAMID CO.
AMERICAN CYANAMID CO.
AMERICAN CYANAMID CO.
AMERICAN CYANAMID CO.
AMERICAN CYANAMID CO.
AMERICAN CYANAMID CO.
AMERICAN CYANAMID CO./CYTEC INDUSTRIES
AMERICAN CYANAMID CO./CYTEC INDUSTRIES
AMERICAN CYANAMID CO./CYTEC INDUSTRIES
AMERICAN CYANAMID CO./CYTEC INDUSTRIES
AMERICAN NATIONAL CAN CO.
AMERICAS INC
AMETEK INC./HAVEG DIVISION
AMOCO CHEMICAL CORP
AMOCO CHEMICAL CORP
AMOCO CHEMICAL CORP
AMOCO CHEMICAL CORP
AMOCO CHEMICAL CORP
AMOCO CHEMICAL CORP
AMOCO CHEMICAL CORP
AMOCO CHEMICAL CORP
AMOCO CHEMICAL CORP
AMOCO CHEMICAL CORP
ATTWOODS INC
AVISON CORP THE
AVON PRODUCTS INC
AVON PRODUCTS INC
AVON PRODUCTS INC
AVON PRODUCTS INC
AVON PRODUCTS INC
B P AMERICA INC
B P AMERICA INC
B P AMERICA INC
B P AMERICA INC
BAYER CROPSCIENCE INC.
BELL ATLANTIC DELAWARE INC
BELL ATLANTIC DELAWARE INC
BUDD CO.
BUDD CO.
BUDD CO.
BUDD CO.
BUDD CO.
BUDD CO.
CADILLAC PLASTIC GROUP, INC.
CHAMPLAIN CABLE CORP
CHAMPLAIN CABLE CORP
CHAMPLAIN CABLE CORP

Click this hyperlink while viewing on your computer to access
234 additional PRP: record(s) in the EDR Site Report.

ICIS:
Enforcement Action ID: 03-2009-7032
FRS ID: 110009328628
Action Name: MOTORS LIQUIDATION CO F/K/A GENERAL MOTORS CORP, IN RE (NATIONAL CASE) (KANE & LOMBARD ST DRUMS)

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Facility Name:	DELAWARE SAND & GRAVEL SUPERFUND SITE
Facility Address:	229 GRANTHAM LANE NEW CASTLE, DE 19720
Enforcement Action Type:	Bankruptcy
Facility County:	NEW CASTLE
Program System Acronym:	ICIS
Enforcement Action Forum Desc:	Judicial
EA Type Code:	BNK
Facility SIC Code:	Not reported
Federal Facility ID:	Not reported
Latitude in Decimal Degrees:	39.391458
Longitude in Decimal Degrees:	75.36750
Permit Type Desc:	Not reported
Program System Acronym:	2655288
Facility NAICS Code:	212321
Tribal Land Code:	Not reported

Enforcement Action ID:	03-2009-7027
FRS ID:	110009328628
Action Name:	OLD CARCO LLC, (F/K/A CHRYSLER LLC), IN RE (NATIONAL CASE)
Facility Name:	DELAWARE SAND & GRAVEL SUPERFUND SITE
Facility Address:	229 GRANTHAM LANE NEW CASTLE, DE 19720
Enforcement Action Type:	Bankruptcy
Facility County:	NEW CASTLE
Program System Acronym:	ICIS
Enforcement Action Forum Desc:	Judicial
EA Type Code:	BNK
Facility SIC Code:	Not reported
Federal Facility ID:	Not reported
Latitude in Decimal Degrees:	39.391458
Longitude in Decimal Degrees:	75.36750
Permit Type Desc:	Not reported
Program System Acronym:	2655288
Facility NAICS Code:	212321
Tribal Land Code:	Not reported

Enforcement Action ID:	03-2009-7015
FRS ID:	110009328628
Action Name:	CHEMTURA CORP, IN RE (NATIONAL CASE)(LEAD)
Facility Name:	DELAWARE SAND & GRAVEL SUPERFUND SITE
Facility Address:	229 GRANTHAM LANE NEW CASTLE, DE 19720
Enforcement Action Type:	Bankruptcy
Facility County:	NEW CASTLE
Program System Acronym:	ICIS
Enforcement Action Forum Desc:	Judicial
EA Type Code:	BNK
Facility SIC Code:	Not reported
Federal Facility ID:	Not reported
Latitude in Decimal Degrees:	39.391458
Longitude in Decimal Degrees:	75.36750
Permit Type Desc:	Not reported
Program System Acronym:	2655288
Facility NAICS Code:	212321
Tribal Land Code:	Not reported

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Enforcement Action ID:	03-2007-0054
FRS ID:	110009328628
Action Name:	NEW CASTLE COUNTY, DELAWARE
Facility Name:	DELAWARE SAND & GRAVEL SUPERFUND SITE
Facility Address:	229 GRANTHAM LANE NEW CASTLE, DE 19720
Enforcement Action Type:	CERCLA 106 AO For Resp Action/Imm Haz
Facility County:	NEW CASTLE
Program System Acronym:	ICIS
Enforcement Action Forum Desc:	Administrative - Formal
EA Type Code:	106
Facility SIC Code:	Not reported
Federal Facility ID:	Not reported
Latitude in Decimal Degrees:	39.391458
Longitude in Decimal Degrees:	75.36750
Permit Type Desc:	Not reported
Program System Acronym:	2655288
Facility NAICS Code:	212321
Tribal Land Code:	Not reported

Facility Name:	DELAWARE SAND & GRAVEL SUPERFUND SITE
Address:	229 GRANTHAM LANE
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	1442

Facility Name:	DELAWARE SAND & GRAVEL SUPERFUND SITE
Address:	229 GRANTHAM LANE
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	1442

Facility Name:	DELAWARE SAND & GRAVEL SUPERFUND SITE
Address:	229 GRANTHAM LANE
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	1442

Facility Name:	DELAWARE SAND & GRAVEL SUPERFUND SITE
Address:	229 GRANTHAM LANE
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	1442

Facility Name:	DELAWARE SAND & GRAVEL SUPERFUND SITE
Address:	229 GRANTHAM LANE
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	1442

Facility Name:	DELAWARE SAND & GRAVEL SUPERFUND SITE

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

Address: 229 GRANTHAM LANE
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 1442

Facility Name: DELAWARE SAND & GRAVEL SUPERFUND SITE
Address: 229 GRANTHAM LANE
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 1442

Facility Name: DELAWARE SAND & GRAVEL SUPERFUND SITE
Address: 229 GRANTHAM LANE
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 1442

Facility Name: DELAWARE SAND & GRAVEL SUPERFUND SITE
Address: 229 GRANTHAM LANE
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 1442

Facility Name: DELAWARE SAND & GRAVEL SUPERFUND SITE
Address: 229 GRANTHAM LANE
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 1442

Facility Name: DELAWARE SAND & GRAVEL SUPERFUND SITE
Address: 229 GRANTHAM LANE
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 1442

Facility Name: DELAWARE SAND & GRAVEL SUPERFUND SITE
Address: 229 GRANTHAM LANE
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 1442

CONSENT:
EPA ID: DED000605972
Site ID: Not reported
Case Title: U.S. AND THE STATE OF DELAWARE V. HERCULES, INC., ET AL.
Court Num: 89-562
District: Delaware
Entered Date: 19910622
Name: DELAWARE SAND AND GRAVEL SITE
Address: 229 GRANTHAM LANE

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

City:	NEW CASTLE
County:	NEW CASTLE
State:	DE
Zip:	19720

EPA ID:	DED000605972
Site ID:	Not reported
Case Title:	U.S. AND THE STATE OF DELAWARE V. HERCULES, INC., ET AL.
Court Num:	89-562
District:	Delaware
Entered Date:	19950614
Name:	DELAWARE SAND AND GRAVEL SITE
Address:	229 GRANTHAM LANE
City:	NEW CASTLE
County:	NEW CASTLE
State:	DE
Zip:	19720

EPA ID:	DED000605972
Site ID:	Not reported
Case Title:	U.S. AND THE STATE OF DELAWARE V. HERCULES, INC., ET AL.
Court Num:	89-562
District:	Delaware
Entered Date:	19961231
Name:	DELAWARE SAND AND GRAVEL SITE
Address:	229 GRANTHAM LANE
City:	NEW CASTLE
County:	NEW CASTLE
State:	DE
Zip:	19720

EPA ID:	DED000605972
Site ID:	Not reported
Case Title:	U.S. AND THE STATE OF DELAWARE V. HERCULES, INC., ET AL.
Court Num:	89-562
District:	Delaware
Entered Date:	19910813
Name:	DELAWARE SAND AND GRAVEL SITE
Address:	229 GRANTHAM LANE
City:	NEW CASTLE
County:	NEW CASTLE
State:	DE
Zip:	19720

EPA ID:	DED000605972
Site ID:	Not reported
Case Title:	U.S. AND THE STATE OF DELAWARE V. HERCULES, INC., ET AL.
Court Num:	89-562
District:	Delaware
Entered Date:	19910625
Name:	DELAWARE SAND AND GRAVEL SITE
Address:	229 GRANTHAM LANE
City:	NEW CASTLE
County:	NEW CASTLE
State:	DE
Zip:	19720

DELAWARE SAND & GRAVEL LANDFILL (Continued) **1000160500**

EPA ID:	DED000605972
Site ID:	Not reported
Case Title:	U.S. AND THE STATE OF DELAWARE V. HERCULES, INC., ET AL.
Court Num:	89-562
District:	Delaware
Entered Date:	19950922
Name:	DELAWARE SAND AND GRAVEL SITE
Address:	229 GRANTHAM LANE
City:	NEW CASTLE
County:	NEW CASTLE
State:	DE
Zip:	19720

EPA ID:	DED000605972
Site ID:	Not reported
Case Title:	U.S. AND THE STATE OF DELAWARE V. HERCULES, INC., ET AL.
Court Num:	89-562
District:	Delaware
Entered Date:	19960807
Name:	DELAWARE SAND AND GRAVEL SITE
Address:	229 GRANTHAM LANE
City:	NEW CASTLE
County:	NEW CASTLE
State:	DE
Zip:	19720

ECHO:

Envid:	1000160500
Registry ID:	110009328628
DFR URL:	http://echo.epa.gov/detailed-facility-report?fid=110009328628

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12 **DELAWARE ARMY NATIONAL GUARD OMS 03** **RCRA-CESQG** **1005415720**
1191 RIVER RD **FINDS** **DED982661365**
< 1/8 **NEW CASTLE, DE 19720** **ECHO**
1 ft. **NJ MANIFEST**

Relative: Higher
Actual: 32 ft.

RCRA-CESQG:

Date form received by agency:	06/01/1989
Facility name:	DELAWARE ARMY NATIONAL GUARD OMS 03
Facility address:	1191 RIVER RD BLDG 20 NEW CASTLE, DE 19720-5198
EPA ID:	DED982661365
Contact:	CARL SARGENT
Contact address:	1191 RIVER RD BLDG 20 NEW CASTLE, DE 19720-5198
Contact country:	US
Contact telephone:	302-324-7309
Contact email:	Not reported
EPA Region:	03
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any

DELAWARE ARMY NATIONAL GUARD OMS 03 (Continued) **1005415720**

land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:

Owner/operator name:	DE ARMY NATL GUARD
Owner/operator address:	FIRST REGIMENT RD WILMINGTON, DE 19808
Owner/operator country:	Not reported
Owner/operator telephone:	302-324-7023
Owner/operator email:	Not reported
Owner/operator fax:	Not reported
Owner/operator extension:	Not reported
Legal status:	State
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Owner/operator name:	OPERNAME
Owner/operator address:	OPERSTREET OPERCITY, AK 99999
Owner/operator country:	Not reported
Owner/operator telephone:	215-555-1212
Owner/operator email:	Not reported
Owner/operator fax:	Not reported
Owner/operator extension:	Not reported
Legal status:	State
Owner/Operator Type:	Operator
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No

Hazardous Waste Summary:

. Waste code: D001

DELAWARE ARMY NATIONAL GUARD OMS 03 (Continued) **1005415720**

. Waste name: IGNITABLE WASTE

. Waste code: D002
. Waste name: CORROSIVE WASTE

Violation Status: No violations found

FINDS:

Registry ID: 110002508778

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

Click this hyperlink while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:
Envid: 1005415720
Registry ID: 110002508778
DFR URL: http://echo.epa.gov/detailed-facility-report?fid=110002508778

NJ MANIFEST:
EPA Id: DED982661365
Mail Address: Not reported
Mail City/State/Zip: Not reported
Facility Phone: 3023247309
Emergency Phone: Not reported
Contact: Not reported
Comments: Not reported
SIC Code: Not reported
County: 00
Municipal: 00
Previous EPA Id: Not reported
Gen Flag: X
Trans Flag: Not reported
TSDF Flag: Not reported
Name Change: Not reported
Date Change: Not reported

Manifest:
Manifest Number: NJA4146929
EPA ID: DED982661365
Date Shipped: 07/23/2004
TSDF EPA ID: NJD980536593
Transporter EPA ID: NJD080631369
Transporter 2 EPA ID: NJD000692061
Transporter 3 EPA ID: Not reported
Transporter 4 EPA ID: Not reported
Transporter 5 EPA ID: Not reported
Transporter 6 EPA ID: Not reported

DELAWARE ARMY NATIONAL GUARD OMS 03 (Continued) **1005415720**

Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	07/23/2004
Date Trans2 Transported Waste:	07/29/2004
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	07/29/2004
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	09030422
Was Load Rejected:	No
Reason Load Was Rejected:	Not reported

Manifest Number:	NJA5077591
EPA ID:	DED982661365
Date Shipped:	02/17/2005
TSDF EPA ID:	NJD002200046
Transporter EPA ID:	NJR000011528
Transporter 2 EPA ID:	Not reported
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	02/17/2005
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	02/24/2005
TSDF EPA Facility Name:	Not reported

DELAWARE ARMY NATIONAL GUARD OMS 03 (Continued) **1005415720**

QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	04290521
Was Load Rejected:	No
Reason Load Was Rejected:	Not reported

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13 **NG NEW CASTLE TS RIFLE RANGE** **DE SHWS** **S109484965**
1199 RIVER ROAD **N/A**
< 1/8 **NEW CASTLE, DE 19720**
1 ft.

Relative: Higher
Actual: 30 ft.

SHWS:

Facility ID:	10711954
Site Type:	National Guard Base
Care Of:	Not reported
PI ID:	222720
Prog ID:	DE-0333
Additional Info:	DOD
Reference Pt:	Facility/Interest Center
Horizontal Method:	Photo Interpolation-2002 Orthophoto
Loc Type:	P
XCoordinate NAD83 Meters:	183661.18
YCoordinate NAD83 Meters:	181657.95
Latitude Dec:	39.636246
Longitude Dec:	-75.607005
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	10.4856
Longitude Degrees:	-75
Longitude Minutes:	36
Longitude Seconds:	25.218
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported

NG NEW CASTLE TS RIFLE RANGE (Continued) **S109484965**

Water District:	Not reported
Mod Grid:	092-330

Facility ID:	10711954
Site Type:	National Guard Base
Care Of:	Not reported
PI ID:	222720
Prog ID:	DE-0333
Additional Info:	DOD
Reference Pt:	Facility/Interest Center
Horizontal Method:	Photo Interpolation-2002 Orthophoto
Loc Type:	P
XCoordinate NAD83 Meters:	183661.18
YCoordinate NAD83 Meters:	181657.95
Latitude Dec:	39.636246
Longitude Dec:	-75.607005
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	10.4856
Longitude Degrees:	-75
Longitude Minutes:	36
Longitude Seconds:	25.218
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	092-330

Facility ID:	10711954
Site Type:	National Guard Base
Care Of:	Not reported
PI ID:	222720
Prog ID:	DE-0333
Additional Info:	FUDS
Reference Pt:	Facility/Interest Center
Horizontal Method:	Photo Interpolation-2002 Orthophoto
Loc Type:	P
XCoordinate NAD83 Meters:	183661.18
YCoordinate NAD83 Meters:	181657.95
Latitude Dec:	39.636246
Longitude Dec:	-75.607005
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	10.4856

NG NEW CASTLE TS RIFLE RANGE (Continued) **S109484965**

Longitude Degrees:	-75
Longitude Minutes:	36
Longitude Seconds:	25.218
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	092-330

Facility ID:	10711954
Site Type:	National Guard Base
Care Of:	Not reported
PI ID:	222720
Prog ID:	DE-0333
Additional Info:	FUDS
Reference Pt:	Facility/Interest Center
Horizontal Method:	Photo Interpolation-2002 Orthophoto
Loc Type:	P
XCoordinate NAD83 Meters:	183661.18
YCoordinate NAD83 Meters:	181657.95
Latitude Dec:	39.636246
Longitude Dec:	-75.607005
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	10.4856
Longitude Degrees:	-75
Longitude Minutes:	36
Longitude Seconds:	25.218
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported

NG NEW CASTLE TS RIFLE RANGE (Continued) **S109484965**

Water District: Not reported
Mod Grid: 092-330

B14 **DE ARNG USPFO** **PA MANIFEST** **S109245432**
1161 RIVER ROAD **N/A**
< 1/8 **NEW CASATLE, DE 19720**
1 ft.

Site 1 of 2 in cluster B

Relative: **Higher**
Actual: **26 ft.**

Manifest Details:

Year:	2011
Manifest Number:	006496639JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED984076372
Generator Date:	10/25/2011
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-326-7372
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	3
Waste Number:	NONE
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	22
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2011
Manifest Number:	006496639JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED984076372
Generator Date:	10/25/2011
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-326-7372
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D001
Container Number:	2
Container Type:	Fiberboard or plastic drums, barrels, kegs

DE ARNG USPFO (Continued) **S109245432**

Waste Quantity:	47
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2011
Manifest Number:	006496639JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED984076372
Generator Date:	10/25/2011
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-326-7372
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	2
Waste Number:	D003
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	45
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2011
Manifest Number:	006496639JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED984076372
Generator Date:	10/25/2011
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-326-7372
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	2
Waste Number:	D001
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	45
Unit:	Pounds
Handling Code:	Not reported

DE ARNG USPFO (Continued) **S109245432**

TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2009
Manifest Number:	003044787JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED984076372
Generator Date:	04/09/2009
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-326-7372
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	2
Waste Number:	XXXX
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	10
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2009
Manifest Number:	003044787JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED984076372
Generator Date:	04/09/2009
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-326-7372
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D004
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	15
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

DE ARNG USPFO (Continued) **S109245432**

Year:	2009
Manifest Number:	003044787JJK
Manifest Type:	TSD Copy
Generator EPA Id:	DED984076372
Generator Date:	04/09/2009
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	302-326-7372
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	3
Waste Number:	XXXX
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	38
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2007
Manifest Number:	000839780JJK
Manifest Type:	Not reported
Generator EPA Id:	DED984076372
Generator Date:	10/23/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	DONNA WILLIAMS
Contact Phone:	302-326-7372
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	2
Waste Number:	NONE
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	5
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2007
Manifest Number:	000839780JJK
Manifest Type:	Not reported

DE ARNG USPFO (Continued) **S109245432**

Generator EPA Id:	DED984076372
Generator Date:	10/23/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	DONNA WILLIAMS
Contact Phone:	302-326-7372
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D007
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	25
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2007
Manifest Number:	003301901JJK
Manifest Type:	Not reported
Generator EPA Id:	DED984076372
Generator Date:	09/06/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	DONNA WILLIAMS
Contact Phone:	302-326-7372
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	2
Waste Number:	D007
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	33
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Click this hyperlink while viewing on your computer to access
5 additional PA_MANIFEST: record(s) in the EDR Site Report.

B15 **DELAWARE ARMY NATIONAL GUARD USPFO** **RCRA-CESQG** **1004682102**
1161 RIVER RD **ECHO** **DED984076372**
< 1/8 **NEW CASTLE, DE 19720** **NY MANIFEST**
1 ft. **NJ MANIFEST**

Site 2 of 2 in cluster B

Relative:
Higher

Actual:
26 ft.

RCRA-CESQG:

Date form received by agency:	05/26/1993
Facility name:	DELAWARE ARMY NATIONAL GUARD USPFO
Facility address:	1161 RIVER RD NEW CASTLE, DE 19720-5199
EPA ID:	DED984076372
Contact:	KEVIN DOUGHERTY
Contact address:	1161 RIVER RD NEW CASTLE, DE 19720-5199
Contact country:	US
Contact telephone:	302-324-7392
Contact email:	Not reported
EPA Region:	03
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:

Owner/operator name:	DELAWARE ARMY NATL GAURD
Owner/operator address:	FIRST REGIMENT RD WILMINGTON, DE 19808
Owner/operator country:	Not reported
Owner/operator telephone:	302-324-7023
Owner/operator email:	Not reported
Owner/operator fax:	Not reported
Owner/operator extension:	Not reported
Legal status:	State
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No

DELAWARE ARMY NATIONAL GUARD USPFO (Continued) **1004682102**

Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Hazardous Waste Summary:

. Waste code: D000
. Waste name: Not Defined

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D002
. Waste name: CORROSIVE WASTE

. Waste code: D003
. Waste name: REACTIVE WASTE

. Waste code: D005
. Waste name: BARIUM

. Waste code: D008
. Waste name: LEAD

. Waste code: D035
. Waste name: METHYL ETHYL KETONE

Violation Status: No violations found

ECHO:
Envid: 1004682102
Registry ID: 110029274336
DFR URL: http://echo.epa.gov/detailed-facility-report?fid=110029274336

NY MANIFEST:
Name: DELAWARE ARNG USPFO
Address: 1161 RIVER RD
City,State,Zip: NEW CASTLE, DE 19720-5199
Country: USA
EPA ID: DED984076372
Facility Status: Not reported
Location Address 1: 1161 RIVER ROAD
Code: BP
Location Address 2: Not reported
Total Tanks: Not reported
Location City: NEW CASTLE
Location State: DE
Location Zip: 19720
Location Zip 4: Not reported

NY MANIFEST:
EPAID: DED984076372
Mailing Name: DELAWARE ARNG USPFO

DELAWARE ARMY NATIONAL GUARD USPFO (Continued) **1004682102**

Mailing Contact:	CHARLES S PRITCHARD
Mailing Address 1:	1161 RIVER ROAD
Mailing Address 2:	Not reported
Mailing City:	NEW CASTLE
Mailing State:	DE
Mailing Zip:	19720
Mailing Zip 4:	Not reported
Mailing Country:	USA
Mailing Phone:	3023247374

NY MANIFEST:

Document ID:	NYB7181046
Manifest Status:	K
seq:	Not reported
Year:	1996
Trans1 State ID:	11338P
Trans2 State ID:	Not reported
Generator Ship Date:	10/10/1996
Trans1 Recv Date:	10/10/1996
Trans2 Recv Date:	/ /
TSD Site Recv Date:	10/22/1996
Part A Recv Date:	10/31/1996
Part B Recv Date:	11/14/1996
Generator EPA ID:	DED984076372
Trans1 EPA ID:	NYD980769947
Trans2 EPA ID:	Not reported
TSDF ID 1:	NYD000632372
TSDF ID 2:	Not reported
Manifest Tracking Number:	Not reported
Import Indicator:	Not reported
Export Indicator:	Not reported
Discr Quantity Indicator:	Not reported
Discr Type Indicator:	Not reported
Discr Residue Indicator:	Not reported
Discr Partial Reject Indicator:	Not reported
Discr Full Reject Indicator:	Not reported
Manifest Ref Number:	Not reported
Alt Facility RCRA ID:	Not reported
Alt Facility Sign Date:	Not reported
MGMT Method Type Code:	Not reported
Waste Code:	D001 - NON-LISTED IGNITABLE WASTES
Waste Code:	Not reported
Waste Code:	Not reported
Waste Code:	Not reported
Waste Code:	Not reported
Waste Code:	Not reported
Quantity:	00150
Units:	P - Pounds
Number of Containers:	001
Container Type:	DM - Metal drums, barrels
Handling Method:	B Incineration, heat recovery, burning.
Specific Gravity:	100

Click this hyperlink while viewing on your computer to access
-1 additional NY MANIFEST: record(s) in the EDR Site Report.

DELAWARE ARMY NATIONAL GUARD USPFO (Continued) **1004682102**

NJ MANIFEST:

EPA Id:	DED984076372
Mail Address:	FIRST REGIMENT ROAD
Mail City/State/Zip:	WILMINGTON 19808
Facility Phone:	3023267132
Emergency Phone:	Not reported
Contact:	Not reported
Comments:	Not reported
SIC Code:	Not reported
County:	00
Municipal:	00
Previous EPA Id:	Not reported
Gen Flag:	X
Trans Flag:	Not reported
TSDF Flag:	Not reported
Name Change:	Not reported
Date Change:	Not reported

Manifest:

Manifest Number:	NJA5022519
EPA ID:	DED984076372
Date Shipped:	07/23/2004
TSDF EPA ID:	NJD980536593
Transporter EPA ID:	NJD080631369
Transporter 2 EPA ID:	NJD000692061
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	07/23/2004
Date Trans2 Transported Waste:	07/29/2004
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	07/29/2004
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	10010421

DELAWARE ARMY NATIONAL GUARD USPFO (Continued) **1004682102**

Was Load Rejected: WILMINGTON 19808
Reason Load Was Rejected: Not reported

16
North
< 1/8
0.025 mi.
130 ft.

DELAWARE BRICK PIT
1136 RIVER ROAD
NEW CASTLE, DE 19720

DE SHWS **S109484972**
N/A

Relative:
Higher

Actual:
6 ft.

SHWS:

Facility ID:	Not reported
Site Type:	Landfill-Municipal/Industrial
Care Of:	Not reported
PI ID:	Not reported
Prog ID:	DE-1151
Additional Info:	HSCA
Reference Pt:	Not reported
Horizontal Method:	Not reported
Loc Type:	Not reported
XCoordinate NAD83 Meters:	Not reported
YCoordinate NAD83 Meters:	Not reported
Latitude Dec:	Not reported
Longitude Dec:	Not reported
Latitude Degrees:	Not reported
Latitude Minutes:	Not reported
Latitude Seconds:	Not reported
Longitude Degrees:	Not reported
Longitude Minutes:	Not reported
Longitude Seconds:	Not reported
PO Name:	Not reported
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Not reported
Watershed:	Not reported
DRBC_Basin:	Not reported
Quad:	Not reported
Senate District:	Not reported
Senator:	Not reported
House District:	Not reported
Representative:	Not reported
School District:	Not reported
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

17 WSW 1/8-1/4 0.182 mi. 961 ft. | **OMMELANDEN HUNTER EDUCATION TRAINING CENTER**
1220 RIVER ROAD
NEW CASTLE, DE 19720 | **DE SHWS** | **S109485021**
N/A

Relative: Higher
Actual: 38 ft.

SHWS:

Facility ID:	10057901
Site Type:	Public Open Space
Care Of:	Not reported
PI ID:	435014
Prog ID:	DE-1457
Additional Info:	HSCA
Reference Pt:	Facility Entance(General)
Horizontal Method:	Address Matching-House Number
Loc Type:	P
XCoordinate NAD83 Meters:	183052.75
YCoordinate NAD83 Meters:	180776
Latitude Dec:	39.628278
Longitude Dec:	-75.614061
Latitude Degrees:	39
Latitude Minutes:	37
Latitude Seconds:	41.8008
Longitude Degrees:	-75
Longitude Minutes:	36
Longitude Seconds:	50.6196
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	092-330

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18 North 1/8-1/4 0.206 mi. 1089 ft. | **DELAWARE BRICK COMPANY INC**
NEW CASTLE (County), DE | **US MINES** | **1011136670**
N/A

Relative: Higher
Actual: 24 ft.

US MINES:

Sic Code(s):	145906
Sic Code(s):	000000
Sic Code(s):	000000
Sic Code(s):	000000
Sic Code(s):	000000
Sic Code(s):	000000
Mine ID:	0700012
Entity Name:	DELAWARE BRICK COMPANY PIT & MILL

DELAWARE BRICK COMPANY INC (Continued) **1011136670**

Company:	DELAWARE BRICK COMPANY INC
Status:	4
Status Date:	19820521
Operation Class:	3
Number of Shops:	0
Number of Plants:	0
Latitude Degree:	00
Longitude Degree:	000
Latitude Minute:	00
Latitude Seconds:	00
Longitude Minutes:	00
Longitude Seconds:	00
Number of Pits:	000

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19 **DENTON LANDFILL** **DE SHWS** **1000416433**
NE **ROUTE 9** **DE INST CONTROL** **N/A**
1/4-1/2 **NEW CASTLE, DE 19720**
0.321 mi.
1695 ft.

Relative:
Higher

Actual:
7 ft.

SHWS:

Facility ID:	10056192
Site Type:	Not reported
Care Of:	Not reported
PI ID:	26987
Prog ID:	DE-0015
Additional Info:	HSCA
Reference Pt:	Unknown
Horizontal Method:	Unknown
Loc Type:	P
XCoordinate NAD83 Meters:	184442.89
YCoordinate NAD83 Meters:	182224.57
Latitude Dec:	39.641301
Longitude Dec:	-75.598204
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	28.6836
Longitude Degrees:	-75
Longitude Minutes:	35
Longitude Seconds:	53.5344
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

DENTON LANDFILL (Continued) **1000416433**

Inst Control:
Facility ID: DE-0015
Report Title: GMZ Sites
Site Type: HSCA
Deed Restriction Date: 02/08/2006
Restrictions: 1. A GMZ shall be established to include the sites and surrounding areas as defined both in the text and on the attached maps, Attachments 1, 2 and 3. 2. No new public or domestic water supply wells will be allowed or permitted in the unconfined Columbia aquifer and any hydraulically interconnected or confined Potomac aquifer units within the GMZ Area A. 3. No new public or domestic water supply wells or non-potable wells will be allowed in the unconfined Columbia aquifer and any hydraulically interconnected Potomac aquifer units within the GMZ Area B without demonstrating that well construction will likely prevent the movement of potential contaminants into the well. The potentially contaminated groundwater will be sufficiently treated to applicable use standards; and following joint review and approval by both DWR and DAWM. 4. Monitoring, observation, and contaminant recovery wells may be installed in the GMZ Areas A and B following joint review and approval by DWR and DAWM. 5. Permits for any wells in the GMZ Areas A and B may be issued by DWR following joint review and approval by both DWR and DAWM.

20
NNE
1/4-1/2
0.333 mi.
1756 ft.

DP AND L, OSTERHELD PROPERTY **DE LUST** **S110838855**
1079 RIVER ROAD **N/A**
NEW CASTLE, DE 19720

Relative:
Higher

Actual:
9 ft.

LUST:
Facility ID: 10025041
Status: Inactive
Date Closed: 07/15/1992
Project Number: N9207179
Watershed: Army Creek
Basin: Delaware Bay
Latitude: 39.64059
Longitude: -75.6028
Country Abv: US
PI ID: 20139
Prog ID: 3-001453
Additional Info: Not reported
Care Of: Not reported
Reference Pt: Unknown
Horizontal Method: GPS-Differentially Corrected
Loc Type: P
PO Name: New Castle
Tax ID: Not reported
Sewer District: Not reported
Floodplain Zone Code: Not reported
Flood Plain Zone: Not reported
DRBC Basin: Y
Quad: WILMINGTON SOUTH
Senate District: 12
Senator: Senator Nicole Poore
House District: 15

DP AND L, OSTERHELD PROPERTY (Continued) **S110838855**

Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
Ag Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

21
NNE
1/4-1/2
0.494 mi.
2607 ft.

RT 9 TCE
1040 RIVER ROAD
NEW CASTLE, DE 19720

DE SHWS **S108514890**
N/A

Relative:
Higher

Actual:
19 ft.

SHWS:

Facility ID:	10056240
Site Type:	Other
Care Of:	Not reported
PI ID:	27035
Prog ID:	DE-1271
Additional Info:	HSCA
Reference Pt:	Facility/Interest Center
Horizontal Method:	Photo Interpolation-2002 Orthophoto
Loc Type:	P
XCoordinate NAD83 Meters:	181309.35
YCoordinate NAD83 Meters:	177354.61
Latitude Dec:	39.597437
Longitude Dec:	-75.634283
Latitude Degrees:	39
Latitude Minutes:	35
Latitude Seconds:	50.7732
Longitude Degrees:	-75
Longitude Minutes:	38
Longitude Seconds:	3.4188
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Red Lion Creek
DRBC_Basin:	Y
Quad:	SAINT GEORGES
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Delaware City Area - Zone A
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	086-322

22 NE 1/2-1 0.648 mi. 3421 ft. | **INDUSTRIAL PROD**
RTE 9TH GRANTHAM RD
NEW CASTLE, DE 19720 | **SEMS-ARCHIVE**
DE SHWS
DE INST CONTROL | **1003864635**
DED980705784

Relative: Higher

Actual: 16 ft.

SEMS Archive:

Site ID:	0300117
EPA ID:	DED980705784
Cong District:	01
FIPS Code:	10003
FF:	N
NPL:	Not on the NPL
Non NPL Status:	NFRAP-Site does not qualify for the NPL based on existing information

SEMS Archive Detail:

Region:	03
Site ID:	0300117
EPA ID:	DED980705784
Site Name:	INDUSTRIAL PROD
NPL:	N
FF:	N
OU:	00
Action Code:	VS
Action Name:	ARCH SITE
SEQ:	1
Start Date:	Not reported
Finish Date:	1986-11-19 05:00:00
Qual:	Not reported
Current Action Lead:	EPA Perf In-Hse

Region:	03
Site ID:	0300117
EPA ID:	DED980705784
Site Name:	INDUSTRIAL PROD
NPL:	N
FF:	N
OU:	00
Action Code:	DS
Action Name:	DISCVRY
SEQ:	1
Start Date:	1980-01-01 05:00:00
Finish Date:	1980-01-01 05:00:00
Qual:	Not reported
Current Action Lead:	EPA Perf

Region:	03
Site ID:	0300117
EPA ID:	DED980705784
Site Name:	INDUSTRIAL PROD
NPL:	N
FF:	N
OU:	00
Action Code:	SI
Action Name:	SI
SEQ:	1
Start Date:	1986-06-18 04:00:00
Finish Date:	1986-11-19 05:00:00
Qual:	N
Current Action Lead:	EPA Perf

INDUSTRIAL PROD (Continued) **1003864635**

Region:	03
Site ID:	0300117
EPA ID:	DED980705784
Site Name:	INDUSTRIAL PROD
NPL:	N
FF:	N
OU:	00
Action Code:	PA
Action Name:	PA
SEQ:	1
Start Date:	1984-09-01 05:00:00
Finish Date:	1984-09-01 05:00:00
Qual:	L
Current Action Lead:	St Perf

SHWS:

Facility ID:	10056249
Site Type:	Other Industrial Plant
Care Of:	Not reported
PI ID:	27044
Prog ID:	DE-0030
Additional Info:	HSCA
Reference Pt:	Unknown
Horizontal Method:	Unknown
Loc Type:	P
XCoordinate NAD83 Meters:	184846.68
YCoordinate NAD83 Meters:	182570.83
Latitude Dec:	39.644477
Longitude Dec:	-75.593202
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	40.1172
Longitude Degrees:	-75
Longitude Minutes:	35
Longitude Seconds:	35.5272
PO Name:	Not reported
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	096-334

Inst Control:

INDUSTRIAL PROD (Continued) **1003864635**

Facility ID: DE-0030
Report Title: GMZ Sites
Site Type: HSCA
Deed Restriction Date: 02/08/2006
Restrictions: 1. A GMZ shall be established to include the sites and surrounding areas as defined both in the text and on the attached maps, Attachments 1, 2 and 3. 2. No new public or domestic water supply wells will be allowed or permitted in the unconfined Columbia aquifer and any hydraulically interconnected or confined Potomac aquifer units within the GMZ Area A. 3. No new public or domestic water supply wells or non-potable wells will be allowed in the unconfined Columbia aquifer and any hydraulically interconnected Potomac aquifer units within the GMZ Area B without demonstrating that well construction will likely prevent the movement of potential contaminants into the well. The potentially contaminated groundwater will be sufficiently treated to applicable use standards; and following joint review and approval by both DWR and DAWM. 4. Monitoring, observation, and contaminant recovery wells may be installed in the GMZ Areas A and B following joint review and approval by DWR and DAWM. 5. Permits for any wells in the GMZ Areas A and B may be issued by DWR following joint review and approval by both DWR and DAWM.

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23 **PETRILLO PROPERTY** **DE SHWS** **S106800053**
North **758 GRANTHAM LANE** **DE INST CONTROL** **N/A**
1/2-1 **NEW CASTLE, DE 19720** **DE BROWNFIELDS**
0.757 mi.
3998 ft.

Relative: **Higher**
Actual: **36 ft.**

SHWS:

Facility ID:	10056394
Site Type:	Other
Care Of:	Not reported
PI ID:	27189
Prog ID:	DE-1281
Additional Info:	HSCA
Reference Pt:	Facility/Interest Center
Horizontal Method:	Map Interpolation-Tiger
Loc Type:	P
XCoordinate NAD83 Meters:	184551.92
YCoordinate NAD83 Meters:	182988.62
Latitude Dec:	39.648237
Longitude Dec:	-75.596761
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	53.6532
Longitude Degrees:	-75
Longitude Minutes:	35
Longitude Seconds:	48.3396
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Unknown
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH

PETRILLO PROPERTY (Continued) **S106800053**

Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

Facility ID:	10056394
Site Type:	Other
Care Of:	Not reported
PI ID:	27189
Prog ID:	DE-1281
Additional Info:	State Funded Brownfield
Reference Pt:	Facility/Interest Center
Horizontal Method:	Map Interpolation-Tiger
Loc Type:	P
XCoordinate NAD83 Meters:	184551.92
YCoordinate NAD83 Meters:	182988.62
Latitude Dec:	39.648237
Longitude Dec:	-75.596761
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	53.6532
Longitude Degrees:	-75
Longitude Minutes:	35
Longitude Seconds:	48.3396
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Unknown
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

Inst Control:

Facility ID:	DE-1281
Report Title:	Deed Restriction Sites
Site Type:	State Funded Brownfield
Deed Restriction Date:	11/17/2003
Restrictions:	1. Limitation of Groundwater Withdrawal. No groundwater wells shall be installed, and no groundwater shall be withdrawn from any well, on the Land without the prior written approval of DNREC-SIRB. 2. Amendment. The foregoing covenants shall not be modified, amended or

PETRILLO PROPERTY (Continued) **S106800053**

altered in whole or in part except with the express written and properly recorded approval of DNREC-SIRB, or its successor, which shall be the only approval or consent required. 3. Violation of Covenants. If Declarant violates any of the restrictive covenants imposed by this Declaration, DNREC-SIRB, or its duly appointed successor, shall have the right to proceed at law or in equity to enforce compliance with or prevent the violation or breach of the terms hereof. 4. Scope and Interpretations. This Declaration shall be governed by Delaware law, shall have no application to or effect upon any property other than the Land as described in Exhibit "A", and shall not be interpreted to benefit any party other than DNREC-SIRB, or its duly appointed successor. No rights hereunder may be assigned by DNREC-SIRB except by operation of law to its duly appointed successor.

Facility ID: DE-1281
Report Title: Deed Restriction Sites
Site Type: HSCA
Deed Restriction Date: 11/17/2003
Restrictions: 1. Limitation of Groundwater Withdrawal. No groundwater wells shall be installed, and no groundwater shall be withdrawn from any well, on the Land without the prior written approval of DNREC-SIRB. 2. Amendment. The foregoing covenants shall not be modified, amended or altered in whole or in part except with the express written and properly recorded approval of DNREC-SIRB, or its successor, which shall be the only approval or consent required. 3. Violation of Covenants. If Declarant violates any of the restrictive covenants imposed by this Declaration, DNREC-SIRB, or its duly appointed successor, shall have the right to proceed at law or in equity to enforce compliance with or prevent the violation or breach of the terms hereof. 4. Scope and Interpretations. This Declaration shall be governed by Delaware law, shall have no application to or effect upon any property other than the Land as described in Exhibit "A", and shall not be interpreted to benefit any party other than DNREC-SIRB, or its duly appointed successor. No rights hereunder may be assigned by DNREC-SIRB except by operation of law to its duly appointed successor.

Facility ID: DE-1281
Report Title: GMZ Sites
Site Type: State Funded Brownfield
Deed Restriction Date: 02/08/2006
Restrictions: 1. A GMZ shall be established to include the sites and surrounding areas as defined both in the text and on the attached maps, Attachments 1, 2 and 3. 2. No new public or domestic water supply wells will be allowed or permitted in the unconfined Columbia aquifer and any hydraulically interconnected or confined Potomac aquifer units within the GMZ Area A. 3. No new public or domestic water supply wells or non-potable wells will be allowed in the unconfined Columbia aquifer and any hydraulically interconnected Potomac aquifer units within the GMZ Area B without demonstrating that well construction will likely prevent the movement of potential contaminants into the well. The potentially contaminated groundwater will be sufficiently treated to applicable use standards; and following joint review and approval by both DWR and DAWM. 4. Monitoring, observation, and contaminant recovery wells may be installed in the GMZ Areas A and B following joint review and

PETRILLO PROPERTY (Continued) **S106800053**

approval by DWR and DAWM. 5. Permits for any wells in the GMZ Areas A and B may be issued by DWR following joint review and approval by both DWR and DAWM.

Facility ID: DE-1281
Report Title: GMZ Sites
Site Type: HSCA
Deed Restriction Date: 02/08/2006
Restrictions: 1. A GMZ shall be established to include the sites and surrounding areas as defined both in the text and on the attached maps, Attachments 1, 2 and 3. 2. No new public or domestic water supply wells will be allowed or permitted in the unconfined Columbia aquifer and any hydraulically interconnected or confined Potomac aquifer units within the GMZ Area A. 3. No new public or domestic water supply wells or non-potable wells will be allowed in the unconfined Columbia aquifer and any hydraulically interconnected Potomac aquifer units within the GMZ Area B without demonstrating that well construction will likely prevent the movement of potential contaminants into the well. The potentially contaminated groundwater will be sufficiently treated to applicable use standards; and following joint review and approval by both DWR and DAWM. 4. Monitoring, observation, and contaminant recovery wells may be installed in the GMZ Areas A and B following joint review and approval by DWR and DAWM. 5. Permits for any wells in the GMZ Areas A and B may be issued by DWR following joint review and approval by both DWR and DAWM.

DE BROWNFIELD:
Facility ID: DE-1281
Certification Date: 04.13.04
Acreage: 30.0+/-

24
SSW
1/2-1
0.819 mi.
4324 ft.

MOTIVA NRDA HABITAT **DE SHWS** **S111766372**
N/A

NEW CASTLE (County), DE 19720

Relative:
Higher

Actual:
4 ft.

SHWS:

Facility ID:	10062968
Site Type:	Chemical Plant
Care Of:	Not reported
PI ID:	128274
Prog ID:	DE-1373
Additional Info:	HSCA
Reference Pt:	Facility/Interest Center
Horizontal Method:	Photo Interpolation-2002 Orthophoto
Loc Type:	P
XCoordinate NAD83 Meters:	182641
YCoordinate NAD83 Meters:	179791.34
Latitude Dec:	39.619401
Longitude Dec:	-75.618826
Latitude Degrees:	39
Latitude Minutes:	37
Latitude Seconds:	9.8436
Longitude Degrees:	-75
Longitude Minutes:	37

MOTIVA NRDA HABITAT (Continued) **S111766372**

Longitude Seconds:	7.7736
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	DELAWARE CITY
Senate District:	12
Senator:	Senator Nicole Poore
House District:	15
Representative:	Representative Valerie Longhurst
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

25
NNE
1/2-1
0.891 mi.
4706 ft.

FORMER AMOCO FILM PLANT **DE SHWS** **S109484973**
955 RIVER ROAD **DE INST CONTROL** **N/A**
NEW CASTLE, DE 19720

Relative:
Higher

Actual:
20 ft.

SHWS:

Facility ID:	10054470
Site Type:	Not reported
Care Of:	Not reported
PI ID:	26975
Prog ID:	DE-1152
Additional Info:	HSCA
Reference Pt:	Facility/Interest Center
Horizontal Method:	Map Interpolation-Other
Loc Type:	P
XCoordinate NAD83 Meters:	184855.91
YCoordinate NAD83 Meters:	183061.74
Latitude Dec:	39.64893
Longitude Dec:	-75.593149
Latitude Degrees:	39
Latitude Minutes:	38
Latitude Seconds:	56.148
Longitude Degrees:	-75
Longitude Minutes:	35
Longitude Seconds:	35.3364
PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Unknown
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	17

FORMER AMOCO FILM PLANT (Continued) **S109484973**

Representative:	Representative Michael P Mulrooney
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

Inst Control:

Facility ID:	DE-1152
Report Title:	GMZ Sites
Site Type:	HSCA
Deed Restriction Date:	02/08/2006
Restrictions:	1. A GMZ shall be established to include the sites and surrounding areas as defined both in the text and on the attached maps, Attachments 1, 2 and 3. 2. No new public or domestic water supply wells will be allowed or permitted in the unconfined Columbia aquifer and any hydraulically interconnected or confined Potomac aquifer units within the GMZ Area A. 3. No new public or domestic water supply wells or non-potable wells will be allowed in the unconfined Columbia aquifer and any hydraulically interconnected Potomac aquifer units within the GMZ Area B without demonstrating that well construction will likely prevent the movement of potential contaminants into the well. The potentially contaminated groundwater will be sufficiently treated to applicable use standards; and following joint review and approval by both DWR and DAWM. 4. Monitoring, observation, and contaminant recovery wells may be installed in the GMZ Areas A and B following joint review and approval by DWR and DAWM. 5. Permits for any wells in the GMZ Areas A and B may be issued by DWR following joint review and approval by both DWR and DAWM.

26
North
1/2-1
0.966 mi.
5100 ft.

ARMY CREEK LANDFILL
0 OFF SOUTH DUPONT HIGHWAY
NEW CASTLE, DE 19720

DE SHWS **S111766329**
DE INST CONTROL **N/A**

Relative:
Higher

Actual:
17 ft.

SHWS:

Facility ID:	10056493
Site Type:	Dump-Unathorized
Care Of:	Not reported
PI ID:	27288
Prog ID:	DE-0001
Additional Info:	NPL
Reference Pt:	Unknown
Horizontal Method:	Unknown
Loc Type:	P
XCoordinate NAD83 Meters:	183338.58
YCoordinate NAD83 Meters:	183508.76
Latitude Dec:	39.653056
Longitude Dec:	-75.611384
Latitude Degrees:	39
Latitude Minutes:	39
Latitude Seconds:	11.0016
Longitude Degrees:	-75
Longitude Minutes:	36
Longitude Seconds:	40.9824

ARMY CREEK LANDFILL (Continued) **S111766329**

PO Name:	New Castle
Tax ID:	Not reported
Sewer District:	Not reported
Floodplain Zone Code:	Not reported
Flood Plain Zone:	Not reported
Basin:	Delaware Bay
Watershed:	Army Creek
DRBC_Basin:	Y
Quad:	WILMINGTON SOUTH
Senate District:	12
Senator:	Senator Nicole Poore
House District:	17
Representative:	Representative Michael P Mulrooney
School District:	Lake Forest
GMZ Name:	Not reported
AG Pres District:	Not reported
Water District:	Not reported
Mod Grid:	Not reported

Inst Control:

Facility ID:	DE-0001
Report Title:	Deed Restriction Sites
Site Type:	NPL
Deed Restriction Date:	09/07/1962
Restrictions:	The entire aforesaid parcel of land herein conveyed, after the Levy Court has completed its as a sanitary landfill, shall be used solely for public park purposes.

Facility ID:	DE-0001
Report Title:	GMZ Sites
Site Type:	NPL
Deed Restriction Date:	02/08/2006
Restrictions:	1. A GMZ shall be established to include the sites and surrounding areas as defined both in the text and on the attached maps, Attachments 1, 2 and 3. 2. No new public or domestic water supply wells will be allowed or permitted in the unconfined Columbia aquifer and any hydraulically interconnected or confined Potomac aquifer units within the GMZ Area A. 3. No new public or domestic water supply wells or non-potable wells will be allowed in the unconfined Columbia aquifer and any hydraulically interconnected Potomac aquifer units within the GMZ Area B without demonstrating that well construction will likely prevent the movement of potential contaminants into the well. The potentially contaminated groundwater will be sufficiently treated to applicable use standards; and following joint review and approval by both DWR and DAWM. 4. Monitoring, observation, and contaminant recovery wells may be installed in the GMZ Areas A and B following joint review and approval by DWR and DAWM. 5. Permits for any wells in the GMZ Areas A and B may be issued by DWR following joint review and approval by both DWR and DAWM.

Count: 2 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
NEW CASTLE	1016375607	RIVERBEND SUBDIVISION - RIVER ROAD	RIVER ROAD	19720	FINDS
NEW CASTLE	1000175390	AMOCO CHEMICAL CORP - POLYMER PLAN	RIVER RD RTE 19	19720	SEMS-ARCHIVE, RCRA NonGen / NL

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: EPA
Telephone: N/A
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: EPA
Telephone: N/A
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: EPA
Telephone: N/A
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 04/03/2019
Date Data Arrived at EDR: 04/05/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 07/03/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA's Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that. based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 02/22/2019
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 41

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 05/10/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 01/31/2019
Date Data Arrived at EDR: 02/04/2019
Date Made Active in Reports: 03/08/2019
Number of Days to Update: 32

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 05/29/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 01/31/2019
Date Data Arrived at EDR: 02/04/2019
Date Made Active in Reports: 03/08/2019
Number of Days to Update: 32

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 05/29/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/26/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 36

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

State- and tribal - equivalent CERCLIS

SHWS: Hazardous Substance Release Sites

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 05/17/2019
Date Data Arrived at EDR: 05/17/2019
Date Made Active in Reports: 05/28/2019
Number of Days to Update: 11

Source: Department of Natural Resources and Environmental Control
Telephone: 302-395-2600
Last EDR Contact: 05/17/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Annually

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Solid Waste Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 06/28/2019
Date Data Arrived at EDR: 06/28/2019
Date Made Active in Reports: 07/08/2019
Number of Days to Update: 10

Source: Department of Natural Resources and Environmental Control
Telephone: 302-739-3820
Last EDR Contact: 06/28/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

State and tribal leaking storage tank lists

LAST: Leaking Aboveground Storage Tank Sites

Leaking aboveground storage tank site locations.

Date of Government Version: 04/15/2019
Date Data Arrived at EDR: 04/16/2019
Date Made Active in Reports: 04/18/2019
Number of Days to Update: 2

Source: Department of Natural Resources & Control
Telephone: 302-395-2500
Last EDR Contact: 07/17/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Quarterly

LUST: Leaking Underground Storage Tank Project Listing

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 04/15/2019
Date Data Arrived at EDR: 04/16/2019
Date Made Active in Reports: 05/28/2019
Number of Days to Update: 42

Source: Department of Natural Resources and Environmental Control
Telephone: 302-395-2500
Last EDR Contact: 07/17/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Quarterly

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 10/12/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 09/24/2018
Date Data Arrived at EDR: 03/12/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 50

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 07/23/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 10/17/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 10/10/2018
Date Data Arrived at EDR: 03/08/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 10/16/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 02/19/2019
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 11/01/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 10/13/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

State and tribal registered storage tank lists

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 05/15/2017
Date Data Arrived at EDR: 05/30/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 136

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 07/10/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Varies

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 04/15/2019
Date Data Arrived at EDR: 04/16/2019
Date Made Active in Reports: 05/24/2019
Number of Days to Update: 38

Source: Department of Natural Resources and Environmental Control
Telephone: 302-395-2500
Last EDR Contact: 07/17/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Quarterly

AST: Aboveground Storage Tank Sites
Facilities with aboveground storage tanks.

Date of Government Version: 06/28/2019
Date Data Arrived at EDR: 06/28/2019
Date Made Active in Reports: 07/08/2019
Number of Days to Update: 10

Source: Department of Natural Resources and Environmental Control
Telephone: 302-739-4764
Last EDR Contact: 06/28/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 10/16/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 10/10/2018
Date Data Arrived at EDR: 03/08/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 54

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 11/07/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 11/01/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 10/12/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 10/17/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 10/03/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 09/24/2018
Date Data Arrived at EDR: 03/12/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 50

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 07/23/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

State and tribal institutional control / engineering control registries

Inst Control: All Sites with Deed Restrictions

Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 02/11/2019
Date Data Arrived at EDR: 02/12/2019
Date Made Active in Reports: 04/10/2019
Number of Days to Update: 57

Source: Department of Natural Resources & Environmental Control
Telephone: 302-395-2600
Last EDR Contact: 05/17/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

VCP: Voluntary Cleanup Program Sites

When a property is contaminated with hazardous substances there are liabilities associated with the cleanup of the site under Federal and State Superfund laws, regardless of who caused the contamination and when it was caused. Because of this liability, old industrial sites (with contamination) located close to well developed infrastructure do not attract developers or buyers. These individuals prefer to purchase pristine property without contamination known as "greenfield." Under the Voluntary Cleanup Program (VCP) developers and buyers performing the cleanup of contaminated properties would be provided the much needed protection from potential liabilities for past contamination. Thus, they can proceed with the purchase or development of the property with the assurance that they will not be held liable for environmental problems that were a result of past practices at the site.

Date of Government Version: 05/17/2019
Date Data Arrived at EDR: 05/17/2019
Date Made Active in Reports: 05/28/2019
Number of Days to Update: 11

Source: Department of Natural Resources & Environmental Control
Telephone: 302-395-2600
Last EDR Contact: 05/17/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Annually

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 142

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 06/20/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Certified Brownfields

Sites that have requested brownfields certification from the Secretary of DNREC.

Date of Government Version: 04/09/2019
Date Data Arrived at EDR: 05/09/2019
Date Made Active in Reports: 05/24/2019
Number of Days to Update: 15

Source: Dept. of Natural Resources & Environmental Control
Telephone: 302-739-4764
Last EDR Contact: 05/06/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Semi-Annually

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 12/17/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 12/18/2018	Telephone: 202-566-2777
Date Made Active in Reports: 01/11/2019	Last EDR Contact: 06/04/2019
Number of Days to Update: 24	Next Scheduled EDR Contact: 09/30/2019
	Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

SWRCY: Recyclers Directory

A listing of recycling facilities.

Date of Government Version: 03/21/2019	Source: Delaware Econonmic Development Office
Date Data Arrived at EDR: 03/22/2019	Telephone: 302-739-4271
Date Made Active in Reports: 04/10/2019	Last EDR Contact: 06/26/2019
Number of Days to Update: 19	Next Scheduled EDR Contact: 10/14/2019
	Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998	Source: Environmental Protection Agency
Date Data Arrived at EDR: 12/03/2007	Telephone: 703-308-8245
Date Made Active in Reports: 01/24/2008	Last EDR Contact: 04/26/2019
Number of Days to Update: 52	Next Scheduled EDR Contact: 08/12/2019
	Data Release Frequency: Varies

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009	Source: EPA, Region 9
Date Data Arrived at EDR: 05/07/2009	Telephone: 415-947-4219
Date Made Active in Reports: 09/21/2009	Last EDR Contact: 07/19/2019
Number of Days to Update: 137	Next Scheduled EDR Contact: 11/04/2019
	Data Release Frequency: No Update Planned

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/09/2004	Telephone: 800-424-9346
Date Made Active in Reports: 09/17/2004	Last EDR Contact: 06/09/2004
Number of Days to Update: 39	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land
A listing of all open dumps located on Indian Land in the United States.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 08/06/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 176

Source: Department of Health & Human Serivces, Indian Health Service
Telephone: 301-443-1452
Last EDR Contact: 04/23/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 02/24/2019
Date Data Arrived at EDR: 02/26/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 50

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: No Update Planned

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 02/24/2019
Date Data Arrived at EDR: 02/26/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 50

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Quarterly

Local Land Records

LIENS 2: CERCLA Lien Information
A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/26/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 49

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

SPILLS: Environmental Release Notification System

The Department of Natural Resources and Environmental Control (DNREC) developed this system to allow Delawareans to learn promptly of releases or discharges of contaminants or pollutants that meet or exceed certain thresholds in their neighborhoods or throughout the state.

Date of Government Version: 04/06/2019
Date Data Arrived at EDR: 04/09/2019
Date Made Active in Reports: 05/28/2019
Number of Days to Update: 49

Source: Department of Natural Resources & Environmental Control
Telephone: 302-739-9902
Last EDR Contact: 07/19/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Semi-Annually

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 03/07/2019
Date Data Arrived at EDR: 04/03/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 50

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 05/21/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 07/09/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 07/10/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 01/01/2017
Date Data Arrived at EDR: 02/03/2017
Date Made Active in Reports: 04/07/2017
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 05/13/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/26/2019
Date Made Active in Reports: 05/07/2019
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 05/06/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 09/30/2017
Date Data Arrived at EDR: 05/08/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 73

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 05/10/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 06/21/2017
Date Made Active in Reports: 01/05/2018
Number of Days to Update: 198

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 06/18/2019
Next Scheduled EDR Contact: 09/30/2019
Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 01/10/2018
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 2

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 04/24/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 04/25/2019
Date Data Arrived at EDR: 05/02/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 07/22/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties
A listing of verified Potentially Responsible Parties

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Quarterly

PADS: PCB Activity Database System
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 03/20/2019
Date Data Arrived at EDR: 04/10/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 34

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 07/12/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System
The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 11/18/2016
Date Data Arrived at EDR: 11/23/2016
Date Made Active in Reports: 02/10/2017
Number of Days to Update: 79

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 07/03/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Quarterly

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: No Update Planned

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: No Update Planned

MLTS: Material Licensing Tracking System
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 08/30/2016
Date Data Arrived at EDR: 09/08/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 43

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 07/22/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 06/07/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 06/07/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 05/24/2017
Date Data Arrived at EDR: 11/30/2017
Date Made Active in Reports: 12/15/2017
Number of Days to Update: 15

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

RADINFO: Radiation Information Database
The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 04/02/2019
Date Data Arrived at EDR: 04/02/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing
A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing
A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 12/03/2018
Date Data Arrived at EDR: 01/29/2019
Date Made Active in Reports: 03/21/2019
Number of Days to Update: 51

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 04/30/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Quarterly

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 03/31/2019
Date Data Arrived at EDR: 04/23/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 30

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 07/08/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2015
Date Data Arrived at EDR: 02/22/2017
Date Made Active in Reports: 09/28/2017
Number of Days to Update: 218

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 07/14/2015
Date Made Active in Reports: 01/10/2017
Number of Days to Update: 546

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 07/10/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 08/08/2017
Date Data Arrived at EDR: 09/11/2018
Date Made Active in Reports: 09/14/2018
Number of Days to Update: 3

Source: Department of Energy
Telephone: 202-586-3559
Last EDR Contact: 05/02/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 06/23/2017
Date Data Arrived at EDR: 10/11/2017
Date Made Active in Reports: 11/03/2017
Number of Days to Update: 23

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 11/27/2018
Date Data Arrived at EDR: 02/27/2019
Date Made Active in Reports: 04/01/2019
Number of Days to Update: 33

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 05/29/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing

This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 02/29/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 49

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 05/31/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing

Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 05/31/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

ABANDONED MINES: Abandoned Mines

An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 03/27/2019
Date Data Arrived at EDR: 03/28/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 34

Source: Department of Interior
Telephone: 202-208-2609
Last EDR Contact: 06/19/2019
Next Scheduled EDR Contact: 09/23/2019
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 02/15/2019
Date Data Arrived at EDR: 03/05/2019
Date Made Active in Reports: 03/15/2019
Number of Days to Update: 10

Source: EPA
Telephone: (215) 814-5000
Last EDR Contact: 06/05/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Quarterly

ECHO: Enforcement & Compliance History Information

ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 04/07/2019
Date Data Arrived at EDR: 04/09/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 44

Source: Environmental Protection Agency
Telephone: 202-564-2280
Last EDR Contact: 07/09/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Quarterly

UXO: Unexploded Ordnance Sites

A listing of unexploded ordnance site locations

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 01/17/2019
Date Made Active in Reports: 04/01/2019
Number of Days to Update: 74

Source: Department of Defense
Telephone: 703-704-1564
Last EDR Contact: 07/15/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Varies

DOCKET HWC: Hazardous Waste Compliance Docket Listing
A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 05/31/2018
Date Data Arrived at EDR: 07/26/2018
Date Made Active in Reports: 10/05/2018
Number of Days to Update: 71

Source: Environmental Protection Agency
Telephone: 202-564-0527
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

FUELS PROGRAM: EPA Fuels Program Registered Listing
This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 02/19/2019
Date Data Arrived at EDR: 02/21/2019
Date Made Active in Reports: 04/01/2019
Number of Days to Update: 39

Source: EPA
Telephone: 800-385-6164
Last EDR Contact: 05/21/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Quarterly

AIRS: Air Emissions Listing
A listing of facilities with air emissions.

Date of Government Version: 06/28/2019
Date Data Arrived at EDR: 06/28/2019
Date Made Active in Reports: 07/05/2019
Number of Days to Update: 7

Source: Department of Natural Resources & Environmental Control
Telephone: 302-323-4542
Last EDR Contact: 06/28/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

DRYCLEANERS: DRYCLEANERS
A listing of drycleaner facility locations.

Date of Government Version: 01/18/2019
Date Data Arrived at EDR: 01/24/2019
Date Made Active in Reports: 02/14/2019
Number of Days to Update: 21

Source: Department of Natural Resources & Environmental Control
Telephone: 302-739-9400
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

ENFORCEMENT: Notice of Violations
Notice of violations are based on the observations of, and information submitted to, DNREC personnel. They only represent preliminary findings of the Department and are subject to further technical and legal review. These notices may or may not result in an enforcement action. Divisions included are Water Resources Air & Waste Management

Date of Government Version: 01/22/2019
Date Data Arrived at EDR: 01/24/2019
Date Made Active in Reports: 02/14/2019
Number of Days to Update: 21

Source: Department of Natural Recourses & Conservation
Telephone: 302-738-9401
Last EDR Contact: 04/25/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Semi-Annually

Financial Assurance 1: Financial Assurance Information Listing
Financial assurance information for hazardous waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay

Date of Government Version: 01/10/2018
Date Data Arrived at EDR: 01/11/2018
Date Made Active in Reports: 01/16/2018
Number of Days to Update: 5

Source: Department of Natural Resources & Environmental Control
Telephone: 302-739-9403
Last EDR Contact: 07/08/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Varies

Financial Assurance 2: Financial Assurance Information Listing
Financial assurance information for solid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay

Date of Government Version: 01/10/2018
Date Data Arrived at EDR: 01/11/2018
Date Made Active in Reports: 02/21/2018
Number of Days to Update: 41

Source: Department of Natural Resources & Environmental Control
Telephone: 302-739-9403
Last EDR Contact: 07/08/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Varies

Financial Assurance 3: Financial Assurance Information Listing
Underground storage tank financial assurance information.

Date of Government Version: 04/15/2019
Date Data Arrived at EDR: 04/16/2019
Date Made Active in Reports: 05/24/2019
Number of Days to Update: 38

Source: Department of Natural Resources & Environmental Control
Telephone: 302-395-2500
Last EDR Contact: 07/17/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Quarterly

NPDES: Wasterwater Permit Listing
A listing of wastewater permits.

Date of Government Version: 06/28/2019
Date Data Arrived at EDR: 06/28/2019
Date Made Active in Reports: 07/08/2019
Number of Days to Update: 10

Source: Department of Natural Resources & Environmental Control
Telephone: 302-739-9946
Last EDR Contact: 06/28/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

TIER 2: Tier 2 Facility Listing
A listing of facilities which store or manufacture hazardous materials that submit a chemical inventory report.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 11/27/2017
Date Made Active in Reports: 01/19/2018
Number of Days to Update: 53

Source: Department of Natural Resources & Environmental Control
Telephone: 302-739-9405
Last EDR Contact: 04/25/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Annually

UIC: Underground Injection Wells Inventory Listing
A listing of underground injection well locations.

Date of Government Version: 04/23/2019
Date Data Arrived at EDR: 05/02/2019
Date Made Active in Reports: 05/28/2019
Number of Days to Update: 26

Source: DNREC
Telephone: 302-739-9948
Last EDR Contact: 07/19/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Semi-Annually

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historical Auto Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historical Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Deparment of Natural Resources and Environmental Control in Delaware.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/15/2014
Number of Days to Update: 198

Source: Department of Natural Resources and Environmental Control
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Deparment of Natural Resources and Environmental Control in Delaware.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/17/2014
Number of Days to Update: 200

Source: Department of Natural Resources and Environmental Control
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 02/11/2019
Date Data Arrived at EDR: 02/12/2019
Date Made Active in Reports: 03/04/2019
Number of Days to Update: 20

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 05/14/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: No Update Planned

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2018
Date Data Arrived at EDR: 04/10/2019
Date Made Active in Reports: 05/16/2019
Number of Days to Update: 36

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 07/09/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 01/01/2019
Date Data Arrived at EDR: 05/01/2019
Date Made Active in Reports: 06/21/2019
Number of Days to Update: 51

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 05/01/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Quarterly

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 10/23/2018
Date Made Active in Reports: 11/27/2018
Number of Days to Update: 35

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 07/15/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 02/23/2018
Date Made Active in Reports: 04/09/2018
Number of Days to Update: 45

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 05/17/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 06/15/2018
Date Made Active in Reports: 07/09/2018
Number of Days to Update: 24

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 06/10/2019
Next Scheduled EDR Contact: 09/23/2019
Data Release Frequency: Annually

Oil/Gas Pipelines
Source: PennWell Corporation
Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Electric Power Transmission Line Data
Source: PennWell Corporation
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Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Care Facility List
Source: Department of Services for Children
Telephone: 302-633-2500

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Statewide Wetlands Mapping Project
Source: Dept. of Natural Resources & Environmental Conservation
Telephone: 302-739-4691

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

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GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

RIVER ROAD TRAINING SITE
1197 RIVER ROAD
NEW CASTLE, DE 19720

TARGET PROPERTY COORDINATES

Latitude (North):	39.634113 - 39˚ 38’ 2.81’’
Longitude (West):	75.60664 - 75˚ 36’ 23.90’’
Universal Tranverse Mercator:	Zone 18
UTM X (Meters):	447940.5
UTM Y (Meters):	4387115.0
Elevation:	4 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	6049807 WILMINGTON SOUTH, DE
Version Date:	2014
Southeast Map:	6049773 DELAWARE CITY, DE
Version Date:	2014
Southwest Map:	6049815 SAINT GEORGES, DE
Version Date:	2014
Northwest Map:	6049791 NEWARK EAST, DE
Version Date:	2014

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

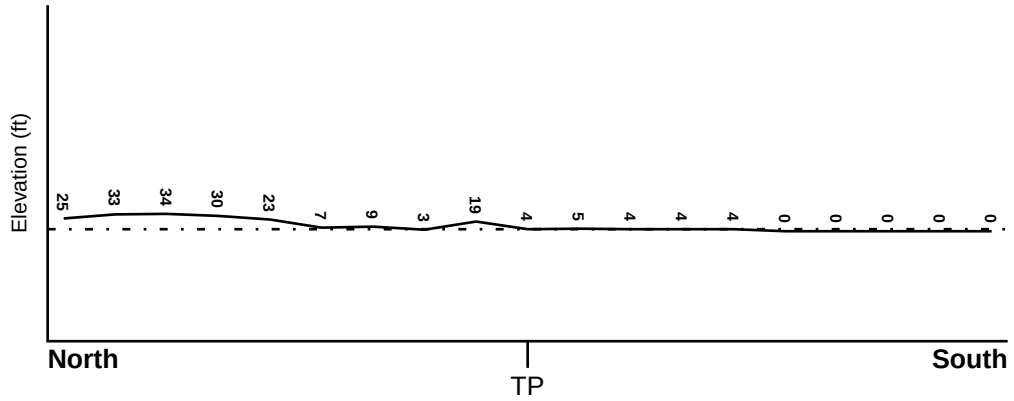
TOPOGRAPHIC INFORMATION

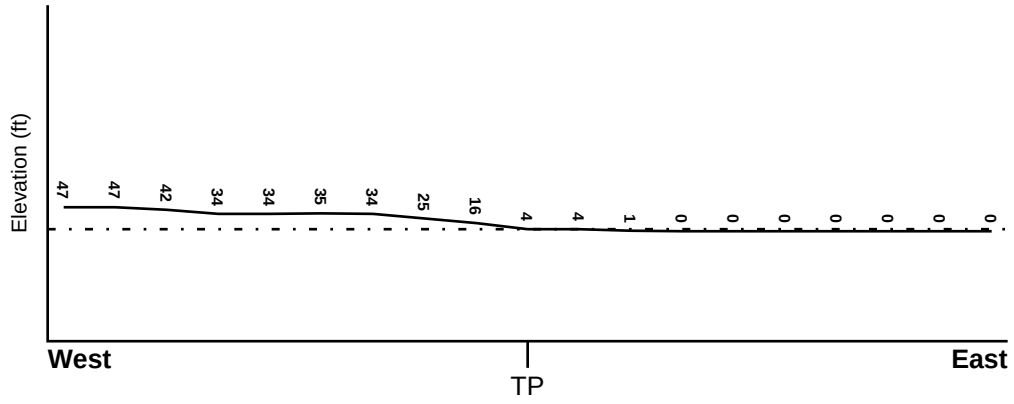
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

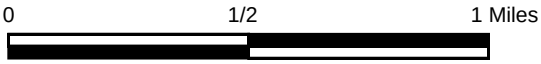
General Topographic Gradient: General East

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 4 ft.



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
10003C0163K	FEMA FIRM Flood data

Additional Panels in search area:	FEMA Source Type
10003C0145J	FEMA FIRM Flood data
10003C0164K	FEMA FIRM Flood data
10003C0251K	FEMA FIRM Flood data
10003C0252K	FEMA FIRM Flood data

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
WILMINGTON SOUTH	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius:	1.25 miles
Location Relative to TP:	1 - 2 Miles North
Site Name:	Delaware Sand & Gravel Landfill
Site EPA ID Number:	DED000605972
Surficial Aquifer Flow Dir.:	VERTICALLY DOWNWARD INTO THE LOWER AQUIFER. THE WATER TABLE AQUIFER IS OFTEN DRY.
Measured Depth to Water:	approximately 20 feet in the water table aquifer.
Hydraulic Connection:	Historically, ground water flowed from the lower aquifer, into the water table aquifer, and discharged into Army Creek. Due to heavy withdrawals, ground water flows from Army Creek into the water table and lower aquifers.
Sole Source Aquifer:	No information about a sole source aquifer is available
Data Quality:	Information based on site-specific subsurface investigations is documented in the CERCLIS investigation report(s)

* ©1996 Site--specific hydrogeological data gathered by CERCLIS Alerts, Inc., Bainbridge Island, WA. All rights reserved. All of the information and opinions presented are those of the cited EPA report(s), which were completed under a Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) investigation.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

Era:	Mesozoic
System:	Cretaceous
Series:	Lower Cretaceous
Code:	lK *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratified Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps. The following information is based on Soil Conservation Service STATSGO data.

Soil Component Name:	MATAPEAKE
Soil Surface Texture:	silt loam
Hydrologic Group:	Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.
Soil Drainage Class:	Well drained. Soils have intermediate water holding capacity. Depth to water table is more than 6 feet.

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel:	MODERATE
Depth to Bedrock Min:	> 60 inches
Depth to Bedrock Max:	> 60 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	Permeability Rate (in/hr)	Soil Reaction (pH)
1	0 inches	11 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 2.00 Min: 0.60	Max: 5.50 Min: 4.50
2	11 inches	34 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 2.00 Min: 0.20	Max: 5.50 Min: 3.60
3	34 inches	62 inches	sandy loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 6.00 Min: 0.60	Max: 5.50 Min: 3.60

OTHER SOIL TYPES IN AREA

Based on Soil Conservation Service STATSGO data, the following additional subordinant soil types may appear within the general area of target property.

Soil Surface Textures: sandy loam
loam
fine sandy loam

Surficial Soil Types: sandy loam
loam
fine sandy loam

Shallow Soil Types: silt loam

Deeper Soil Types: sand
stratified
silt loam

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A3	USGS40000231706	1/8 - 1/4 Mile SW
B8	USGS40000231708	1/4 - 1/2 Mile WSW
B9	USGS40000231707	1/4 - 1/2 Mile WSW
G23	USGS40000231709	1/4 - 1/2 Mile North
G24	USGS40000231710	1/4 - 1/2 Mile North
67	USGS40000231704	1/2 - 1 Mile WSW
O74	USGS40000231699	1/2 - 1 Mile SW
O75	USGS40000231700	1/2 - 1 Mile SW
O76	USGS40000231701	1/2 - 1 Mile SW

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	DE2000000097439	0 - 1/8 Mile WSW
2	DE2000000097277	1/8 - 1/4 Mile NNW
A4	DE2000000121285	1/4 - 1/2 Mile SW
5	DE2000000136414	1/4 - 1/2 Mile WNW
6	DE2000000124963	1/4 - 1/2 Mile WSW
7	DE2000000124665	1/4 - 1/2 Mile North
B10	DE2000000124773	1/4 - 1/2 Mile WSW
C11	DE2000000110390	1/4 - 1/2 Mile NNW
C12	DE2000000110391	1/4 - 1/2 Mile NNW
D13	DE2000000124974	1/4 - 1/2 Mile SW
D14	DE2000000124964	1/4 - 1/2 Mile SW
D15	DE2000000125289	1/4 - 1/2 Mile SW
D16	DE2000000125291	1/4 - 1/2 Mile SW
D17	DE2000000125290	1/4 - 1/2 Mile SW
E18	DE2000000133162	1/4 - 1/2 Mile NE
E19	DE2000000133163	1/4 - 1/2 Mile NE
F20	DE2000000136046	1/4 - 1/2 Mile NNE

STATE DATABASE WELL INFORMATION

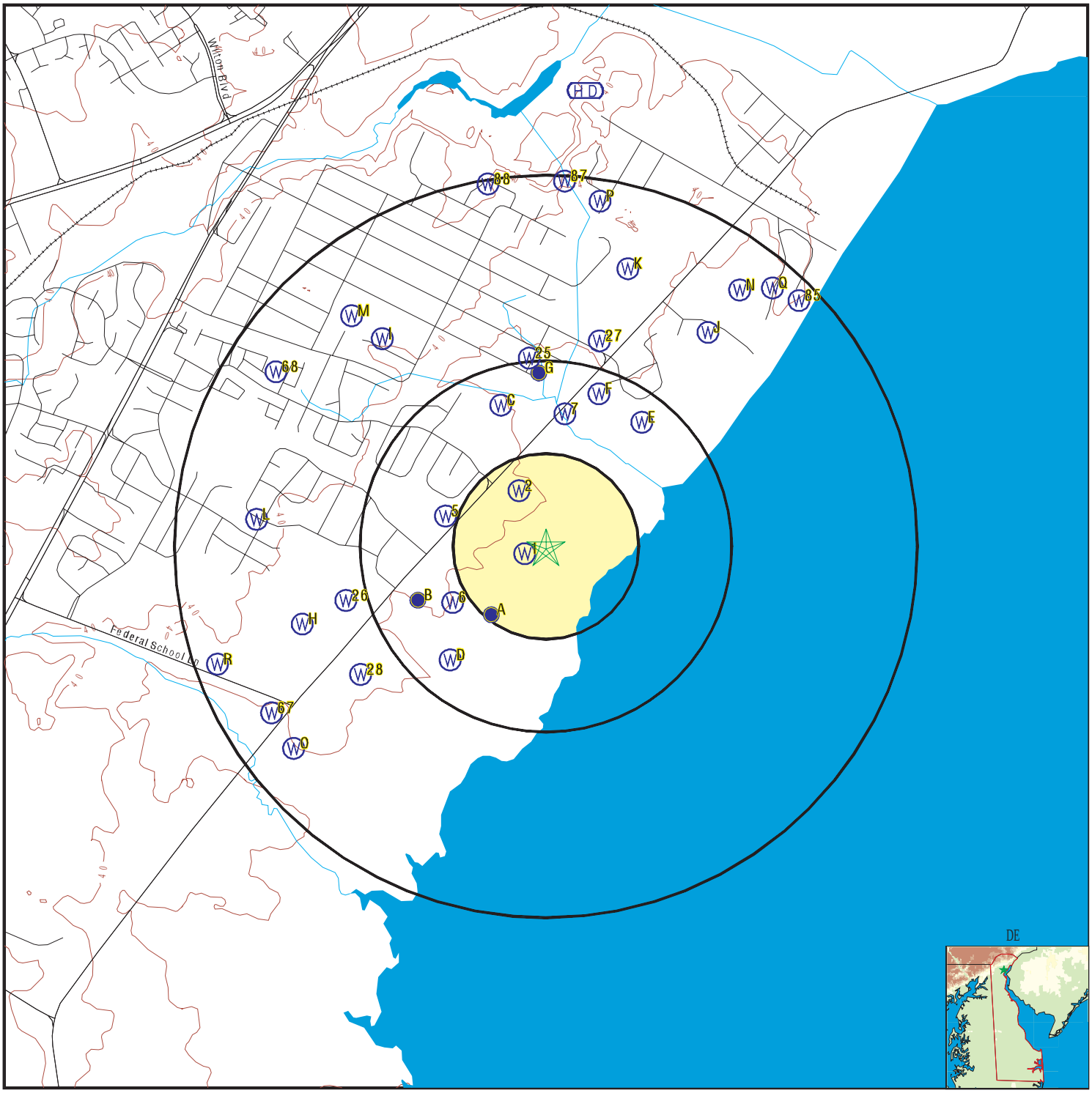
MAP ID	WELL ID	LOCATION FROM TP
F21	DE2000000132921	1/4 - 1/2 Mile NNE
G22	DE2000000017280	1/4 - 1/2 Mile North
25	DE2000000135984	1/2 - 1 Mile North
26	DE2000000007956	1/2 - 1 Mile WSW
27	DE2000000124755	1/2 - 1 Mile NNE
28	DE2000000086286	1/2 - 1 Mile SW
H29	DE2000000116290	1/2 - 1 Mile WSW
H30	DE2000000123105	1/2 - 1 Mile WSW
H31	DE2000000123104	1/2 - 1 Mile WSW
H32	DE2000000123103	1/2 - 1 Mile WSW
H33	DE2000000123108	1/2 - 1 Mile WSW
H34	DE2000000123107	1/2 - 1 Mile WSW
H35	DE2000000123106	1/2 - 1 Mile WSW
I36	DE2000000136984	1/2 - 1 Mile NW
I37	DE2000000135080	1/2 - 1 Mile NW
J38	DE2000000134496	1/2 - 1 Mile NE
J39	DE2000000134495	1/2 - 1 Mile NE
J40	DE2000000134498	1/2 - 1 Mile NE
J41	DE2000000134497	1/2 - 1 Mile NE
K42	DE2000000122414	1/2 - 1 Mile NNE
L43	DE2000000131879	1/2 - 1 Mile West
L44	DE2000000131878	1/2 - 1 Mile West
L45	DE2000000131881	1/2 - 1 Mile West
L46	DE2000000131880	1/2 - 1 Mile West
L47	DE2000000124973	1/2 - 1 Mile West
L48	DE2000000124972	1/2 - 1 Mile West
L49	DE2000000131346	1/2 - 1 Mile West
L50	DE2000000126797	1/2 - 1 Mile West
L51	DE2000000131909	1/2 - 1 Mile West
L52	DE2000000131908	1/2 - 1 Mile West
L53	DE2000000131911	1/2 - 1 Mile West
L54	DE2000000131910	1/2 - 1 Mile West
L55	DE2000000131883	1/2 - 1 Mile West
L56	DE2000000131882	1/2 - 1 Mile West
L57	DE2000000131907	1/2 - 1 Mile West
L58	DE2000000131906	1/2 - 1 Mile West
K59	DE2000000148923	1/2 - 1 Mile NNE
M60	DE2000000130556	1/2 - 1 Mile NW
M61	DE2000000130555	1/2 - 1 Mile NW
M62	DE2000000124782	1/2 - 1 Mile NW
M63	DE2000000130557	1/2 - 1 Mile NW
M64	DE2000000132888	1/2 - 1 Mile NW
M65	DE2000000130559	1/2 - 1 Mile NW
M66	DE2000000130558	1/2 - 1 Mile NW
68	DE2000000120186	1/2 - 1 Mile WNW
N69	DE2000000125799	1/2 - 1 Mile NE
N70	DE2000000125798	1/2 - 1 Mile NE
N71	DE2000000125800	1/2 - 1 Mile NE
N72	DE2000000125802	1/2 - 1 Mile NE
N73	DE2000000125801	1/2 - 1 Mile NE
P77	DE2000000121407	1/2 - 1 Mile North
Q78	DE2000000112597	1/2 - 1 Mile NE

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
Q79	DE2000000112596	1/2 - 1 Mile NE
Q80	DE2000000112599	1/2 - 1 Mile NE
Q81	DE2000000112598	1/2 - 1 Mile NE
R82	DE2000000068036	1/2 - 1 Mile WSW
R83	DE2000000021942	1/2 - 1 Mile WSW
R84	DE2000000068981	1/2 - 1 Mile WSW
85	DE2000000147872	1/2 - 1 Mile NE
P86	DE2000000122413	1/2 - 1 Mile North
87	DE2000000135703	1/2 - 1 Mile North
88	DE2000000022560	1/2 - 1 Mile North

PHYSICAL SETTING SOURCE MAP - 5765905.2s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

0 1/4 1/2 1 Miles

Groundwater Flow Direction
GI Indeterminate Groundwater Flow at Location
GV Groundwater Flow Varies at Location
HD Closest Hydrogeological Data

N

SITE NAME: River Road Training Site	CLIENT: AECOM
ADDRESS: 1197 River Road New Castle DE 19720	CONTACT: Hans Sund
LAT/LONG: 39.634113 / 75.60664	INQUIRY #: 5765905.2s
	DATE: August 26, 2019 12:54 pm

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Map ID Direction Distance Elevation	Database	EDR ID Number
1 **WSW** **0 - 1/8 Mile** **Higher**	**DE WELLS**	**DE2000000097439**

Permit #:	230087	Local Well ID:	Not Reported
Well Type:	Geothermal - Closed Loop	DGS ID:	Not Reported
Tax ID:	10-041.00-005	Septic Permit #:	central
Well Authorization Code:	4564455	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Mud Rotary	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	400	Actual Total Depth:	410
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	20-NOV-09
Constr Review Date:	10-DEC-09	Permit Approval Date:	10-DEC-09
Actual Construction Date:	Not Reported	Completion Report Date:	15-MAR-10
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	Yes	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	822386	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Allied Well Drilling	License #:	5275
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

---

2 **NNW** **1/8 - 1/4 Mile** **Higher**	**DE WELLS**	**DE2000000097277**

Permit #:	227982	Local Well ID:	Not Reported
Well Type:	Geothermal - Closed Loop	DGS ID:	Not Reported
Tax ID:	10-041.00-005	Septic Permit #:	n/a
Well Authorization Code:	6440362	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Mud Rotary	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported

Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	10	Water Level Date:	03-JUN-09
Total Proposed Depth:	400	Actual Total Depth:	410
Well Terminus Inches:	0	Well Terminus Type:	None
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	28-APR-09
Constr Review Date:	02-JUN-09	Permit Approval Date:	02-JUN-09
Actual Construction Date:	Not Reported	Completion Report Date:	01-JUL-09
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	Yes
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	Yes	Emergency:	No
Confined:	Yes	Reviewable:	Yes
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	809359	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Allied Well Drilling	License #:	5275
Grout Top:	0	Grout Base:	410
Grout Material:	Bentonite	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

A3
SW
1/8 - 1/4 Mile
Higher

FED USGS **USGS40000231706**

Organization ID:	USGS-MD	Organization Name:	USGS Maryland Water Science Center
Monitor Location:	Dc34-07	Type:	Well
Description:	Not Reported	HUC:	02040205
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Northern Atlantic Coastal Plain aquifer system		
Formation Type:	Potomac Formation	Aquifer Type:	Not Reported
Construction Date:	Not Reported	Well Depth:	168
Well Depth Units:	ft	Well Hole Depth:	Not Reported
Well Hole Depth Units:	Not Reported		

A4
SW
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000121285**

Permit #:	228224	Local Well ID:	Not Reported
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	10-041.00-005	Septic Permit #:	n/a
Well Authorization Code:	6370589	Well Status:	Well Abandoned
Est Max Capacity:	0	Est Daily Use:	0

Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Geo-Probe	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	30	Actual Total Depth:	16
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	12-MAY-09
Constr Review Date:	15-MAY-09	Permit Approval Date:	15-MAY-09
Actual Construction Date:	Not Reported	Completion Report Date:	09-JUN-09
Abandon Report Date:	09-JUN-09	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	Yes	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	Yes
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	810245	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

5
WNW
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000136414**

Permit #:	187080	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Permit Expired
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Unknown	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	50
Well Terminus Inches:	0	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	River Rd	Application Received:	20-JUN-02
Constr Review Date:	20-JUN-02	Permit Approval Date:	20-JUN-02
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported

Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	72613	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Middletown Well Drilling Company		
License #:	607	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

6
WSW **DE WELLS** **DE2000000124963**
1/4 - 1/2 Mile
Higher

Permit #:	34468	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	5	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	19-AUG-75
Proposed Drill Method:	Unknown	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	10
Rated Capacity:	0	Test Time:	4
Water Level:	161	Retain Well:	0
Static Water Level:	132	Water Level Date:	29-AUG-75
Total Proposed Depth:	0	Actual Total Depth:	600
Well Terminus Inches:	24	Well Terminus Type:	Other
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Rt 9	Application Received:	07-JUL-75
Constr Review Date:	07-JUL-75	Permit Approval Date:	07-JUL-75
Actual Construction Date:	Not Reported	Completion Report Date:	19-AUG-75
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	574
Screen Base:	579	Screen Material:	Other
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	82890	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205

Well Contractor:	Walter E Welldriler	License #:	4058
Grout Top:	0	Grout Base:	100
Grout Material:	Neat Cement	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	600
Inner Casing Material:	Steel	Comments:	Not Reported

7
North **DE WELLS** **DE2000000124665**
1/4 - 1/2 Mile
Higher

Permit #:	179609	Local Well ID:	Not Reported
Well Type:	Monitor - Zone of Interest		
DGS ID:	Not Reported	Tax ID:	Not Reported
Septic Permit #:	Not Reported	Well Authorization Code:	Not Reported
Well Status:	Active	Est Max Capacity:	0
Est Daily Use:	0	Require Alloc Permit:	NO
Est Construction Date:	02-AUG-01	Proposed Drill Method:	Mud Rotary
Formation:	Undetermined	Aquifer:	Undetermined
Pump:	Not Reported	Intake Setting:	Not Reported
Test Rate:	10	Rated Capacity:	0
Test Time:	1	Water Level:	78
Retain Well:	0	Static Water Level:	58
Water Level Date:	02-AUG-01	Total Proposed Depth:	0
Actual Total Depth:	210	Well Terminus Inches:	26
Well Terminus Type:	Other	Replacement Well:	Not Reported
Replaced Well Permit #:	Not Reported	How Abandoned:	Not Reported
Why Abandoned:	Not Reported	Local ID:	MW #4
Application Received:	27-JUN-01	Constr Review Date:	27-JUN-01
Permit Approval Date:	27-JUN-01	Actual Construction Date:	Not Reported
Completion Report Date:	02-AUG-01	Abandon Report Date:	Not Reported
Reclassify Date:	Not Reported	Potable:	No
Test Temp:	No	Groundwater Mgmt Zone:	No
Well Pit:	No	Replacement:	No
Alloc Review:	No	Sampled:	No
CPCN:	No	Ag Preservation District:	No
Floodplain:	No	Small Lot:	No
Injection:	No	Potential Contam in Vicinity:	No
Emergency:	No	Confined:	No
Reviewable:	No	Existing:	No
Screen Top:	144	Screen Base:	164
Screen Material:	PVC	Min Well Diameter:	2
Max Well Diameter:	2	Loc ID:	68663
Watershed:	Army Creek	Basin:	Delaware Bay
USGS Hydrologic Code:	2040205	Well Contractor:	Walton Corporation
License #:	52	Grout Top:	0
Grout Base:	140	Grout Material:	Bentonite
Gravel Top:	140	Gravel Base:	210
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	144	Inner Casing Material:	PVC
Comments:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
B8 **WSW** **1/4 - 1/2 Mile** **Higher**	**FED USGS**	**USGS40000231708**

Organization ID:	USGS-MD	Organization Name:	USGS Maryland Water Science Center
Monitor Location:	Dc34-06	Type:	Well
Description:	Not Reported	HUC:	02040205
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Northern Atlantic Coastal Plain aquifer system		
Formation Type:	Potomac Formation	Aquifer Type:	Confined single aquifer
Construction Date:	197509	Well Depth:	188
Well Depth Units:	ft	Well Hole Depth:	200
Well Hole Depth Units:	ft		

Ground water levels,Number of Measurements:	446	Level reading date:	2004-09-16
Feet below surface:	53.58	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	2004-08-18	Feet below surface:	56.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-07-13	Feet below surface:	60.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-06-14	Feet below surface:	58.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-05-17	Feet below surface:	58.83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-04-12	Feet below surface:	59.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-03-17	Feet below surface:	58.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-02-18	Feet below surface:	60.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-01-12	Feet below surface:	64.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-12-12	Feet below surface:	63.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-11-13	Feet below surface:	63.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-10-14	Feet below surface:	64.11
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-09-22	Feet below surface:	61.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-04-30	Feet below surface:	63.66
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	2002-10-30	Feet below surface:	65.02
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-04-30	Feet below surface:	61.64
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-10-23	Feet below surface:	64.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-04-12	Feet below surface:	56.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-10-03	Feet below surface:	64.61
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-04-19	Feet below surface:	56.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1999-10-14	Feet below surface:	61.91
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1999-04-30	Feet below surface:	60.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1998-10-20	Feet below surface:	60.51
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1998-04-23	Feet below surface:	54.62
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-10-24	Feet below surface:	59.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-04-30	Feet below surface:	55.77
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-10-01	Feet below surface:	61.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-05-03	Feet below surface:	58.42
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-10-12	Feet below surface:	60.77
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-04-07	Feet below surface:	53.79
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-10-19	Feet below surface:	53.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-04-08	Feet below surface:	51.74
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-11-10	Feet below surface:	55.74
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-04-07	Feet below surface:	55.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-10-23	Feet below surface:	52.94
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1992-04-20	Feet below surface:	51.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1991-10-21	Feet below surface:	49.87
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1991-04-05	Feet below surface:	42.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-10-15	Feet below surface:	50.61
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-04-16	Feet below surface:	52.03
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-10-10	Feet below surface:	52.04
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-04-25	Feet below surface:	54.51
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-10-18	Feet below surface:	56.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-02-22	Feet below surface:	56.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1987-08-24	Feet below surface:	56.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1987-03-11	Feet below surface:	54.59
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1985-08-22	Feet below surface:	55.87
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1985-02-04	Feet below surface:	51.43
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-10-10	Feet below surface:	53.19
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-04-16	Feet below surface:	56.49
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-11-21	Feet below surface:	57.58
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-04-20	Feet below surface:	62.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-10-15	Feet below surface:	62.37
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-04-20	Feet below surface:	60.27
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-11-10	Feet below surface:	59.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-11-05	Feet below surface:	59.65
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1981-10-31	Feet below surface:	59.87
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-25	Feet below surface:	59.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-20	Feet below surface:	59.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-15	Feet below surface:	59.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-10	Feet below surface:	58.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-05	Feet below surface:	59.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-30	Feet below surface:	59.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-25	Feet below surface:	60.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-20	Feet below surface:	60.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-15	Feet below surface:	60.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-10	Feet below surface:	59.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-05	Feet below surface:	60.02
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-31	Feet below surface:	59.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-25	Feet below surface:	60.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-20	Feet below surface:	59.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-15	Feet below surface:	59.37
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-10	Feet below surface:	59.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-05	Feet below surface:	59.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-07-31	Feet below surface:	59.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-07-25	Feet below surface:	59.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-07-20	Feet below surface:	59.55
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1981-07-15	Feet below surface:	58.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-07-10	Feet below surface:	59.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-06-15	Feet below surface:	59.12
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-05-20	Feet below surface:	58.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-05-10	Feet below surface:	57.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-05-05	Feet below surface:	57.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-30	Feet below surface:	57.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-25	Feet below surface:	57.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-20	Feet below surface:	56.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-15	Feet below surface:	57.09
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-10	Feet below surface:	57.17
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-05	Feet below surface:	55.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-31	Feet below surface:	56.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-25	Feet below surface:	56.96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-20	Feet below surface:	55.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-15	Feet below surface:	56.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-10	Feet below surface:	54.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-05	Feet below surface:	55.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-02-28	Feet below surface:	56.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-02-25	Feet below surface:	56.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-02-20	Feet below surface:	54.55
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1981-02-15	Feet below surface:	55.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-02-10	Feet below surface:	55.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-02-05	Feet below surface:	54.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-01-31	Feet below surface:	53.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-01-25	Feet below surface:	53.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-01-20	Feet below surface:	52.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-01-15	Feet below surface:	53.22
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-12-05	Feet below surface:	55.77
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-30	Feet below surface:	56.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-25	Feet below surface:	55.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-20	Feet below surface:	55.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-15	Feet below surface:	54.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-10	Feet below surface:	53.03
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-05	Feet below surface:	46.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-31	Feet below surface:	46.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-25	Feet below surface:	45.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-20	Feet below surface:	46.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-15	Feet below surface:	46.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-10	Feet below surface:	46.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-05	Feet below surface:	46.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-09-30	Feet below surface:	46.59
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1980-09-25	Feet below surface:	45.64
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-09-20	Feet below surface:	46.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-09-15	Feet below surface:	46.89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-09-10	Feet below surface:	46.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-09-05	Feet below surface:	45.96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-31	Feet below surface:	45.99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-25	Feet below surface:	45.51
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-20	Feet below surface:	45.34
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-15	Feet below surface:	44.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-10	Feet below surface:	45.23
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-05	Feet below surface:	45.22
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-07-31	Feet below surface:	45.13
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-07-25	Feet below surface:	44.59
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-07-20	Feet below surface:	45.04
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-07-15	Feet below surface:	45.88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-07-10	Feet below surface:	44.96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-07-05	Feet below surface:	45.51
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-06-30	Feet below surface:	44.86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-06-25	Feet below surface:	45.13
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-06-20	Feet below surface:	45.23
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-06-15	Feet below surface:	44.64
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1980-06-10	Feet below surface:	44.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-06-05	Feet below surface:	45.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-05-31	Feet below surface:	44.76
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-05-25	Feet below surface:	44.43
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-05-15	Feet below surface:	57.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-04-20	Feet below surface:	41.94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-04-15	Feet below surface:	41.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-04-10	Feet below surface:	41.63
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-04-05	Feet below surface:	42.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-03-31	Feet below surface:	42.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-03-25	Feet below surface:	43.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-03-20	Feet below surface:	43.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-03-15	Feet below surface:	43.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-03-10	Feet below surface:	42.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-03-05	Feet below surface:	42.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-02-28	Feet below surface:	42.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-02-25	Feet below surface:	43.13
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-02-20	Feet below surface:	42.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-02-15	Feet below surface:	42.01
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-02-10	Feet below surface:	42.37
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-02-05	Feet below surface:	42.40
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1980-01-31	Feet below surface:	42.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-01-25	Feet below surface:	43.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-01-20	Feet below surface:	42.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-01-15	Feet below surface:	42.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-01-10	Feet below surface:	43.59
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-01-05	Feet below surface:	42.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-12-31	Feet below surface:	42.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-12-25	Feet below surface:	41.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-12-20	Feet below surface:	42.36
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-12-15	Feet below surface:	42.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-12-10	Feet below surface:	43.07
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-12-05	Feet below surface:	42.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-11-30	Feet below surface:	42.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-11-25	Feet below surface:	42.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-11-20	Feet below surface:	42.67
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-11-15	Feet below surface:	43.13
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-10-20	Feet below surface:	44.22
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-10-15	Feet below surface:	44.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-10-10	Feet below surface:	43.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-10-05	Feet below surface:	44.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-09-30	Feet below surface:	44.61
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1979-09-25	Feet below surface:	47.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-09-20	Feet below surface:	43.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-09-15	Feet below surface:	44.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-09-10	Feet below surface:	44.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-09-05	Feet below surface:	43.88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-08-31	Feet below surface:	44.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-08-25	Feet below surface:	44.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-08-20	Feet below surface:	43.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-08-15	Feet below surface:	44.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-08-10	Feet below surface:	43.40
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-08-05	Feet below surface:	44.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-07-31	Feet below surface:	44.34
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-07-25	Feet below surface:	44.56
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-07-20	Feet below surface:	43.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-07-15	Feet below surface:	44.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-07-10	Feet below surface:	43.86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-07-05	Feet below surface:	44.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-06-30	Feet below surface:	43.82
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-06-25	Feet below surface:	44.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-06-20	Feet below surface:	44.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-06-15	Feet below surface:	44.90
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1979-06-10	Feet below surface:	44.59
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-06-05	Feet below surface:	44.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-05-31	Feet below surface:	45.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-05-25	Feet below surface:	44.59
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-05-20	Feet below surface:	45.03
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-05-15	Feet below surface:	45.67
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-05-10	Feet below surface:	45.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-05-05	Feet below surface:	45.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-04-30	Feet below surface:	45.06
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-04-25	Feet below surface:	45.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-04-20	Feet below surface:	45.88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-04-15	Feet below surface:	45.47
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-04-10	Feet below surface:	46.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-04-05	Feet below surface:	46.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-31	Feet below surface:	45.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-25	Feet below surface:	45.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-20	Feet below surface:	47.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-15	Feet below surface:	46.89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-10	Feet below surface:	46.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-05	Feet below surface:	47.71
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-02-28	Feet below surface:	47.09
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1979-02-25	Feet below surface:	46.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-02-20	Feet below surface:	47.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-02-15	Feet below surface:	47.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-02-10	Feet below surface:	47.64
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-02-05	Feet below surface:	48.22
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-01-31	Feet below surface:	48.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-01-25	Feet below surface:	47.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-01-20	Feet below surface:	48.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-01-15	Feet below surface:	48.47
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-01-10	Feet below surface:	48.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-01-05	Feet below surface:	49.22
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-31	Feet below surface:	48.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-25	Feet below surface:	47.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-20	Feet below surface:	47.46
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-15	Feet below surface:	47.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-10	Feet below surface:	48.13
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-05	Feet below surface:	48.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-11-30	Feet below surface:	47.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-11-25	Feet below surface:	48.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-11-20	Feet below surface:	48.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-11-15	Feet below surface:	48.20
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1978-11-10	Feet below surface:	48.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-11-05	Feet below surface:	48.34
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-10-31	Feet below surface:	48.18
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-10-25	Feet below surface:	48.42
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-10-20	Feet below surface:	48.67
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-08-25	Feet below surface:	50.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-08-20	Feet below surface:	50.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-08-05	Feet below surface:	50.29
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-07-05	Feet below surface:	50.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-30	Feet below surface:	52.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-25	Feet below surface:	52.03
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-20	Feet below surface:	51.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-15	Feet below surface:	52.14
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-10	Feet below surface:	52.41
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-05	Feet below surface:	51.13
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-05-31	Feet below surface:	52.63
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-05-25	Feet below surface:	52.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-05-20	Feet below surface:	52.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-05-15	Feet below surface:	52.31
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-05-10	Feet below surface:	52.49
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-05-05	Feet below surface:	52.16
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1978-04-30	Feet below surface:	52.59
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-04-25	Feet below surface:	52.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-04-20	Feet below surface:	52.07
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-04-15	Feet below surface:	53.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-04-10	Feet below surface:	52.47
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-04-05	Feet below surface:	52.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-31	Feet below surface:	53.24
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-25	Feet below surface:	52.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-20	Feet below surface:	52.88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-15	Feet below surface:	52.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-10	Feet below surface:	52.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-05	Feet below surface:	52.62
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-02-28	Feet below surface:	52.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-02-25	Feet below surface:	52.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-02-20	Feet below surface:	52.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-02-15	Feet below surface:	52.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-02-10	Feet below surface:	52.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-02-05	Feet below surface:	52.47
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-01-31	Feet below surface:	52.99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-01-25	Feet below surface:	52.01
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-01-20	Feet below surface:	51.50
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1978-01-15	Feet below surface:	52.58
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-01-10	Feet below surface:	52.63
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-01-05	Feet below surface:	52.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-31	Feet below surface:	51.89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-25	Feet below surface:	51.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-20	Feet below surface:	51.42
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-15	Feet below surface:	51.67
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-10	Feet below surface:	51.97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-05	Feet below surface:	50.89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-30	Feet below surface:	51.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-25	Feet below surface:	51.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-20	Feet below surface:	51.56
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-15	Feet below surface:	52.02
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-10	Feet below surface:	51.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-05	Feet below surface:	51.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-10-31	Feet below surface:	51.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-10-25	Feet below surface:	51.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-10-20	Feet below surface:	51.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-10-15	Feet below surface:	52.09
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-10-10	Feet below surface:	51.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-10-05	Feet below surface:	52.14
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1977-09-30	Feet below surface:	52.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-09-25	Feet below surface:	51.32
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-09-20	Feet below surface:	52.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-09-15	Feet below surface:	51.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-09-10	Feet below surface:	50.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-09-05	Feet below surface:	50.82
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-08-31	Feet below surface:	50.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-08-25	Feet below surface:	50.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-08-20	Feet below surface:	50.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-08-15	Feet below surface:	50.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-08-10	Feet below surface:	49.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-08-05	Feet below surface:	49.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-07-31	Feet below surface:	49.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-07-25	Feet below surface:	49.96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-07-20	Feet below surface:	49.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-07-15	Feet below surface:	50.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-07-10	Feet below surface:	50.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-07-05	Feet below surface:	50.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-06-30	Feet below surface:	50.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-06-25	Feet below surface:	50.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-06-20	Feet below surface:	48.90
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1977-06-15	Feet below surface:	49.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-06-10	Feet below surface:	50.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-06-05	Feet below surface:	50.66
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-31	Feet below surface:	50.23
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-25	Feet below surface:	50.72
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-20	Feet below surface:	50.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-15	Feet below surface:	50.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-10	Feet below surface:	50.40
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-05	Feet below surface:	49.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-04-30	Feet below surface:	49.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-04-25	Feet below surface:	48.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-04-20	Feet below surface:	49.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-04-15	Feet below surface:	49.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-04-10	Feet below surface:	49.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-04-05	Feet below surface:	47.97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03-31	Feet below surface:	48.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03-25	Feet below surface:	49.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03-20	Feet below surface:	48.63
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03-15	Feet below surface:	49.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03-10	Feet below surface:	49.40
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03-05	Feet below surface:	47.40
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1977-02-28	Feet below surface:	48.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-02-25	Feet below surface:	48.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-02-20	Feet below surface:	48.27
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-02-15	Feet below surface:	47.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-02-10	Feet below surface:	48.40
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-02-05	Feet below surface:	47.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-01-31	Feet below surface:	47.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-01-25	Feet below surface:	47.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-01-20	Feet below surface:	47.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-01-15	Feet below surface:	47.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-01-10	Feet below surface:	46.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-01-05	Feet below surface:	47.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-31	Feet below surface:	47.42
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-25	Feet below surface:	46.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-20	Feet below surface:	44.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-15	Feet below surface:	46.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-10	Feet below surface:	48.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-05	Feet below surface:	47.42
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-11-30	Feet below surface:	47.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-11-25	Feet below surface:	46.18
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-11-20	Feet below surface:	44.60
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1976-11-15	Feet below surface:	44.40
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-11-10	Feet below surface:	44.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-11-05	Feet below surface:	44.23
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-10-31	Feet below surface:	44.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-10-25	Feet below surface:	44.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-10-20	Feet below surface:	44.46
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-10-15	Feet below surface:	45.68
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-10-10	Feet below surface:	46.71
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-10-05	Feet below surface:	46.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-09-30	Feet below surface:	46.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-09-25	Feet below surface:	46.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-09-20	Feet below surface:	46.64
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-09-15	Feet below surface:	46.82
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-09-10	Feet below surface:	45.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-09-05	Feet below surface:	46.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-08-31	Feet below surface:	46.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-08-25	Feet below surface:	46.18
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-08-20	Feet below surface:	46.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-08-15	Feet below surface:	46.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-08-10	Feet below surface:	46.07
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-08-05	Feet below surface:	46.52
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1976-07-31	Feet below surface:	46.27
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-07-25	Feet below surface:	46.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-07-20	Feet below surface:	46.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-07-15	Feet below surface:	45.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-07-10	Feet below surface:	45.61
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-07-05	Feet below surface:	45.72
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-06-30	Feet below surface:	45.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-06-25	Feet below surface:	45.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-06-20	Feet below surface:	45.58
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-06-15	Feet below surface:	45.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-06-10	Feet below surface:	45.21
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-06-05	Feet below surface:	44.69
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-05-31	Feet below surface:	44.64
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-05-25	Feet below surface:	44.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-05-20	Feet below surface:	44.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-05-15	Feet below surface:	44.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-05-10	Feet below surface:	44.77
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-05-05	Feet below surface:	45.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-04-30	Feet below surface:	44.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-04-25	Feet below surface:	43.67
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-04-20	Feet below surface:	43.80
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1976-04-15	Feet below surface:	42.86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-04-10	Feet below surface:	42.66
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-04-05	Feet below surface:	40.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-03-31	Feet below surface:	40.49
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-03-25	Feet below surface:	42.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-03-20	Feet below surface:	40.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-03-15	Feet below surface:	40.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-03-10	Feet below surface:	40.37
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-03-05	Feet below surface:	40.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-02-28	Feet below surface:	40.04
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-02-25	Feet below surface:	40.22
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-02-20	Feet below surface:	40.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-02-15	Feet below surface:	39.94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-02-10	Feet below surface:	40.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-02-05	Feet below surface:	40.47
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-01-31	Feet below surface:	40.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-01-25	Feet below surface:	40.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-01-20	Feet below surface:	40.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-01-15	Feet below surface:	40.71
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-01-10	Feet below surface:	41.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-01-05	Feet below surface:	41.10
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1975-12-31	Feet below surface:	40.42
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-25	Feet below surface:	40.83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-20	Feet below surface:	40.64
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-15	Feet below surface:	40.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-10	Feet below surface:	40.88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-05	Feet below surface:	41.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-11-30	Feet below surface:	41.26
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-11-25	Feet below surface:	41.60
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-11-20	Feet below surface:	41.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-11-15	Feet below surface:	42.12
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-11-11	Feet below surface:	44.59
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-11-10	Feet below surface:	42.59
Feet to sea level:	Not Reported	Note:	Not Reported

B9
WSW
1/4 - 1/2 Mile
Higher

FED USGS **USGS40000231707**

Organization ID:	USGS-MD	Organization Name:	USGS Maryland Water Science Center
Monitor Location:	Dc34-05	Type:	Well
Description:	DGS Lat/Long:N393753W753649		
HUC:	02040205	Drainage Area:	Not Reported
Drainage Area Units:	Not Reported	Contrib Drainage Area:	Not Reported
Contrib Drainage Area Unts:	Not Reported		
Aquifer:	Northern Atlantic Coastal Plain aquifer system		
Formation Type:	Potomac Formation	Aquifer Type:	Not Reported
Construction Date:	19750828	Well Depth:	579
Well Depth Units:	ft	Well Hole Depth:	599
Well Hole Depth Units:	ft		

Ground water levels,Number of Measurements:	129	Level reading date:	2004-09-16
Feet below surface:	101.52	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	2004-08-18	Feet below surface:	102.00
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	2004-07-13	Feet below surface:	100.88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-06-14	Feet below surface:	101.18
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-05-17	Feet below surface:	99.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-04-12	Feet below surface:	100.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-03-17	Feet below surface:	101.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-02-18	Feet below surface:	103.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-01-12	Feet below surface:	103.53
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-12-12	Feet below surface:	101.94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-11-13	Feet below surface:	102.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-10-14	Feet below surface:	101.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-09-22	Feet below surface:	103.69
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-04-30	Feet below surface:	108.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-10-30	Feet below surface:	102.77
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-04-30	Feet below surface:	94.06
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-10-23	Feet below surface:	102.32
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-04-12	Feet below surface:	106.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-10-03	Feet below surface:	109.76
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-04-19	Feet below surface:	104.86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1999-10-14	Feet below surface:	102.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1999-04-30	Feet below surface:	99.81
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1998-10-20	Feet below surface:	92.16
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1998-04-23	Feet below surface:	98.82
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-10-24	Feet below surface:	104.09
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-04-30	Feet below surface:	97.99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-10-01	Feet below surface:	93.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-05-03	Feet below surface:	102.17
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-10-12	Feet below surface:	95.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-04-07	Feet below surface:	99.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-10-19	Feet below surface:	104.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-04-08	Feet below surface:	102.13
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-11-10	Feet below surface:	92.53
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-04-07	Feet below surface:	94.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-10-23	Feet below surface:	99.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-04-20	Feet below surface:	100.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1991-10-21	Feet below surface:	101.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1991-04-05	Feet below surface:	105.09
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-10-15	Feet below surface:	105.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-04-16	Feet below surface:	105.97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-10-10	Feet below surface:	98.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-04-25	Feet below surface:	100.88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-10-18	Feet below surface:	98.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-02-22	Feet below surface:	102.51
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1987-08-24	Feet below surface:	105.74
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1987-03-11	Feet below surface:	106.79
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1985-08-22	Feet below surface:	101.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1985-02-04	Feet below surface:	95.51
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-10-10	Feet below surface:	88.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-04-16	Feet below surface:	96.41
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-11-21	Feet below surface:	100.66
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-04-20	Feet below surface:	97.87
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-10-14	Feet below surface:	96.74
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-04-20	Feet below surface:	101.81
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-11-13	Feet below surface:	97.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-14	Feet below surface:	96.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-14	Feet below surface:	96.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-13	Feet below surface:	97.49
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-07-14	Feet below surface:	100.46
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-06-12	Feet below surface:	101.81
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-05-15	Feet below surface:	105.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-16	Feet below surface:	108.04
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-18	Feet below surface:	106.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-02-13	Feet below surface:	108.29
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-01-15	Feet below surface:	107.05
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1980-12-15	Feet below surface:	110.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-13	Feet below surface:	115.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-16	Feet below surface:	117.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-09-16	Feet below surface:	112.74
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-18	Feet below surface:	104.76
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-07-18	Feet below surface:	106.73
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-06-19	Feet below surface:	110.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-05-22	Feet below surface:	119.23
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-04-23	Feet below surface:	113.69
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-04-07	Feet below surface:	110.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-03-07	Feet below surface:	101.67
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-02-08	Feet below surface:	100.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-01-11	Feet below surface:	105.97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-12-14	Feet below surface:	113.72
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-11-16	Feet below surface:	114.53
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-10-16	Feet below surface:	116.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-09-14	Feet below surface:	117.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-08-17	Feet below surface:	119.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-07-18	Feet below surface:	121.27
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-06-18	Feet below surface:	119.12
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-05-18	Feet below surface:	123.18
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1979-04-19	Feet below surface:	123.69
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-21	Feet below surface:	125.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-02	Feet below surface:	124.73
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-01-30	Feet below surface:	122.72
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-29	Feet below surface:	120.40
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-11-29	Feet below surface:	117.91
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-10-30	Feet below surface:	121.27
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-10-18	Feet below surface:	121.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-09-08	Feet below surface:	124.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-08-07	Feet below surface:	123.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-07-06	Feet below surface:	126.89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-05	Feet below surface:	129.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-05-05	Feet below surface:	130.62
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-04-05	Feet below surface:	129.51
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-07	Feet below surface:	127.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-02-01	Feet below surface:	126.13
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-05	Feet below surface:	119.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-11-05	Feet below surface:	122.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-10-05	Feet below surface:	122.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-09-05	Feet below surface:	120.88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-08-05	Feet below surface:	120.22
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1977-07-07	Feet below surface:	122.16
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-06-10	Feet below surface:	121.86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-10	Feet below surface:	122.11
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-04-10	Feet below surface:	120.24
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-03-10	Feet below surface:	117.63
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-02-10	Feet below surface:	118.68
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-01-05	Feet below surface:	115.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-15	Feet below surface:	113.02
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-11-15	Feet below surface:	117.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-10-15	Feet below surface:	120.94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-09-15	Feet below surface:	124.34
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-08-15	Feet below surface:	123.82
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-07-20	Feet below surface:	123.04
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-06-15	Feet below surface:	121.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-05-10	Feet below surface:	119.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-04-10	Feet below surface:	122.58
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-03-10	Feet below surface:	124.34
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-02-10	Feet below surface:	119.77
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-01-10	Feet below surface:	120.88
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-10	Feet below surface:	124.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1975-12-05	Feet below surface:	125.55
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1975-11-10	Feet below surface:	130.42
Feet to sea level:	Not Reported	Note:	Not Reported

B10
WSW
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000124773**

Permit #:	10231	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	23-SEP-75
Proposed Drill Method:	Unknown	Formation:	Potomac Fm
Aquifer:	Potomac Upper Zone	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	188
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	01-NOV-75
Constr Review Date:	01-NOV-75	Permit Approval Date:	01-NOV-75
Actual Construction Date:	Not Reported	Completion Report Date:	23-SEP-75
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	183
Screen Base:	188	Screen Material:	Steel
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	89680	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	A C Schultes Of Delaware	License #:	14
Grout Top:	0	Grout Base:	30
Grout Material:	Neat Cement	Gravel Top:	180
Gravel Base:	195	Gravel Material:	Gravel
Inner Casing Top:	38	Inner Casing Base:	183
Inner Casing Material:	Steel	Comments:	Not Reported

C11
NNW
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000110390**

Permit #:	168034	Local Well ID:	Not Reported
Well Type:	Monitor - Direct Push	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Permit Expired
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported

Proposed Drill Method:	Unknown	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	20
Well Terminus Inches:	0	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	BPS GP 1 - 10	Application Received:	29-SEP-99
Constr Review Date:	29-SEP-99	Permit Approval Date:	29-SEP-99
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	62161	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

C12
NNW
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000110391**

Permit #:	168035	Local Well ID:	Not Reported
Well Type:	Monitor - Direct Push	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Permit Expired
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Unknown	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	20
Well Terminus Inches:	0	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	BPS GP 11 - 17	Application Received:	29-SEP-99
Constr Review Date:	29-SEP-99	Permit Approval Date:	29-SEP-99
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No

Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	62162	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

D13
SW
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000124974**

Permit #:	35535	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Well Abandoned
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	10-MAY-76
Proposed Drill Method:	Mud Rotary	Formation:	Potomac Fm
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	241
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	25-FEB-76
Constr Review Date:	25-FEB-76	Permit Approval Date:	25-FEB-76
Actual Construction Date:	Not Reported	Completion Report Date:	10-MAY-76
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	156
Screen Base:	196	Screen Material:	PVC
Min Well Diameter:	6	Max Well Diameter:	6
Loc ID:	114278	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	AC Schultes Inc	License #:	31
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0

Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	156
Inner Casing Material:	PVC	Comments:	Not Reported

D14
SW
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000124964**

Permit #:	34509	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	23-SEP-75
Proposed Drill Method:	Reverse Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	188
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	09-JUL-75
Constr Review Date:	09-JUL-75	Permit Approval Date:	09-JUL-75
Actual Construction Date:	Not Reported	Completion Report Date:	23-SEP-75
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	183
Screen Base:	188	Screen Material:	Steel
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	113376	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	A C Schultes Of Delaware	License #:	14
Grout Top:	0	Grout Base:	30
Grout Material:	Neat Cement	Gravel Top:	180
Gravel Base:	195	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	183
Inner Casing Material:	Steel	Comments:	Not Reported

D15
SW
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000125289**

Permit #:	50812	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Well Abandoned

Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	07-MAY-82
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	25.5
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	20-APR-82
Constr Review Date:	20-APR-82	Permit Approval Date:	20-APR-82
Actual Construction Date:	Not Reported	Completion Report Date:	07-MAY-82
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	20
Screen Base:	25.5	Screen Material:	PVC
Min Well Diameter:	1.2	Max Well Diameter:	1.2
Loc ID:	113612	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	0	Grout Base:	20
Grout Material:	Bentonite	Gravel Top:	0
Gravel Base:	25.5	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	20
Inner Casing Material:	PVC	Comments:	Not Reported

D16
SW
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000125291**

Permit #:	50814	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Well Abandoned
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	07-MAY-82
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	25.5
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	20-APR-82
Constr Review Date:	20-APR-82	Permit Approval Date:	20-APR-82
Actual Construction Date:	Not Reported	Completion Report Date:	07-MAY-82

Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	20
Screen Base:	25.5	Screen Material:	PVC
Min Well Diameter:	1.2	Max Well Diameter:	1.2
Loc ID:	113285	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	0	Grout Base:	20
Grout Material:	Bentonite	Gravel Top:	0
Gravel Base:	25.5	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	20
Inner Casing Material:	PVC	Comments:	Not Reported

D17
SW
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000125290**

Permit #:	50813	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Well Abandoned
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	07-MAY-82
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	25.5
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	20-APR-82
Constr Review Date:	20-APR-82	Permit Approval Date:	20-APR-82
Actual Construction Date:	Not Reported	Completion Report Date:	07-MAY-82
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	20
Screen Base:	25.5	Screen Material:	PVC
Min Well Diameter:	1.2	Max Well Diameter:	1.2
Loc ID:	113284	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52

Grout Top:	0	Grout Base:	20
Grout Material:	Bentonite	Gravel Top:	0
Gravel Base:	25.5	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	20
Inner Casing Material:	PVC	Comments:	Not Reported

E18
NE
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000133162**

Permit #:	156750	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	28-APR-98
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	-41.5	Water Level Date:	28-APR-98
Total Proposed Depth:	0	Actual Total Depth:	210
Well Terminus Inches:	24	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW 2	Application Received:	17-FEB-98
Constr Review Date:	17-FEB-98	Permit Approval Date:	17-FEB-98
Actual Construction Date:	Not Reported	Completion Report Date:	28-APR-98
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	90
Screen Base:	180	Screen Material:	PVC
Min Well Diameter:	4	Max Well Diameter:	4
Loc ID:	100163	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Artesian Water Company	License #:	157
Grout Top:	0	Grout Base:	83
Grout Material:	Neat Cement	Gravel Top:	85
Gravel Base:	210	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	90
Inner Casing Material:	PVC	Comments:	Not Reported

E19
NE
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000133163**

Permit #:	156751	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported

Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Permit Expired
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Unknown	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	0
Well Terminus Inches:	0	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW 3	Application Received:	17-FEB-98
Constr Review Date:	17-FEB-98	Permit Approval Date:	17-FEB-98
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	100164	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Artesian Water Company	License #:	157
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

F20
NNE
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000136046**

Permit #:	183685	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	24-JAN-02
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	10
Rated Capacity:	0	Test Time:	2
Water Level:	100	Retain Well:	0
Static Water Level:	42	Water Level Date:	24-JAN-02
Total Proposed Depth:	0	Actual Total Depth:	115
Well Terminus Inches:	12	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW2-R	Application Received:	23-JAN-02

Constr Review Date:	23-JAN-02	Permit Approval Date:	23-JAN-02
Actual Construction Date:	Not Reported	Completion Report Date:	24-JAN-02
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	90
Screen Base:	115	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	70858	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	American Water Well Systems		
License #:	608	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	88	Gravel Base:	120
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	90	Inner Casing Material:	PVC
Comments:	Not Reported		

F21
NNE
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000132921**

Permit #:	155074	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	26-NOV-97
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	30
Rated Capacity:	0	Test Time:	.5
Water Level:	19	Retain Well:	0
Static Water Level:	14	Water Level Date:	26-NOV-97
Total Proposed Depth:	0	Actual Total Depth:	0
Well Terminus Inches:	12	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	J 1	Application Received:	23-OCT-97
Constr Review Date:	23-OCT-97	Permit Approval Date:	23-OCT-97
Actual Construction Date:	Not Reported	Completion Report Date:	26-NOV-97
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	59
Screen Base:	64	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2

Loc ID:	56501	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Artesian Water Company	License #:	157
Grout Top:	0	Grout Base:	20
Grout Material:	Bentonite	Gravel Top:	59
Gravel Base:	60	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	59
Inner Casing Material:	PVC	Comments:	Not Reported

G22
North
1/4 - 1/2 Mile
Higher

DE WELLS **DE2000000017280**

Permit #:	243673	Local Well ID:	Not Reported
Well Type:	Dewater - Standard	DGS ID:	Not Reported
Tax ID:	10-041.20-057	Septic Permit #:	Not Reported
Well Authorization Code:	3310350	Well Status:	Well Abandoned
Est Max Capacity:	50	Est Daily Use:	72000
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Mud Rotary	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	0	Test Rate:	10
Rated Capacity:	0	Test Time:	120
Water Level:	15	Retain Well:	N
Static Water Level:	7	Water Level Date:	02-JUL-13
Total Proposed Depth:	20	Actual Total Depth:	15
Well Terminus Inches:	12	Well Terminus Type:	Other
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	28-MAY-13
Constr Review Date:	31-MAY-13	Permit Approval Date:	31-MAY-13
Actual Construction Date:	Not Reported	Completion Report Date:	01-JUL-13
Abandon Report Date:	21-JUN-13	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	Yes
Groundwater Mgmt Zone:	Yes	Well Pit:	No
Replacement:	No	Alloc Review:	Yes
Sampled:	No	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	Yes
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	1025485	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Eastern States Construction Service Inc		
License #:	839	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	15	Inner Casing Material:	Steel
Comments:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
G23 **North** **1/4 - 1/2 Mile** **Higher**	**FED USGS**	**USGS40000231709**

Organization ID:	USGS-MD	Organization Name:	USGS Maryland Water Science Center
Monitor Location:	Dc24-41	Type:	Well
Description:	DGS Lat/Long:N393835W753635S		
HUC:	02040205	Drainage Area:	Not Reported
Drainage Area Units:	Not Reported	Contrib Drainage Area:	Not Reported
Contrib Drainage Area Unts:	Not Reported		
Aquifer:	Northern Atlantic Coastal Plain aquifer system		
Formation Type:	Potomac Formation	Aquifer Type:	Not Reported
Construction Date:	19690203	Well Depth:	155
Well Depth Units:	ft	Well Hole Depth:	195
Well Hole Depth Units:	ft		

G24 **North** **1/4 - 1/2 Mile** **Higher**	**FED USGS**	**USGS40000231710**

Organization ID:	USGS-MD	Organization Name:	USGS Maryland Water Science Center
Monitor Location:	Dc24-18	Type:	Well
Description:	DGS Lat/Long:N393835W753645S		
HUC:	02040205	Drainage Area:	Not Reported
Drainage Area Units:	Not Reported	Contrib Drainage Area:	Not Reported
Contrib Drainage Area Unts:	Not Reported		
Aquifer:	Northern Atlantic Coastal Plain aquifer system		
Formation Type:	Potomac Formation	Aquifer Type:	Not Reported
Construction Date:	19710101	Well Depth:	155
Well Depth Units:	ft	Well Hole Depth:	200
Well Hole Depth Units:	ft		

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25 **North** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000135984**

Permit #:	183417	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Permit Expired
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Unknown	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	200
Well Terminus Inches:	12	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW 6	Application Received:	11-JAN-02

Constr Review Date:	11-JAN-02	Permit Approval Date:	11-JAN-02
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	70719	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	American Water Well Systems		
License #:	608	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

26
WSW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000007956**

Permit #:	178773	Local Well ID:	Not Reported
Well Type:	Agricultural - Within CPCN		
DGS ID:	Not Reported	Tax ID:	Not Reported
Septic Permit #:	Not Reported	Well Authorization Code:	Not Reported
Well Status:	Active	Est Max Capacity:	20
Est Daily Use:	30000	Require Alloc Permit:	NO
Est Construction Date:	08-JUN-01	Proposed Drill Method:	Mud Rotary
Formation:	Undetermined	Aquifer:	Undetermined
Pump:	Not Reported	Intake Setting:	140
Test Rate:	100	Rated Capacity:	60
Test Time:	6	Water Level:	140
Retain Well:	0	Static Water Level:	61
Water Level Date:	08-JUN-01	Total Proposed Depth:	0
Actual Total Depth:	197	Well Terminus Inches:	12
Well Terminus Type:	Pitless Adaptor	Replacement Well:	Not Reported
Replaced Well Permit #:	Not Reported	How Abandoned:	Not Reported
Why Abandoned:	Not Reported	Local ID:	River Rd
Application Received:	21-MAY-01	Constr Review Date:	21-MAY-01
Permit Approval Date:	21-MAY-01	Actual Construction Date:	Not Reported
Completion Report Date:	08-JUN-01	Abandon Report Date:	Not Reported
Reclassify Date:	Not Reported	Potable:	No
Test Temp:	No	Groundwater Mgmt Zone:	No
Well Pit:	No	Replacement:	No
Alloc Review:	No	Sampled:	No
CPCN:	No	Ag Preservation District:	No
Floodplain:	No	Small Lot:	No
Injection:	No	Potential Contam in Vicinity:	No
Emergency:	No	Confined:	No
Reviewable:	No	Existing:	No
Screen Top:	187	Screen Base:	197
Screen Material:	PVC	Min Well Diameter:	6

Max Well Diameter:	6	Loc ID:	68163
Watershed:	Army Creek	Basin:	Delaware Bay
USGS Hydrologic Code:	2040205	Well Contractor:	Shore Well Drillers Inc
License #:	28	Grout Top:	0
Grout Base:	180	Grout Material:	Bentonite
Gravel Top:	180	Gravel Base:	197
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	187	Inner Casing Material:	PVC
Comments:	Not Reported		

27
NNE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000124755**

Permit #:	10052	Local Well ID:	LLANGOLLEN K1
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Issued
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	01-JAN-71
Proposed Drill Method:	Mud Rotary	Formation:	Potomac Fm
Aquifer:	Potomac Middle Zone	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	220	Actual Total Depth:	220
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	LLANGOLLEN K1	Application Received:	01-JAN-71
Constr Review Date:	05-MAR-14	Permit Approval Date:	05-MAR-14
Actual Construction Date:	Not Reported	Completion Report Date:	01-JAN-71
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	Yes	Reviewable:	No
Existing:	Yes	Screen Top:	135
Screen Base:	173	Screen Material:	Rock
Min Well Diameter:	10	Max Well Diameter:	10
Loc ID:	89948	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Not Reported	License #:	0
Grout Top:	0	Grout Base:	40
Grout Material:	Neat Cement	Gravel Top:	40
Gravel Base:	185	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

Map ID Direction Distance Elevation	Database	EDR ID Number
28 **SW** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000086286**

Permit #:	223458	Local Well ID:	Not Reported
Well Type:	Domestic - Standard	DGS ID:	Not Reported
Tax ID:	10-046.00-001	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Permit Expired
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Mud Rotary	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	0
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	25-MAR-08
Constr Review Date:	31-MAR-08	Permit Approval Date:	31-MAR-08
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	Yes	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	Yes	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	373342	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Lifetime Well Drilling Co	License #:	101
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

H29 **WSW** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000116290**

Permit #:	104215	Local Well ID:	Not Reported
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Well Abandoned
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	09-JUN-95
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported

Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	7
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	31-MAY-95
Constr Review Date:	31-MAY-95	Permit Approval Date:	31-MAY-95
Actual Construction Date:	Not Reported	Completion Report Date:	09-JUN-95
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	2
Screen Base:	7	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	99000	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Not Reported	License #:	0
Grout Top:	0	Grout Base:	0
Grout Material:	Bentonite	Gravel Top:	0
Gravel Base:	7	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	2
Inner Casing Material:	PVC	Comments:	Not Reported

H30
WSW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000123105**

Permit #:	244496	Local Well ID:	MW-3
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	10-046.00-001	Septic Permit #:	Not Reported
Well Authorization Code:	3720244	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	26-SEP-13
Total Proposed Depth:	30	Actual Total Depth:	28
Well Terminus Inches:	0	Well Terminus Type:	Other
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	13-AUG-13
Constr Review Date:	19-AUG-13	Permit Approval Date:	19-AUG-13
Actual Construction Date:	Not Reported	Completion Report Date:	24-SEP-13
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	Yes
Replacement:	No	Alloc Review:	No

Sampled:	Yes	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	15
Screen Base:	25	Screen Material:	PVC
Min Well Diameter:	4	Max Well Diameter:	4
Loc ID:	1032684	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	13	Grout Material:	Bentonite
Gravel Top:	13	Gravel Base:	25
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	15	Inner Casing Material:	PVC
Comments:	Not Reported		

H31
WSW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000123104**

Permit #:	244495	Local Well ID:	MW-2
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	10-046.00-001	Septic Permit #:	Not Reported
Well Authorization Code:	3720244	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	29.73	Water Level Date:	26-SEP-13
Total Proposed Depth:	30	Actual Total Depth:	36
Well Terminus Inches:	36	Well Terminus Type:	Other
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	13-AUG-13
Constr Review Date:	19-AUG-13	Permit Approval Date:	19-AUG-13
Actual Construction Date:	Not Reported	Completion Report Date:	24-SEP-13
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	Yes	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	25.5
Screen Base:	35.5	Screen Material:	PVC
Min Well Diameter:	.75	Max Well Diameter:	.75
Loc ID:	1032683	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	23	Grout Material:	Bentonite
Gravel Top:	23	Gravel Base:	35.5

Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	25.5	Inner Casing Material:	PVC
Comments:	Not Reported		

H32
WSW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000123103**

Permit #:	244494	Local Well ID:	MW-1
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	10-046.00-001	Septic Permit #:	Not Reported
Well Authorization Code:	3720244	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	4.29	Water Level Date:	26-SEP-13
Total Proposed Depth:	30	Actual Total Depth:	15
Well Terminus Inches:	30	Well Terminus Type:	Other
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	13-AUG-13
Constr Review Date:	19-AUG-13	Permit Approval Date:	19-AUG-13
Actual Construction Date:	Not Reported	Completion Report Date:	24-SEP-13
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	Yes	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	3
Screen Base:	15	Screen Material:	PVC
Min Well Diameter:	.75	Max Well Diameter:	.75
Loc ID:	1032682	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	2	Grout Material:	Bentonite
Gravel Top:	2	Gravel Base:	13
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	3	Inner Casing Material:	PVC
Comments:	Not Reported		

H33
WSW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000123108**

Permit #:	244499	Local Well ID:	MW-6
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	10-046.00-001	Septic Permit #:	Not Reported

Well Authorization Code:	3720244	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Mud Rotary	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	30	Actual Total Depth:	0
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	13-AUG-13
Constr Review Date:	19-AUG-13	Permit Approval Date:	19-AUG-13
Actual Construction Date:	Not Reported	Completion Report Date:	24-SEP-13
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	Yes	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	1032687	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

H34
WSW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000123107**

Permit #:	244498	Local Well ID:	MW-5
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	10-046.00-001	Septic Permit #:	Not Reported
Well Authorization Code:	3720244	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Mud Rotary	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	30	Actual Total Depth:	0
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	13-AUG-13

Constr Review Date:	19-AUG-13	Permit Approval Date:	19-AUG-13
Actual Construction Date:	Not Reported	Completion Report Date:	24-SEP-13
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	Yes	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	1032686	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

H35
WSW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000123106**

Permit #:	244497	Local Well ID:	MW-4
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	10-046.00-001	Septic Permit #:	Not Reported
Well Authorization Code:	3720244	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	26-SEP-13
Total Proposed Depth:	30	Actual Total Depth:	16
Well Terminus Inches:	36	Well Terminus Type:	Other
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	13-AUG-13
Constr Review Date:	19-AUG-13	Permit Approval Date:	19-AUG-13
Actual Construction Date:	Not Reported	Completion Report Date:	24-SEP-13
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	Yes	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	3
Screen Base:	13	Screen Material:	PVC
Min Well Diameter:	.75	Max Well Diameter:	.75

Loc ID:	1032685	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	2	Grout Material:	Bentonite
Gravel Top:	2	Gravel Base:	13
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	3	Inner Casing Material:	PVC
Comments:	Not Reported		

I36
NW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000136984**

Permit #:	193399	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	27-MAY-03
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	29	Water Level Date:	27-MAY-03
Total Proposed Depth:	0	Actual Total Depth:	37
Well Terminus Inches:	24	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW-1	Application Received:	30-APR-03
Constr Review Date:	30-APR-03	Permit Approval Date:	30-APR-03
Actual Construction Date:	Not Reported	Completion Report Date:	27-MAY-03
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	17
Screen Base:	37	Screen Material:	PVC
Min Well Diameter:	4	Max Well Diameter:	4
Loc ID:	76072	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	John's Well Drilling Inc	License #:	201
Grout Top:	0	Grout Base:	16
Grout Material:	Bentonite	Gravel Top:	17
Gravel Base:	37	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	17
Inner Casing Material:	PVC	Comments:	Not Reported

Map ID Direction Distance Elevation	Database	EDR ID Number
I37 **NW** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000135080**

Permit #:	174898	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	03-NOV-00
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	38
Rated Capacity:	0	Test Time:	2
Water Level:	305	Retain Well:	0
Static Water Level:	128	Water Level Date:	03-NOV-00
Total Proposed Depth:	0	Actual Total Depth:	587
Well Terminus Inches:	24	Well Terminus Type:	Other
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Gordy Pl	Application Received:	02-OCT-00
Constr Review Date:	02-OCT-00	Permit Approval Date:	02-OCT-00
Actual Construction Date:	Not Reported	Completion Report Date:	03-NOV-00
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	530
Screen Base:	550	Screen Material:	PVC
Min Well Diameter:	4	Max Well Diameter:	4
Loc ID:	66014	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	A C Schultes Of Maryland	License #:	221
Grout Top:	0	Grout Base:	450
Grout Material:	Bentonite	Gravel Top:	450
Gravel Base:	587	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	530
Inner Casing Material:	PVC	Comments:	Not Reported

J38 **NE** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000134496**

Permit #:	169204	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	30-NOV-99
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported

Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	16
Well Terminus Inches:	2	Well Terminus Type:	Pad Mount
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW-2	Application Received:	30-NOV-99
Constr Review Date:	30-NOV-99	Permit Approval Date:	30-NOV-99
Actual Construction Date:	Not Reported	Completion Report Date:	30-NOV-99
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	6
Screen Base:	16	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	62874	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	B L Myers Brothers of PA Inc		
License #:	627	Grout Top:	0
Grout Base:	4	Grout Material:	Neat Cement
Gravel Top:	6	Gravel Base:	16
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	6	Inner Casing Material:	PVC
Comments:	Not Reported		

J39
NE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000134495**

Permit #:	169203	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	30-NOV-99
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	16
Well Terminus Inches:	2	Well Terminus Type:	Pad Mount
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW 1	Application Received:	30-NOV-99
Constr Review Date:	30-NOV-99	Permit Approval Date:	30-NOV-99
Actual Construction Date:	Not Reported	Completion Report Date:	30-NOV-99
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No

Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	8
Screen Base:	16	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	62873	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	B L Myers Brothers of PA Inc		
License #:	627	Grout Top:	0
Grout Base:	6	Grout Material:	Neat Cement
Gravel Top:	8	Gravel Base:	16
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	8	Inner Casing Material:	PVC
Comments:	Not Reported		

J40
NE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000134498**

Permit #:	169206	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	30-NOV-99
Proposed Drill Method:	Unknown	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	14
Well Terminus Inches:	2	Well Terminus Type:	Pad Mount
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW-4	Application Received:	30-NOV-99
Constr Review Date:	30-NOV-99	Permit Approval Date:	30-NOV-99
Actual Construction Date:	Not Reported	Completion Report Date:	30-NOV-99
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	4
Screen Base:	14	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	62876	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	B L Myers Brothers of PA Inc		
License #:	627	Grout Top:	0
Grout Base:	2	Grout Material:	Neat Cement

Gravel Top:	4	Gravel Base:	14
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	4	Inner Casing Material:	PVC
Comments:	Not Reported		

J41
NE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000134497**

Permit #:	169205	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	30-NOV-99
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	27
Well Terminus Inches:	2	Well Terminus Type:	Pad Mount
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW-3	Application Received:	30-NOV-99
Constr Review Date:	30-NOV-99	Permit Approval Date:	30-NOV-99
Actual Construction Date:	Not Reported	Completion Report Date:	30-NOV-99
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	22
Screen Base:	27	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	62875	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	B L Myers Brothers of PA Inc		
License #:	627	Grout Top:	0
Grout Base:	20	Grout Material:	Bentonite
Gravel Top:	22	Gravel Base:	27
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	22	Inner Casing Material:	PVC
Comments:	Not Reported		

K42
NNE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000122414**

Permit #:	237680	Local Well ID:	UPA-03
Well Type:	Monitor - Standard	DGS ID:	Not Reported

Tax ID:	10-035.40-101	Septic Permit #:	Not Reported
Well Authorization Code:	3334561	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Vibracore	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	07-MAR-12
Total Proposed Depth:	185	Actual Total Depth:	187
Well Terminus Inches:	2	Well Terminus Type:	Pad Mount
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	29-NOV-11
Constr Review Date:	01-DEC-11	Permit Approval Date:	01-DEC-11
Actual Construction Date:	Not Reported	Completion Report Date:	06-MAR-12
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	Yes	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	Yes	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	Yes	Emergency:	No
Confined:	Yes	Reviewable:	No
Existing:	No	Screen Top:	155
Screen Base:	165	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	937486	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Cascade Drilling LP	License #:	5377
Grout Top:	0	Grout Base:	151
Grout Material:	Bentonite/Cement Mixture	Gravel Top:	151
Gravel Base:	166	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	155
Inner Casing Material:	PVC	Comments:	Not Reported

L43
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000131879**

Permit #:	94150	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	18-FEB-93

Constr Review Date:	18-FEB-93	Permit Approval Date:	18-FEB-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	146651	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Delmarva Environmental & Tank Services		
License #:	807	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

L44
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000131878**

Permit #:	94149	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	18-FEB-93
Constr Review Date:	18-FEB-93	Permit Approval Date:	18-FEB-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0

Loc ID:	148447	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Delmarva Environmental & Tank Services		
License #:	807	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

L45
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000131881**

Permit #:	94152	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	18-FEB-93
Constr Review Date:	18-FEB-93	Permit Approval Date:	18-FEB-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	147197	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Delmarva Environmental & Tank Services		
License #:	807	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
L46 **West** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000131880**

Permit #:	94151	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	18-FEB-93
Constr Review Date:	18-FEB-93	Permit Approval Date:	18-FEB-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	147196	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Delmarva Environmental & Tank Services		
License #:	807	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

L47 **West** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000124973**

Permit #:	35533	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Well Abandoned
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	07-MAY-76
Proposed Drill Method:	Mud Rotary	Formation:	Not Reported

Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	231
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	25-FEB-76
Constr Review Date:	25-FEB-76	Permit Approval Date:	25-FEB-76
Actual Construction Date:	Not Reported	Completion Report Date:	07-MAY-76
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	113419	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	AC Schultes Inc	License #:	31
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

L48
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000124972**

Permit #:	35532	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Well Abandoned
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	14-MAY-76
Proposed Drill Method:	Mud Rotary	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	91
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	25-FEB-76
Constr Review Date:	25-FEB-76	Permit Approval Date:	25-FEB-76
Actual Construction Date:	Not Reported	Completion Report Date:	14-MAY-76
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No

Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	113868	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	AC Schultes Inc	License #:	31
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

L49
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000131346**

Permit #:	90398	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	10-MAY-92
Proposed Drill Method:	Augered	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	15
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	17-MAR-92
Constr Review Date:	17-MAR-92	Permit Approval Date:	17-MAR-92
Actual Construction Date:	Not Reported	Completion Report Date:	10-MAY-92
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	141853	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	1	Grout Base:	3
Grout Material:	Bentonite	Gravel Top:	3
Gravel Base:	15	Gravel Material:	Gravel

Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

L50
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000126797**

Permit #:	64117	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	1	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	04-MAR-86
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	13.5
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	28-FEB-86
Constr Review Date:	28-FEB-86	Permit Approval Date:	28-FEB-86
Actual Construction Date:	Not Reported	Completion Report Date:	04-MAR-86
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	3.5
Screen Base:	13.5	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	122043	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	1	Grout Base:	2
Grout Material:	Neat Cement	Gravel Top:	2
Gravel Base:	13.5	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	3.5
Inner Casing Material:	PVC	Comments:	Not Reported

L51
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000131909**

Permit #:	94918	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0

Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	12-APR-93
Constr Review Date:	12-APR-93	Permit Approval Date:	12-APR-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	148113	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Professional Well Drilling		
License #:	900	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

L52
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000131908**

Permit #:	94917	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	12-APR-93
Constr Review Date:	12-APR-93	Permit Approval Date:	12-APR-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported

Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	148112	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Professional Well Drilling		
License #:	900	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

L53
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000131911**

Permit #:	94920	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	12-APR-93
Constr Review Date:	12-APR-93	Permit Approval Date:	12-APR-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	144937	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205

Well Contractor:	Professional Well Drilling		
License #:	900	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

L54
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000131910**

Permit #:	94919	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	12-APR-93
Constr Review Date:	12-APR-93	Permit Approval Date:	12-APR-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	145633	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Professional Well Drilling		
License #:	900	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
L55 **West** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000131883**

Permit #:	94154	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	18-FEB-93
Constr Review Date:	18-FEB-93	Permit Approval Date:	18-FEB-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	148448	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Delmarva Environmental & Tank Services		
License #:	807	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

L56 **West** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000131882**

Permit #:	94153	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported

Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	18-FEB-93
Constr Review Date:	18-FEB-93	Permit Approval Date:	18-FEB-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	146237	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Delmarva Environmental & Tank Services		
License #:	807	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

L57
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000131907**

Permit #:	94916	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	12-APR-93
Constr Review Date:	12-APR-93	Permit Approval Date:	12-APR-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No

Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	144936	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Professional Well Drilling		
License #:	900	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

L58
West
1/2 - 1 Mile
Higher

DE WELLS **DE2000000131906**

Permit #:	94915	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	12-APR-93
Constr Review Date:	12-APR-93	Permit Approval Date:	12-APR-93
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	148111	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Professional Well Drilling		
License #:	900	Grout Top:	0

Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

K59
NNE **DE WELLS** **DE2000000148923**
1/2 - 1 Mile
Higher

Permit #:	238310	Local Well ID:	Not Reported
Well Type:	Not Reported	DGS ID:	Not Reported
Tax ID:	10-035.40-101	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Voided
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Not Reported	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	Not Reported
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	0
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	08-FEB-12
Constr Review Date:	Not Reported	Permit Approval Date:	Not Reported
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	Yes	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	944499	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Cascade Drilling LP	License #:	5377
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

M60
NW **DE WELLS** **DE2000000130556**
1/2 - 1 Mile
Higher

Permit #:	86619	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported

Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	14-MAY-91
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	32
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	19-APR-91
Constr Review Date:	19-APR-91	Permit Approval Date:	19-APR-91
Actual Construction Date:	Not Reported	Completion Report Date:	14-MAY-91
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	22
Screen Base:	32	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	139410	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Earth Environmental Drilling Inc		
License #:	813	Grout Top:	0
Grout Base:	20	Grout Material:	Bentonite
Gravel Top:	20	Gravel Base:	32
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	22	Inner Casing Material:	PVC
Comments:	Not Reported		

M61
NW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000130555**

Permit #:	86618	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	13-MAY-91
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported

Local ID:	Not Reported	Application Received:	19-APR-91
Constr Review Date:	19-APR-91	Permit Approval Date:	19-APR-91
Actual Construction Date:	Not Reported	Completion Report Date:	13-MAY-91
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	20
Screen Base:	30	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	143226	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Earth Environmental Drilling Inc		
License #:	813	Grout Top:	0
Grout Base:	18	Grout Material:	Bentonite
Gravel Top:	18	Gravel Base:	30
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	20	Inner Casing Material:	PVC
Comments:	Not Reported		

M62
NW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000124782**

Permit #:	10272	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Well Abandoned
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	01-JAN-48
Proposed Drill Method:	Other	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	160
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	01-JAN-51
Constr Review Date:	01-JAN-51	Permit Approval Date:	01-JAN-51
Actual Construction Date:	Not Reported	Completion Report Date:	01-JAN-48
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported

Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	107605	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Not Reported	License #:	0
Grout Top:	0	Grout Base:	160
Grout Material:	Neat Cement	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

M63
NW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000130557**

Permit #:	86620	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	14-MAY-91
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	39
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	19-APR-91
Constr Review Date:	19-APR-91	Permit Approval Date:	19-APR-91
Actual Construction Date:	Not Reported	Completion Report Date:	14-MAY-91
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	29
Screen Base:	39	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	138002	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Earth Environmental Drilling Inc		
License #:	813	Grout Top:	0
Grout Base:	27	Grout Material:	Bentonite
Gravel Top:	27	Gravel Base:	39
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	29	Inner Casing Material:	PVC
Comments:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
M64 **NW** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000132888**

Permit #:	154641	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	10-041.20-015	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	14-JAN-98
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Potomac Upper Zone	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	14-JAN-98
Total Proposed Depth:	0	Actual Total Depth:	170
Well Terminus Inches:	0	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW-1	Application Received:	22-OCT-97
Constr Review Date:	22-OCT-97	Permit Approval Date:	22-OCT-97
Actual Construction Date:	Not Reported	Completion Report Date:	14-JAN-98
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	122
Screen Base:	162	Screen Material:	PVC
Min Well Diameter:	4	Max Well Diameter:	4
Loc ID:	149648	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Artesian Water Company	License #:	157
Grout Top:	0	Grout Base:	112
Grout Material:	Bentonite	Gravel Top:	116
Gravel Base:	170	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	122
Inner Casing Material:	PVC	Comments:	Not Reported

M65 **NW** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000130559**

Permit #:	86622	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	15-MAY-91
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported

Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	36
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	19-APR-91
Constr Review Date:	19-APR-91	Permit Approval Date:	19-APR-91
Actual Construction Date:	Not Reported	Completion Report Date:	15-MAY-91
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	26
Screen Base:	36	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	139411	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Earth Environmental Drilling Inc		
License #:	813	Grout Top:	0
Grout Base:	24	Grout Material:	Bentonite
Gravel Top:	24	Gravel Base:	36
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	26	Inner Casing Material:	PVC
Comments:	Not Reported		

M66
NW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000130558**

Permit #:	86621	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Well Abandoned
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	15-MAY-91
Proposed Drill Method:	Augered	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	30
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	19-APR-91
Constr Review Date:	19-APR-91	Permit Approval Date:	19-APR-91
Actual Construction Date:	Not Reported	Completion Report Date:	15-MAY-91
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No

Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	20
Screen Base:	30	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	138003	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walter E Welldriler	License #:	4058
Grout Top:	0	Grout Base:	18
Grout Material:	Bentonite	Gravel Top:	18
Gravel Base:	30	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	20
Inner Casing Material:	PVC	Comments:	Not Reported

67
WSW **FED USGS** **USGS40000231704**
1/2 - 1 Mile
Higher

Organization ID:	USGS-MD	Organization Name:	USGS Maryland Water Science Center
Monitor Location:	Dc33-07	Type:	Well
Description:	DGS Lat/Long:N393740W753719		
HUC:	02040205	Drainage Area:	Not Reported
Drainage Area Units:	Not Reported	Contrib Drainage Area:	Not Reported
Contrib Drainage Area Unts:	Not Reported		
Aquifer:	Northern Atlantic Coastal Plain aquifer system		
Formation Type:	Potomac Formation	Aquifer Type:	Not Reported
Construction Date:	19790917	Well Depth:	215
Well Depth Units:	ft	Well Hole Depth:	215
Well Hole Depth Units:	ft		

68
WNW **DE WELLS** **DE2000000120186**
1/2 - 1 Mile
Higher

Permit #:	221192	Local Well ID:	MW #1
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	10-040.00-033	Septic Permit #:	n/a
Well Authorization Code:	3951428	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Hydropunch	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	47	Water Level Date:	26-SEP-07
Total Proposed Depth:	50	Actual Total Depth:	55
Well Terminus Inches:	0	Well Terminus Type:	Other
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	17-SEP-07
Constr Review Date:	18-SEP-07	Permit Approval Date:	19-SEP-07

Actual Construction Date:	Not Reported	Completion Report Date:	24-OCT-07
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	Yes	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	35
Screen Base:	55	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	361388	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Draper Environmental Services		
License #:	5374	Grout Top:	0
Grout Base:	25	Grout Material:	Bentonite
Gravel Top:	33	Gravel Base:	55
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	35	Inner Casing Material:	PVC
Comments:	Not Reported		

N69
NE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000125799**

Permit #:	56187	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	1	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	16-FEB-84
Proposed Drill Method:	Augered	Formation:	Columbia Gp
Aquifer:	Columbia Gp	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	17
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	14-FEB-84
Constr Review Date:	14-FEB-84	Permit Approval Date:	14-FEB-84
Actual Construction Date:	Not Reported	Completion Report Date:	16-FEB-84
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	4.5
Screen Base:	14.5	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	118950	Watershed:	Army Creek

Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	0	Grout Base:	0
Grout Material:	Neat Cement	Gravel Top:	0
Gravel Base:	14.5	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	4.5
Inner Casing Material:	PVC	Comments:	Not Reported

N70
NE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000125798**

Permit #:	56186	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	1	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	14-FEB-84
Proposed Drill Method:	Augered	Formation:	Columbia Gp
Aquifer:	Columbia Gp	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	15.5
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	14-FEB-84
Constr Review Date:	14-FEB-84	Permit Approval Date:	14-FEB-84
Actual Construction Date:	Not Reported	Completion Report Date:	14-FEB-84
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	5.5
Screen Base:	15.5	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	115448	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	0	Grout Base:	3
Grout Material:	Neat Cement	Gravel Top:	3
Gravel Base:	15.5	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	5.5
Inner Casing Material:	PVC	Comments:	Not Reported

Map ID Direction Distance Elevation	Database	EDR ID Number
N71 **NE** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000125800**

Permit #:	56188	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	1	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	18-FEB-84
Proposed Drill Method:	Augered	Formation:	Columbia Gp
Aquifer:	Columbia Gp	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	17.5
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	14-FEB-84
Constr Review Date:	14-FEB-84	Permit Approval Date:	14-FEB-84
Actual Construction Date:	Not Reported	Completion Report Date:	18-FEB-84
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	4.5
Screen Base:	14.5	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	115252	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	0	Grout Base:	2
Grout Material:	Neat Cement	Gravel Top:	2
Gravel Base:	14.5	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	4.5
Inner Casing Material:	PVC	Comments:	Not Reported

N72 **NE** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000125802**

Permit #:	56190	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	1	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	17-FEB-84
Proposed Drill Method:	Augered	Formation:	Columbia Gp
Aquifer:	Columbia Gp	Pump:	Not Reported

Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	15.5
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	14-FEB-84
Constr Review Date:	14-FEB-84	Permit Approval Date:	14-FEB-84
Actual Construction Date:	Not Reported	Completion Report Date:	17-FEB-84
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	4.5
Screen Base:	14.5	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	115450	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	0	Grout Base:	2
Grout Material:	Neat Cement	Gravel Top:	2
Gravel Base:	14.5	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	4.5
Inner Casing Material:	PVC	Comments:	Not Reported

N73
NE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000125801**

Permit #:	56189	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	1	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	17-FEB-84
Proposed Drill Method:	Augered	Formation:	Columbia Gp
Aquifer:	Columbia Gp	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	18.5
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	14-FEB-84
Constr Review Date:	14-FEB-84	Permit Approval Date:	14-FEB-84
Actual Construction Date:	Not Reported	Completion Report Date:	17-FEB-84
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No

Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	4.5
Screen Base:	14.5	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	115449	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	0	Grout Base:	2
Grout Material:	Neat Cement	Gravel Top:	2
Gravel Base:	14.5	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	4.5
Inner Casing Material:	PVC	Comments:	Not Reported

O74
SW
1/2 - 1 Mile
Higher

FED USGS **USGS40000231699**

Organization ID:	USGS-MD	Organization Name:	USGS Maryland Water Science Center
Monitor Location:	Db33-19	Type:	Well
Description:	One of three wells in hole		
HUC:	02040205	Drainage Area:	Not Reported
Drainage Area Units:	Not Reported	Contrib Drainage Area:	Not Reported
Contrib Drainage Area Unts:	Not Reported		
Aquifer:	Northern Atlantic Coastal Plain aquifer system		
Formation Type:	Columbia Group	Aquifer Type:	Unconfined single aquifer
Construction Date:	19800926	Well Depth:	39
Well Depth Units:	ft	Well Hole Depth:	243
Well Hole Depth Units:	ft		

Ground water levels,Number of Measurements:	69	Level reading date:	2004-09-16
Feet below surface:	26.53	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	2004-08-18	Feet below surface:	26.21
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-07-13	Feet below surface:	26.16
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-06-14	Feet below surface:	26.47
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-05-19	Feet below surface:	26.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-04-12	Feet below surface:	26.36
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-03-17	Feet below surface:	26.46
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-02-18	Feet below surface:	26.41
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	2004-01-12	Feet below surface:	26.18
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-12-12	Feet below surface:	26.07
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-11-13	Feet below surface:	26.15
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-10-14	Feet below surface:	26.53
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-09-24	Feet below surface:	26.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-04-30	Feet below surface:	26.28
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-10-30	Feet below surface:	26.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-04-30	Feet below surface:	26.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-10-23	Feet below surface:	27.26
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-04-12	Feet below surface:	26.71
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-10-03	Feet below surface:	26.77
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-04-19	Feet below surface:	23.69
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1999-10-14	Feet below surface:	26.22
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1999-04-30	Feet below surface:	26.51
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1998-10-20	Feet below surface:	26.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-10-24	Feet below surface:	27.66
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-04-30	Feet below surface:	26.23
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-10-01	Feet below surface:	27.06
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-05-03	Feet below surface:	26.24
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-10-12	Feet below surface:	26.81
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-04-07	Feet below surface:	26.62
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1994-10-19	Feet below surface:	26.96
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-04-19	Feet below surface:	26.49
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-11-10	Feet below surface:	26.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-04-07	Feet below surface:	26.31
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-10-23	Feet below surface:	27.07
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-04-20	Feet below surface:	26.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1991-10-21	Feet below surface:	27.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1991-04-05	Feet below surface:	26.46
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-10-15	Feet below surface:	26.42
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-04-16	Feet below surface:	26.47
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-10-10	Feet below surface:	26.29
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-04-25	Feet below surface:	26.26
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-11-15	Feet below surface:	26.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-10-18	Feet below surface:	26.41
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-02-22	Feet below surface:	25.86
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1987-08-24	Feet below surface:	26.64
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1987-03-11	Feet below surface:	26.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1985-08-22	Feet below surface:	26.43
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1985-02-04	Feet below surface:	25.87
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-10-10	Feet below surface:	26.13
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-04-16	Feet below surface:	25.88
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1983-11-21	Feet below surface:	25.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-04-18	Feet below surface:	25.59
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-10-12	Feet below surface:	26.68
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-04-20	Feet below surface:	26.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-11-13	Feet below surface:	26.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-14	Feet below surface:	26.77
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-14	Feet below surface:	25.71
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-13	Feet below surface:	26.58
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-07-14	Feet below surface:	25.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-06-12	Feet below surface:	26.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-05-15	Feet below surface:	26.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-16	Feet below surface:	27.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-03	Feet below surface:	28.23
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-18	Feet below surface:	27.58
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-02-13	Feet below surface:	26.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-01-15	Feet below surface:	26.92
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-12-15	Feet below surface:	26.89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-16	Feet below surface:	26.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-16	Feet below surface:	26.69
Feet to sea level:	Not Reported	Note:	Not Reported

Map ID Direction Distance Elevation	Database	EDR ID Number
O75 **SW** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS40000231700**

Organization ID:	USGS-MD	Organization Name:	USGS Maryland Water Science Center
Monitor Location:	Db33-18	Type:	Well
Description:	One of three wells in one hole		
HUC:	02040205	Drainage Area:	Not Reported
Drainage Area Units:	Not Reported	Contrib Drainage Area:	Not Reported
Contrib Drainage Area Unts:	Not Reported		
Aquifer:	Northern Atlantic Coastal Plain aquifer system		
Formation Type:	Potomac Formation	Aquifer Type:	Not Reported
Construction Date:	19800926	Well Depth:	143
Well Depth Units:	ft	Well Hole Depth:	243
Well Hole Depth Units:	ft		

Ground water levels,Number of Measurements:	69	Level reading date:	2004-09-16
Feet below surface:	94.32	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	2004-08-18	Feet below surface:	92.21
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-07-13	Feet below surface:	87.97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-06-14	Feet below surface:	92.09
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-05-19	Feet below surface:	91.27
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-04-12	Feet below surface:	139.94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-03-17	Feet below surface:	92.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-02-18	Feet below surface:	94.99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-01-12	Feet below surface:	96.63
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-12-12	Feet below surface:	95.58
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-11-13	Feet below surface:	95.09
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-10-14	Feet below surface:	93.81
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-09-24	Feet below surface:	98.97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-04-30	Feet below surface:	99.27
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	2002-10-30	Feet below surface:	98.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-04-30	Feet below surface:	89.98
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-10-23	Feet below surface:	96.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-04-12	Feet below surface:	108.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-10-03	Feet below surface:	109.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-04-19	Feet below surface:	110.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1999-10-14	Feet below surface:	102.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1999-04-30	Feet below surface:	104.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1998-10-20	Feet below surface:	98.28
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-10-24	Feet below surface:	109.71
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-04-30	Feet below surface:	101.53
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-10-01	Feet below surface:	97.31
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-05-03	Feet below surface:	104.16
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-10-12	Feet below surface:	88.31
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-04-07	Feet below surface:	101.62
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-10-19	Feet below surface:	104.75
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-04-19	Feet below surface:	102.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-11-10	Feet below surface:	91.32
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-04-07	Feet below surface:	96.46
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-10-23	Feet below surface:	105.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-04-20	Feet below surface:	106.06
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1991-10-21	Feet below surface:	107.56
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1991-04-05	Feet below surface:	111.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-10-15	Feet below surface:	113.44
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-04-16	Feet below surface:	109.71
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-10-10	Feet below surface:	105.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-04-29	Feet below surface:	109.09
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-11-15	Feet below surface:	94.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-10-18	Feet below surface:	94.53
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-02-22	Feet below surface:	100.55
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1987-08-24	Feet below surface:	106.06
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1987-03-11	Feet below surface:	103.32
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1985-08-22	Feet below surface:	102.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1985-02-04	Feet below surface:	99.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-10-10	Feet below surface:	99.17
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-04-16	Feet below surface:	96.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-11-21	Feet below surface:	99.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-04-18	Feet below surface:	106.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-10-12	Feet below surface:	98.73
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-04-20	Feet below surface:	102.53
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-11-13	Feet below surface:	99.94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-14	Feet below surface:	99.43
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1981-09-14	Feet below surface:	100.76
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-13	Feet below surface:	100.73
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-07-14	Feet below surface:	103.43
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-06-12	Feet below surface:	103.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-05-15	Feet below surface:	102.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-16	Feet below surface:	103.23
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-03	Feet below surface:	106.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-18	Feet below surface:	107.06
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-02-13	Feet below surface:	105.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-01-15	Feet below surface:	105.27
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-12-15	Feet below surface:	104.62
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-13	Feet below surface:	102.34
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-16	Feet below surface:	98.85
Feet to sea level:	Not Reported	Note:	Not Reported

O76
SW
1/2 - 1 Mile
Higher

FED USGS **USGS40000231701**

Organization ID:	USGS-MD	Organization Name:	USGS Maryland Water Science Center
Monitor Location:	Db33-17	Type:	Well
Description:	One of three wells in one hole		
HUC:	02040205	Drainage Area:	Not Reported
Drainage Area Units:	Not Reported	Contrib Drainage Area:	Not Reported
Contrib Drainage Area Unts:	Not Reported		
Aquifer:	Northern Atlantic Coastal Plain aquifer system		
Formation Type:	Potomac Formation	Aquifer Type:	Not Reported
Construction Date:	19800926	Well Depth:	189
Well Depth Units:	ft	Well Hole Depth:	243
Well Hole Depth Units:	ft		

Ground water levels,Number of Measurements:	69	Level reading date:	2004-09-16
Feet below surface:	97.58	Feet to sea level:	Not Reported
Note:	Not Reported		

Level reading date:	2004-08-18	Feet below surface:	95.29
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-07-13	Feet below surface:	90.32
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-06-14	Feet below surface:	94.82
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-05-19	Feet below surface:	94.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-04-12	Feet below surface:	93.36
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-03-17	Feet below surface:	94.22
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-02-18	Feet below surface:	97.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2004-01-12	Feet below surface:	98.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-12-12	Feet below surface:	98.61
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-11-13	Feet below surface:	83.24
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-10-14	Feet below surface:	97.36
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-09-24	Feet below surface:	101.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2003-04-30	Feet below surface:	101.77
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-10-30	Feet below surface:	102.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2002-04-30	Feet below surface:	92.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-10-23	Feet below surface:	99.51
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2001-04-12	Feet below surface:	111.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-10-03	Feet below surface:	112.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	2000-04-19	Feet below surface:	114.10
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1999-10-14	Feet below surface:	105.59
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1999-04-30	Feet below surface:	107.19
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1998-10-20	Feet below surface:	101.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-10-24	Feet below surface:	112.25
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1997-04-30	Feet below surface:	104.07
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-10-01	Feet below surface:	99.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1996-05-03	Feet below surface:	106.74
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-10-12	Feet below surface:	90.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1995-04-07	Feet below surface:	104.00
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-10-19	Feet below surface:	107.28
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1994-04-19	Feet below surface:	104.68
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-11-10	Feet below surface:	93.21
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1993-04-07	Feet below surface:	98.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-10-23	Feet below surface:	108.09
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1992-04-20	Feet below surface:	108.58
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1991-10-21	Feet below surface:	109.66
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1991-04-05	Feet below surface:	114.56
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-10-15	Feet below surface:	115.82
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1990-04-16	Feet below surface:	113.87
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-10-10	Feet below surface:	107.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1989-04-25	Feet below surface:	115.72
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-11-15	Feet below surface:	97.31
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1988-10-18	Feet below surface:	96.13
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1988-02-22	Feet below surface:	101.66
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1987-08-24	Feet below surface:	108.99
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1987-03-11	Feet below surface:	108.20
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1985-08-22	Feet below surface:	104.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1985-02-04	Feet below surface:	102.76
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-10-10	Feet below surface:	101.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1984-04-16	Feet below surface:	97.93
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-11-21	Feet below surface:	102.12
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1983-04-18	Feet below surface:	109.08
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-10-12	Feet below surface:	101.14
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1982-04-19	Feet below surface:	105.51
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-11-13	Feet below surface:	101.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-10-14	Feet below surface:	101.85
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-09-14	Feet below surface:	102.76
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-08-13	Feet below surface:	103.03
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-07-14	Feet below surface:	105.53
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-06-12	Feet below surface:	106.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-05-15	Feet below surface:	104.83
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-16	Feet below surface:	105.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-04-03	Feet below surface:	104.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-03-18	Feet below surface:	109.36
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1981-02-13	Feet below surface:	109.35
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1981-01-15	Feet below surface:	105.26
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-12-15	Feet below surface:	108.71
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-11-13	Feet below surface:	104.89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-10-16	Feet below surface:	102.40
Feet to sea level:	Not Reported	Note:	Not Reported

P77
North
1/2 - 1 Mile
Higher

DE WELLS **DE2000000121407**

Permit #:	228950	Local Well ID:	Not Reported
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	10-035.00-005	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Voided
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Not Reported	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	Not Reported
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	0
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	30-JUL-09
Constr Review Date:	Not Reported	Permit Approval Date:	Not Reported
Actual Construction Date:	Not Reported	Completion Report Date:	Not Reported
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	Yes	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	Yes	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	814087	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	AmeriDrill Inc	License #:	4162
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

Map ID Direction Distance Elevation	Database	EDR ID Number
Q78 **NE** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000112597**

Permit #:	247192	Local Well ID:	Not Reported
Well Type:	Monitor - Direct Push	DGS ID:	Not Reported
Tax ID:	10-035.00-043	Septic Permit #:	Not Reported
Well Authorization Code:	8835876	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Geo-Probe	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	6	Retain Well:	N
Static Water Level:	4.71	Water Level Date:	05-SEP-14
Total Proposed Depth:	13	Actual Total Depth:	16
Well Terminus Inches:	-3	Well Terminus Type:	Pad Mount
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	27-MAY-14
Constr Review Date:	29-MAY-14	Permit Approval Date:	29-MAY-14
Actual Construction Date:	Not Reported	Completion Report Date:	04-SEP-14
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	4
Screen Base:	14	Screen Material:	PVC
Min Well Diameter:	.75	Max Well Diameter:	.75
Loc ID:	1051314	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	3	Grout Material:	Bentonite
Gravel Top:	3	Gravel Base:	14
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	4	Inner Casing Material:	PVC
Comments:	Not Reported		

Q79 **NE** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000112596**	

Permit #:	247191	Local Well ID:	Not Reported
Well Type:	Monitor - Direct Push	DGS ID:	Not Reported
Tax ID:	10-035.00-043	Septic Permit #:	Not Reported
Well Authorization Code:	8835876	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Geo-Probe	Formation:	Undetermined

Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	3	Water Level Date:	05-SEP-14
Total Proposed Depth:	13	Actual Total Depth:	16
Well Terminus Inches:	-3	Well Terminus Type:	Pad Mount
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	27-MAY-14
Constr Review Date:	29-MAY-14	Permit Approval Date:	29-MAY-14
Actual Construction Date:	Not Reported	Completion Report Date:	04-SEP-14
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	Yes	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	2.5
Screen Base:	12.5	Screen Material:	PVC
Min Well Diameter:	.75	Max Well Diameter:	.75
Loc ID:	1051313	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	0	Grout Material:	Bentonite
Gravel Top:	0	Gravel Base:	12.5
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	2.5	Inner Casing Material:	PVC
Comments:	Not Reported		

Q80
NE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000112599**

Permit #:	247194	Local Well ID:	Not Reported
Well Type:	Monitor - Direct Push	DGS ID:	Not Reported
Tax ID:	10-035.00-043	Septic Permit #:	Not Reported
Well Authorization Code:	8835876	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Geo-Probe	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	4.58	Water Level Date:	05-SEP-14
Total Proposed Depth:	13	Actual Total Depth:	12
Well Terminus Inches:	-3	Well Terminus Type:	Pad Mount
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	27-MAY-14
Constr Review Date:	29-MAY-14	Permit Approval Date:	29-MAY-14
Actual Construction Date:	Not Reported	Completion Report Date:	04-SEP-14
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No

Groundwater Mgmt Zone:	No	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	2
Screen Base:	12	Screen Material:	PVC
Min Well Diameter:	4	Max Well Diameter:	4
Loc ID:	1051316	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	2	Grout Material:	Bentonite
Gravel Top:	2	Gravel Base:	12
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	2	Inner Casing Material:	PVC
Comments:	Not Reported		

Q81
NE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000112598**

Permit #:	247193	Local Well ID:	Not Reported
Well Type:	Monitor - Direct Push	DGS ID:	Not Reported
Tax ID:	10-035.00-043	Septic Permit #:	Not Reported
Well Authorization Code:	8835876	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Geo-Probe	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	6.91	Water Level Date:	05-SEP-14
Total Proposed Depth:	13	Actual Total Depth:	16
Well Terminus Inches:	-3	Well Terminus Type:	Pad Mount
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	27-MAY-14
Constr Review Date:	29-MAY-14	Permit Approval Date:	29-MAY-14
Actual Construction Date:	Not Reported	Completion Report Date:	04-SEP-14
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	4
Screen Base:	14	Screen Material:	PVC
Min Well Diameter:	.75	Max Well Diameter:	.75
Loc ID:	1051315	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0

Grout Base:	3	Grout Material:	Bentonite
Gravel Top:	3	Gravel Base:	14
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	4	Inner Casing Material:	PVC
Comments:	Not Reported		

R82
WSW
1/2 - 1 Mile
Higher

DE WELLS **DE2000000068036**

Permit #:	167662	Local Well ID:	Not Reported
Well Type:	Domestic - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	15	Est Daily Use:	150
Require Alloc Permit:	NO	Est Construction Date:	03-JAN-00
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	60	Test Rate:	30
Rated Capacity:	7	Test Time:	2
Water Level:	50	Retain Well:	0
Static Water Level:	16	Water Level Date:	04-JAN-00
Total Proposed Depth:	0	Actual Total Depth:	80
Well Terminus Inches:	8	Well Terminus Type:	Pitless Adaptor
Replacement Well:	Y	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Federal School	Application Received:	08-SEP-99
Constr Review Date:	08-SEP-99	Permit Approval Date:	08-SEP-99
Actual Construction Date:	Not Reported	Completion Report Date:	03-JAN-00
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	65
Screen Base:	80	Screen Material:	PVC
Min Well Diameter:	4	Max Well Diameter:	4
Loc ID:	61935	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Middletown Well Drilling Company		
License #:	607	Grout Top:	3
Grout Base:	55	Grout Material:	Bentonite
Gravel Top:	55	Gravel Base:	80
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	65	Inner Casing Material:	PVC
Comments:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
R83 **WSW** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000021942**

Permit #:	39549	Local Well ID:	Not Reported
Well Type:	Domestic - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Pending
Est Max Capacity:	10	Est Daily Use:	1000
Require Alloc Permit:	NO	Est Construction Date:	10-OCT-77
Proposed Drill Method:	Mud Rotary	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	50
Rated Capacity:	0	Test Time:	3.5
Water Level:	50	Retain Well:	0
Static Water Level:	31	Water Level Date:	10-OCT-77
Total Proposed Depth:	0	Actual Total Depth:	75
Well Terminus Inches:	0	Well Terminus Type:	None
Replacement Well:	Y	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Federal Lane Rd	Application Received:	26-SEP-77
Constr Review Date:	26-SEP-77	Permit Approval Date:	26-SEP-77
Actual Construction Date:	Not Reported	Completion Report Date:	10-OCT-77
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	85833	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	A C Schultes Of Delaware	License #:	14
Grout Top:	0	Grout Base:	10
Grout Material:	Bentonite	Gravel Top:	70
Gravel Base:	85	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

R84 **WSW** **1/2 - 1 Mile** **Higher**	**DE WELLS**	**DE2000000068981**

Permit #:	170649	Local Well ID:	Not Reported
Well Type:	Domestic - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	10	Est Daily Use:	1000
Require Alloc Permit:	NO	Est Construction Date:	10-MAY-00
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported

Intake Setting:	60	Test Rate:	25
Rated Capacity:	10	Test Time:	2
Water Level:	50	Retain Well:	0
Static Water Level:	17	Water Level Date:	11-MAY-00
Total Proposed Depth:	0	Actual Total Depth:	75
Well Terminus Inches:	8	Well Terminus Type:	Pitless Adaptor
Replacement Well:	Y	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Fed Sch Ln	Application Received:	02-MAR-00
Constr Review Date:	02-MAR-00	Permit Approval Date:	02-MAR-00
Actual Construction Date:	Not Reported	Completion Report Date:	10-MAY-00
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	65
Screen Base:	75	Screen Material:	PVC
Min Well Diameter:	4	Max Well Diameter:	4
Loc ID:	63728	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Middletown Well Drilling Company		
License #:	607	Grout Top:	3
Grout Base:	60	Grout Material:	Bentonite
Gravel Top:	60	Gravel Base:	75
Gravel Material:	Gravel	Inner Casing Top:	0
Inner Casing Base:	65	Inner Casing Material:	PVC
Comments:	Not Reported		

85
NE
1/2 - 1 Mile
Higher

DE WELLS **DE2000000147872**

Permit #:	247198	Local Well ID:	Not Reported
Well Type:	Soil Borings - Standard	DGS ID:	Not Reported
Tax ID:	10-036.00-009	Septic Permit #:	Not Reported
Well Authorization Code:	8851441	Well Status:	Well Abandoned
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Geo-Probe	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	12	Actual Total Depth:	12
Well Terminus Inches:	0	Well Terminus Type:	Not Reported
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	27-MAY-14
Constr Review Date:	29-MAY-14	Permit Approval Date:	29-MAY-14
Actual Construction Date:	Not Reported	Completion Report Date:	04-SEP-14
Abandon Report Date:	05-SEP-14	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	Yes	Well Pit:	No

Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	1051306	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Northeast Regional Probing Inc		
License #:	4223	Grout Top:	0
Grout Base:	0	Grout Material:	Not Reported
Gravel Top:	0	Gravel Base:	0
Gravel Material:	Not Reported	Inner Casing Top:	0
Inner Casing Base:	0	Inner Casing Material:	Not Reported
Comments:	Not Reported		

P86
North
1/2 - 1 Mile
Higher

DE WELLS **DE2000000122413**

Permit #:	237679	Local Well ID:	UPA-02
Well Type:	Monitor - Standard	DGS ID:	Not Reported
Tax ID:	10-035.00-005	Septic Permit #:	Not Reported
Well Authorization Code:	4244482	Well Status:	Completed
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	Not Reported
Proposed Drill Method:	Vibracore	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	0	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	N
Static Water Level:	0	Water Level Date:	31-JAN-12
Total Proposed Depth:	165	Actual Total Depth:	177
Well Terminus Inches:	0	Well Terminus Type:	Pad Mount
Replacement Well:	N	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Not Reported	Application Received:	29-NOV-11
Constr Review Date:	01-DEC-11	Permit Approval Date:	01-DEC-11
Actual Construction Date:	Not Reported	Completion Report Date:	30-JAN-12
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	Yes	Well Pit:	Yes
Replacement:	No	Alloc Review:	No
Sampled:	Yes	CPCN:	Yes
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	Yes	Emergency:	No
Confined:	Yes	Reviewable:	No
Existing:	No	Screen Top:	151
Screen Base:	161	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	937483	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Cascade Drilling LP	License #:	5377
Grout Top:	0	Grout Base:	148
Grout Material:	Bentonite/Cement Mixture	Gravel Top:	148

Gravel Base:	161	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	151
Inner Casing Material:	PVC	Comments:	Not Reported

87
North
1/2 - 1 Mile
Higher

DE WELLS **DE2000000135703**

Permit #:	180113	Local Well ID:	Not Reported
Well Type:	Observation - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active
Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	02-AUG-01
Proposed Drill Method:	Mud Rotary	Formation:	Undetermined
Aquifer:	Undetermined	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	10
Rated Capacity:	0	Test Time:	1
Water Level:	32	Retain Well:	0
Static Water Level:	12	Water Level Date:	02-AUG-01
Total Proposed Depth:	0	Actual Total Depth:	210
Well Terminus Inches:	26	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	MW-5 ASR	Application Received:	19-JUL-01
Constr Review Date:	19-JUL-01	Permit Approval Date:	19-JUL-01
Actual Construction Date:	Not Reported	Completion Report Date:	02-AUG-01
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	92
Screen Base:	112	Screen Material:	PVC
Min Well Diameter:	2	Max Well Diameter:	2
Loc ID:	68959	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walton Corporation	License #:	52
Grout Top:	0	Grout Base:	90
Grout Material:	Bentonite	Gravel Top:	90
Gravel Base:	112	Gravel Material:	Gravel
Inner Casing Top:	0	Inner Casing Base:	92
Inner Casing Material:	PVC	Comments:	Not Reported

88
North
1/2 - 1 Mile
Higher

DE WELLS **DE2000000022560**

Permit #:	40337	Local Well ID:	Not Reported
Well Type:	Domestic - Standard	DGS ID:	Not Reported
Tax ID:	Not Reported	Septic Permit #:	Not Reported
Well Authorization Code:	Not Reported	Well Status:	Active

Est Max Capacity:	0	Est Daily Use:	0
Require Alloc Permit:	NO	Est Construction Date:	27-FEB-78
Proposed Drill Method:	Jetted	Formation:	Not Reported
Aquifer:	Not Reported	Pump:	Not Reported
Intake Setting:	Not Reported	Test Rate:	0
Rated Capacity:	0	Test Time:	0
Water Level:	0	Retain Well:	0
Static Water Level:	0	Water Level Date:	Not Reported
Total Proposed Depth:	0	Actual Total Depth:	17
Well Terminus Inches:	0	Well Terminus Type:	None
Replacement Well:	Not Reported	Replaced Well Permit #:	Not Reported
How Abandoned:	Not Reported	Why Abandoned:	Not Reported
Local ID:	Rt 9	Application Received:	01-FEB-78
Constr Review Date:	01-FEB-78	Permit Approval Date:	01-FEB-78
Actual Construction Date:	Not Reported	Completion Report Date:	27-FEB-78
Abandon Report Date:	Not Reported	Reclassify Date:	Not Reported
Potable:	No	Test Temp:	No
Groundwater Mgmt Zone:	No	Well Pit:	No
Replacement:	No	Alloc Review:	No
Sampled:	No	CPCN:	No
Ag Preservation District:	No	Floodplain:	No
Small Lot:	No	Injection:	No
Potential Contam in Vicinity:	No	Emergency:	No
Confined:	No	Reviewable:	No
Existing:	No	Screen Top:	0
Screen Base:	0	Screen Material:	Not Reported
Min Well Diameter:	0	Max Well Diameter:	0
Loc ID:	103550	Watershed:	Army Creek
Basin:	Delaware Bay	USGS Hydrologic Code:	2040205
Well Contractor:	Walter E Welldriler	License #:	4058
Grout Top:	0	Grout Base:	0
Grout Material:	Not Reported	Gravel Top:	0
Gravel Base:	0	Gravel Material:	Not Reported
Inner Casing Top:	0	Inner Casing Base:	0
Inner Casing Material:	Not Reported	Comments:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: DE Radon

Radon Test Results

Zipcode	Num Tests	< 4 pCi/L	4 - 10	10 - 20	> 20 pCi/L
19720	1701	1515	170	12	5

EPA Region 3 Statistical Summary Readings for Zip Code: 19720

Number of sites tested: 449.

Maximum Radon Level: 21.0 pCi/L.
Minimum Radon Level: 0.4 pCi/L.

pCi/L <4	pCi/L 4-10	pCi/L 10-20	pCi/L 20-50	pCi/L 50-100	pCi/L >100
416 (92.65%)	29 (6.46%)	3 (0.67%)	1 (0.22%)	0 (0.00%)	0 (0.00%)

Federal EPA Radon Zone for NEW CASTLE County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Statewide Wetlands Mapping Project
Source: Dept. of Natural Resources & Environmental Conservation
Telephone: 302-739-4691

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Delaware Water Well Data
Source: Department of Natural Resources and Environmental Conservation
Telephone: 302-739-4860

OTHER STATE DATABASE INFORMATION

RADON

State Database: DE Radon
Source: Division of Public Health
Telephone: 302-739-4731
Radon Screening Survey of Private Dwellings

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

EPA Region 3 Statistical Summary Readings
Source: Region 3 EPA
Telephone: 215-814-2082
Radon readings for Delaware, D.C., Maryland, Pennsylvania, Virginia and West Virginia.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

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