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February 14, 2018

Ms. Debra Rossi
Remedial Project Manager
United States Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

RE: Army Creek Landfill - New Castle County, Delaware
Work Plan for Additional Investigation

Dear Ms. Rossi:

This work plan has been prepared on behalf of New Castle County (NCC) and the Army Creek Private Settlors (ACPS) in response to the September 28, 2017 letter from the United States Environmental Protection Agency (USEPA) requesting additional investigation at the Army Creek Landfill (ACL; Site; USEPA, 2017). More specifically, in the September 28, 2017 letter, the USEPA indicated that additional investigation is needed to:

- Determine the extent of dissolved metals (subsequently agreed on January 11, 2018 to include iron, manganese, cobalt) and 1,2-dichloroethane (1,2-DCA) contamination in groundwater within the Upper Potomac Aquifer (UPA) downgradient of the Army Creek Landfill (ACL) Western Lobe.
- Evaluate the vulnerability of Artesian Water Company's (AWC's) Llangollen Wellfield to releases from the ACL Western Lobe.
- Determine whether the ACL is a source of per- and polyfluoroalkyl substances (PFAS) in groundwater within the UPA.

The scope included in this work plan was developed in consideration of the following:

- Discussions via teleconference on November 30, 2017 between representatives of the USEPA, State of Delaware Department of Natural Resources and Environmental Control (DNREC), NCC and ACPS
- Meeting on January 11, 2018 with representatives of the USEPA, DNREC, Artesian Water Company (AWC), NCC and ACPS at DNREC's offices
- Email dated January 19, 2018 and subsequent letter dated January 24, 2018 from the USEPA requesting analysis of major anions and cations in groundwater be added to the scope (USEPA, 2018a)
- Email dated January 31, 2018 from the USEPA in response to email from Ruth Associates Inc. (RAI) dated January 30, 2018. The USEPA's email approved

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RAI's request for extension of the submittal date to February 14, 2018, and indicated that the USEPA will require the scope include sampling and analysis of water within the ACL gas vents for PFAS. (USEPA, 2018b)

The following provides the background, conceptual site model (CSM), general approach, methodologies, reporting, and schedule.

## BACKGROUND

The ACL Site is a former 60-acre sand and gravel quarry that was operated as a landfill between 1960 and 1968 and received 1.9 million cubic yards of municipal and industrial wastes. (USEPA, 1998) The Site is bounded to the west and north by the Norfolk Southern Railroad and to the south and east by Army Creek/Army Pond, which eventually discharges to the Delaware River. Beyond Army Creek, to the east and northeast, there is another Superfund Site, the Delaware Sand & Gravel (DS&G) Site. The DS&G Site is not part of this scope of work; however, information available from investigations performed in connection with the DS&G Site are included within this Work Plan, and groundwater monitoring will be coordinated, to the extent possible, with monitoring being performed for DS&G, to provide synoptic data sets. The location of the ACL and DS&G Sites (Sites) and a map showing existing and proposed monitoring wells in the vicinity of the Sites are provided as Figures 1 and 2.

A stability evaluation of manganese, iron and cobalt in the vicinity of the ACL and DS&G Sites was prepared by RAI in response to a recommendation in the USEPA's Fourth Five-Year Review Report for the Site, dated September 8, 2014 (2014 FYR; USEPA, 2014). RAI's draft report dated December 12, 2016 (RAI, 2016) identified statistically significant increases in the concentrations of these metals at Monitoring Well P-4, located downgradient of the Western Lobe of the ACL, between 2006 and 2016. In addition, based on RAI's semi-annual monitoring reports, 1,2-DCA has frequently been detected in groundwater samples collected from Monitoring Well P-4 at concentrations that exceed the maximum concentration limit (MCL). The historical ground-water monitoring results from the wells located downgradient of the Western Lobe are provided as Attachment 1. The scope included in this work plan will assist with qualitative evaluation of the vulnerability of AWC's Llangollen Wellfield to migration of constituents from ACL's Western Lobe.

Manganese concentrations are increasing at AWC's Llangollen Wellfield, and AWC is in the process of designing a treatment system to reduce manganese concentrations to below the secondary drinking water standard (aesthetic standard) of 50 micrograms per liter (ug/l) prior to public distribution. The contaminant plume located between the DS&G Site and the eastern lobe of the ACL that extends downgradient to AWC's Llangollen Wellfield will be mitigated through the remedial actions put forth in the DS&G Record of Decision Amendment No. 2 issued by the USEPA on December 12, 2017.

Based on per- and polyfluoroalkyl substances (PFAS) groundwater monitoring results for samples collected by Golder Associates Inc. from UPA monitoring wells located

downgradient of the ACL and DS&G Sites (see Attachment 2), perfluorooctanoic acid (PFOA) and/or perfluorooctanyl sulfonate (PFOS) have been detected above the Health Advisory (HA) of 70 nanograms per liter (ng/l; individually and/or in combination) in monitoring wells along the downgradient edge of the ACL, including Wells P-4, MW-29, and MW-31. Based on a preliminary assessment performed by DNREC in 2015, there are numerous upgradient Sites that may be the source(s) of, or potential contributors to, the PFAS concentrations detected in the UPA downgradient of the Sites.

## CONCEPTUAL SITE MODEL

### Hydrogeology

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, with highly variable lateral and vertical distribution of sand, silt, clay and gravel. Figure 3 provides the conceptual stratigraphic column described herein. The Columbia rests unconformably upon the upper portion of the UPA. There are occasional subcrop zones (zero-clay areas) where the Upper Potomac Confining Unit (UPCU) has been eroded away and replaced by sands, gravels and cobbles as evidenced by the presence of the Columbia basal gravel unit in areas where paleochannels exist. In the subcrop zones in the vicinity of the Sites, the Columbia Aquifer is in direct contact with the generally fining-upward sequence that is present between the UPCU and the top of the UPA upper sand, referred to as the Transition Zone, or UPCUTZ.

Within the UPA, which is the focus of this study, there is an intermittent clay unit referred to as the Upper Potomac Dividing Clay (UPDC), which separates the UPA into two sand units - the upper sand (US) of the UPA and the lower sand (LS) of the UPA. Based on an oral report from AWC during the January 11, 2018 meeting, the UPDC was not observed during the recent advancement of a borehole for installation of replacement production well AWC-6R.

Columbia Aquifer groundwater is recharged by precipitation, with the exception of the capped area of the Site which is designed to reduce infiltration. The localized groundwater flow direction within the Columbia Aquifer is generally toward Army Pond and Army Creek, which discharges to the Delaware River to the northeast of the ACL Site. The general groundwater flow direction in the UPA is to the south/southeast toward the AWC's Llangollen Wellfield, and the presumed dominant direction of groundwater flow downgradient of ACL's Western Lobe is shown in Figure 2. Prior to the groundwater withdrawals in this area, the natural groundwater flow in the UPA was toward the Delaware River, located to the east of the Site.

The UPA is a confined aquifer except in areas near the zero-clay areas where the UPA is semi-confined. There is generally a strong downward vertical gradient from the Columbia to the UPA, and between the UPA upper sand to the UPA lower sand, due to extraction, predominantly from the UPA lower sand, by AWC at its Llangollen Wellfield.

## Current and Historical Aquifer Use

The UPA is used regionally as a drinking water supply. The groundwater within the UPA upper and lower sand units is withdrawn and treated by AWC at its Llangollen Wellfield. The extraction wells in use by AWC in the Llangollen Wellfield have changed over time, causing shifts in the groundwater flow direction. Prior to the 1980s, wells in the western portion of the wellfield (AWC-2, AWC-6, and AWC-7) were predominantly used. During the 1980s and 1990s, wells across the east-west extent of the wellfield were used (wells AWC-2, AWC-6, AWC-7, AWC-G3 and AWC-K1). Between the late 1990s through 2012, extraction shifted to the wells in the eastern portion of the wellfield (AWC-G3 and AWC-K1) with some contribution from Well AWC-7 in the western portion of the wellfield. The well screens on Wells AWC-K1 and AWC-G3 failed in 2012, and withdrawal shifted to Wells AWC-7 and AWC-2 with a total withdrawal rate ranging from 0 to 1 million-gallons-per-day (MGD) until 2014. Since 2014, AWC has been withdrawing from Wells AWC-2, AWC-6, AWC-7 and AWC-G3R, and average total withdrawal rates have increased to approximately 2 MGD. Due to a screen failure in 2017, Well AWC-6 was replaced by well AWC-6R and brought online in January 2018.

Historical pumping in the area included a groundwater recovery system installed and operated by NCC between 1973 and 2004 to extract contaminated groundwater from the UPA between ACL and AWC's Llangollen Wellfield. Extraction rates in the early years of operation were as high as 1.7 MGD, and declined over time to less than 1.0 MGD as the wells, pumps and distribution system became fouled. Between 1992 and 1993, a cap was constructed on the ACL. After installation of the landfill cap, NCC installed and began operating a treatment plant to decrease the iron concentrations in the extracted water prior to discharge to Army Creek, until shut-down of the system occurred in 2004.

## Groundwater Management

As discussed above, the UPA is used regionally for drinking water, with AWC's Llangollen Wellfield located approximately 2,100 feet to the southeast of the westernmost portion of the ACL Site. As a result of the aquifer use activities in the area, the Site and surrounding area is considered a Delaware Wellhead Protection Area.

In June 2006, the DNREC Division of Air and Waste Management and the DNREC Division of Water Resources entered into a "Memorandum of Agreement" (MOA) for the "Army Creek & Vicinity, New Castle, Delaware" (DNREC, 2006). The MOA establishes two groundwater management zones (GMZs) to manage releases from ten state-listed sites in the vicinity of Army Creek "and to protect exposure of the public by way of potential groundwater contamination." In general, the GMZs were established to prevent installation of new public or domestic water supply wells without additional layers of State review. Based on discussions with AWC and DNREC, it is anticipated that future use will be similar to current use.

**Surface Water**

Surface-water samples collected as part of the monitoring program for the ACL Site do not indicate impacts in surface water in Army Creek located between the Sites. Historical surface water monitoring results for monitoring conducted through 2017 are provided in Attachment 3. There are no known or documented surface-discharge points for the impacted UPA groundwater associated with the ACL since shutdown of the groundwater-recovery system. Based on the strong downward gradients between the Columbia Aquifer and the UPA, discharge of UPA groundwater to the Columbia Aquifer and/or surface water does not occur.

## APPROACH AND METHODOLOGIES

The approach and an overview of the methodologies that will be employed for this program are outlined below. Detailed descriptions of the field methods, documentation and quality assurance/quality control procedures that will be employed are provided in the Sampling and Analysis Plan (SAP), which is provided as Attachment 4.

**Western Lobe Study Area**

The following activities will be conducted to evaluate the extent of iron, manganese, cobalt and 1,2-DCA in the UPA downgradient of the ACL Western Lobe and the vulnerability of AWC's Llangollen Wellfield to releases from ACL's Western Lobe:

- The existing UPA monitoring network will be expanded through installation of additional monitoring wells downgradient of the Western Lobe. A total of four new UPA wells will be installed as shown on Figure 2:
    - one new well (P-4L) will be screened in the UPA lower sand adjacent to existing UPA upper sand well P-4, to complete the UPA upper and lower sand well pair at that location;
    - one new well (MW-22NU) will be screened in the UPA upper sand adjacent to existing UPA lower sand well MW-22N, to complete the UPA upper and lower sand well pair at that location; and
    - two new wells (WL-1U and WL-1L) will be installed to form a third pair (one UPA upper sand well and one UPA lower sand well) to the west/southwest of the P-4 and P-4/L well pair.

  Addition of these wells will create an east-west transect of UPA wells (MW-38N in the east, P-4 and P-4L in the center, and WL-1U and WL-1L in the west), and a north-south transect of UPA wells (P-4 and P-4L in the north, MW-22NU and MW-22N in the center, and AWC- 2, AWC-6R and AWC-7 in the south).

- Groundwater from UPA wells in the Western Lobe Study Area (see Figure 4) will be monitored for iron, manganese, and cobalt for four quarters and volatile organic compounds (VOCs) including 1,2-DCA semi-annually. Additionally, major anions and cations will be included in the list of analytes for the semi-annual events. The monitoring program is summarized in Table 1, and the well locations and the general Western Lobe Study Area are shown in Figure 2.

***Well Installation/Development***

Roto-sonic drilling methods will be employed to advance the boreholes for the proposed monitoring wells. Continuous lithologic logging will be used for all proposed wells.

The wells will be constructed of 2-inch diameter, PVC, with 10-foot long, 0.010-inch slotted screen, and will be installed through 8-inch diameter, steel isolation casing grouted into the UPCU (competent clay) which divides, where present, the Columbia Aquifer from the UPA. If the UPCU is absent, the isolation casing will be grouted into a lower conductivity portion of the UPCUTZ. The placement of the well screens will be determined in the field, based on: 1) observed volatile organic impact based on organic vapor (i.e., PID) readings (although unlikely) and/or 2) visual evidence of impacts. If there is no evidence of either, then the screen interval will be set across the portion of the UPA (either upper sand or lower sand) with the coarsest materials. Additional information is provided in the SAP (see Attachment 4).

The wells will be developed using swabbing and purging, until clear, sediment-free (low turbidity) water is produced. Pumping rates, observed drawdowns and field parameters will be documented. Additional information is provided in the SAP (see Attachment 4).

***Surveying***

All new wells will be surveyed for location, ground elevation, top of PVC elevation and top of steel casing elevation. Certain wells for which discrepancies exist between the ACL and DS&G survey data, or which may otherwise be suspect, will be re-surveyed as part of this effort. Additional information is provided in the SAP (see Attachment 4).

***Groundwater Monitoring***

Groundwater samples will be collected from the wells located in the Western Lobe Study Area as shown in Figure 4. A summary of the proposed groundwater-monitoring program is provided in Table 1. Samples will be collected during four quarterly monitoring events, two of which will be synoptic with the ACL semi-annual (April) and annual (October) sampling events.

The primary constituents of interest are iron, manganese and cobalt, and samples will be collected for analysis of both total and dissolved for these constituents during the four quarterly events. The semi-annual and annual sampling events will include sample collection for and analysis of VOCs including 1,2-DCA and major cations and anions (i.e., calcium, magnesium, sodium, potassium, ammonia, nitrate, nitrite, ferrous iron, bicarbonate, chloride, sulfate, and sulfide). Details of the sample collection, handling and analyses are provided in the SAP (see Attachment 4).

These data will be used to evaluate spatial distribution and temporal trends to evaluate the extent of the impacts from the Western Lobe and to qualitatively evaluate the vulnerability of AWC's Llangollen Wellfield from iron, manganese and/or 1,2-DCA concentrations observed in Well P-4.

**PFAS Source Evaluation**

PFAS has been detected in the majority of the UPA wells sampled downgradient of the DS&G and ACL Sites. Based on a preliminary assessment performed by DNREC in 2015, there are numerous upgradient sites that may be the source(s) of, or potential contributors to, the PFAS concentrations detected in the UPA downgradient of the Sites.

Evaluation of the ACL as a potential source of or contributor to the PFAS concentrations detected in UPA groundwater will be performed by getting a "snapshot" of the distribution of PFAS in groundwater in the vicinity of the ACL and DS&G Sites. During the first semi-annual sampling event conducted after installation of the new wells, groundwater samples will be collected from the wells shown on Table 1 and Figure 4, which will include UPA wells located upgradient and downgradient of the ACL, and the samples will be analyzed for the list of PFAS included in the SAP (see Attachment 4). This event will be synchronized with a DS&G PFAS sampling event, and the complete sets of data collected for both sites will be included in the evaluation.

At the request of the USEPA, in addition to collection of samples from the UPA, collection of leachate samples will be attempted from up to ten landfill gas vents (see Table 1 and Figure 4) synchronous with the UPA PFAS monitoring event. An important consideration in the evaluation of PFAS in the gas vent liquids is that the analytical method for PFAS is a drinking water method not intended for use on other matrices such as leachate or wastewater. Therefore, due to the inherent differences between leachate matrices and drinking water matrices, there is the potential for matrix interferences and false positive or false negative results from this analysis, and PFAS analytical results for the aqueous samples collected from gas vents will be considered suspect.

These data along with information about the nature and extent of PFAS migrating from upgradient sources will be incorporated into the qualitative evaluation of other potential sources of the PFAS concentrations detected in UPA groundwater in the vicinity of the Sites.

**REPORTING**

The results from the first round of monitoring for the Western Lobe Study results will be reported within 90 days receipt of validated data, and will include documentation of the new well installation. Subsequent reports will be synchronous with the ACL semi-annual and annual reporting. Reports will include temporal and spatial plots for the data from the Western Lobe Study Area, and groundwater flow evaluation.

The PFAS Source Evaluation will be issued following completion of the DS&G and ACL monitoring events, and will include all data from those events, as well as information gathered about other potential sources located upgradient and in the vicinity of the Sites.

A final report summarizing the activities performed and data collected as part of the scope presented in this work plan will be submitted to the USEPA after the completion of the activities outlined in this work plan. The report will include the updated CSM.

**SCHEDULE**

The following is a listing of the anticipated schedule to complete this work. Please note this these time periods are contingent on USEPA review, response times, and approval and driller availability. Also, monitoring events will be synchronized with the routine ACL and DS&G semi-annual monitoring events.

- Western Lobe Well Installation and Development – May/June 2018
- Quarterly Sampling Events – July 2018; October 2018; January 2019; April 2019
- PFAS Sampling Event – October 2018
- First Quarterly Event and Well Installation Report – October 2018
- PFAS Source Evaluation Report – January 2019
- Subsequent sampling data submitted with ACL semi-annual and annual monitoring reports in January 2019 and July 2019.
- Final Report with Updated CSM – July 2019

We hope you find the proposed scope and methodologies clear and satisfactory. If you have any questions or comments, we trust you will contact us so we can provide clarification and revisions as necessary.

Respectfully,

RUTH ASSOCIATES, INC.

Michele C. Ruth

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President

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Attachment 1 - Historical Groundwater Monitoring Results, Downgradient of Western Lobe Study Area
Attachment 2 - PFAS Groundwater Monitoring Results Collected by Golder, October 2016 and April 2017
Attachment 3 - Historical Surface Water Quality Monitoring Results, Army Creek
Attachment 4 - Sampling and Analysis Plan

**REFERENCES**

DNREC, 2006. Amended Memorandum of Agreement. Department of Natural Resources and Environmental Control. Army Creek and Vicinity. New Castle, Delaware. June 2006.

RAI, 2016. Stability of Iron, Manganese and Cobalt in Groundwater in the Vicinity of Army Creek Landfill, Delaware Sand & Gravel Landfills and the Llangollen Well Field, New Castle County, Delaware, Draft Revision 1. December 12, 2016.

USEPA, 1998. Five-Year Review Report, Army Creek Landfill Superfund Site, New Castle, Delaware. November 25, 1998.

USEPA, 2014. Five-Year Review Report for Army Creek Landfill Superfund Site, New Castle County, Delaware. September 8, 2014.

USEPA, 2017. USEPA letter to ACPS and NCC requesting additional investigation at ACL. September 28, 2017.

USEPA, 2018a. USEPA email including a letter from Rick Wilkin (USEPA) requesting addition of major cations and anions to groundwater monitoring program. January 24, 2018.

USEPA, 2018b. USEPA email approving request for extension and requesting sampling and analysis of gas vents for PFAS. January 31, 2018.

**TABLE 1**
**PROPOSED MONITORING PROGRAM**
**ARMY CREEK LANDFILL, NEW CASTLE, DELAWARE**

| Monitoring Location | Well Type | PFAS | Western Lobe | Water Levels |
|---|---|---|---|---|
| MW-28 | Former Recovery | X | | X |
| MW-29 | Former Recovery | X | | X |
| MW-31 | Former Recovery | X | | X |
| RW-10 | Former Recovery | X | X | X |
| BW-1 | Existing Monitoring | X | | X |
| BW-2 | Existing Monitoring | X | | X |
| BW-3 | Existing Monitoring | X | | X |
| MW-40 | Existing Monitoring | X | | X |
| MW-38N | Existing Monitoring | X | X | X |
| P-4 | Existing Monitoring | X | X | X |
| P-4L | Proposed Monitoring | X | X | X |
| WL-1U | Proposed Monitoring | X | X | X |
| WL-1L | Proposed Monitoring | X | X | X |
| P-5U | Existing Monitoring | | | X |
| P-5L | Existing Monitoring | | | X |
| P-6 | Existing Monitoring | | | X |
| MW-22N | Existing Monitoring | X | X | X |
| MW-22NU | Proposed Monitoring | X | X | X |
| MW-26N | Existing Monitoring | | | X |
| MW-49N | Existing Monitoring | X | X | X |
| MW-54 | Existing Background | X | | X |
| MW-56 | Existing Background | X | | X |
| MW-58 | Existing Background | X | | X |
| MW-18 | Existing Monitoring | | | X |
| DGC-10S | Existing Monitoring | | | X |
| DGC-10D | Existing Monitoring | | | X |
| DGC-11S | Existing Monitoring | | | X |
| DGC-11D | Existing Monitoring | | | X |
| GV-1 | Gas Vent | X | | X |
| GV-7 | Gas Vent | X | | X |
| GV-9 | Gas Vent | X | | X |
| GV-13 | Gas Vent | X | | X |
| GV-14 | Gas Vent | X | | X |
| GV-17 | Gas Vent | X | | X |
| GV-29 | Gas Vent | X | | X |
| GV-46 | Gas Vent | X | | X |
| GV-48 | Gas Vent | X | | X |
| GV-51 | Gas Vent | X | | X |

2/10/2018

Notes:

X - Groundwater samples will be analyzed for PFAS suite, consistent with the PFAS suite for DS&G, plus field parameters.
Samples from gas vents will be analyzed for PFAS suite only.

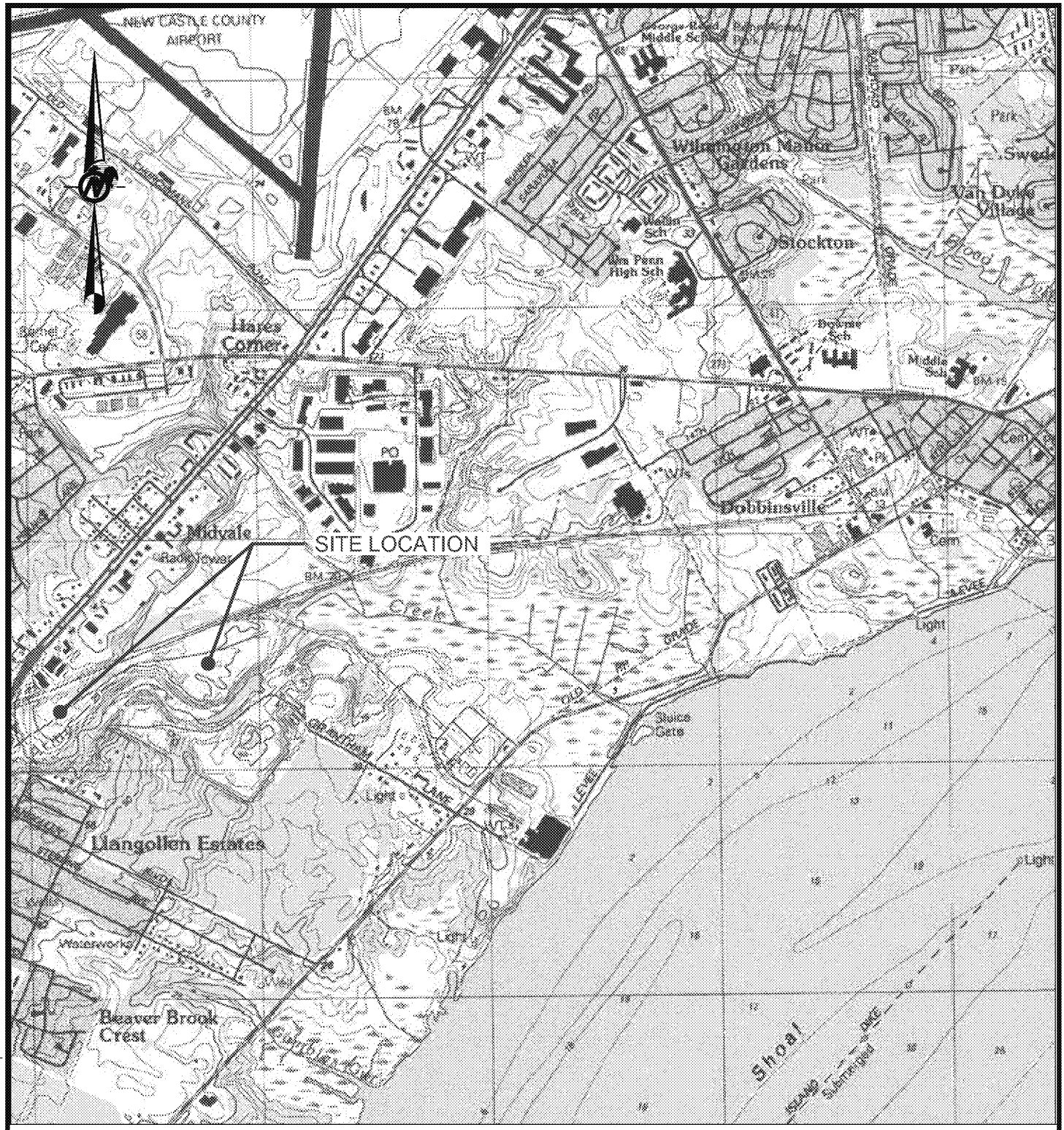
X - Analytical parameters will include total and dissolved iron, total and dissolved manganese, total and dissolved cobalt, and field parameters. The smi-annual events (April and October) will also include VOCs and cations and anions as follows: calcium, magnesium, potassium, sodium, ferrous iron, ammonia, nitrate, nitrite, sulfate, sulfide, chloride, and bicarbonate.

X - A complete round of water levels will be measured synoptically at all wells.

(1) - PFAS monitoring event will be conducted synoptically during the first DS&G event performed after the new wells are installed.

(2) - Western Lobe Study will be conducted quarterly for four quarters, two of which will be done at same time as annual/semi-annual events.

(3) - Field Indicator Parameters include temperature, specific conductance, pH, oxidation-reduction potential, dissolved oxygen and turbidity.




## 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

Golder Associates
Manchester, New Hampshire

| | |
|---|---|
| SCALE | AS SHOWN |
| DATE | 02/06/18 |
| DESIGN | RWB |
| CADD | RWC |
| CHECK | RWB |
| REVIEW | TAM |

FILE No. 0136052Z006B.dwg
PROJECT No. P1793358 REV. 0

TITLE

# SITE LOCUS MAP

ARMY CREEK LANDFILL SUPERFUND SITE

FIGURE 1

Drawing file: 0136052Z006B.dwg Feb 06, 2018 – 2:03pm

# Figure 2.
# Existing and Proposed Monitoring Network for ACL Western Lobe Investigation

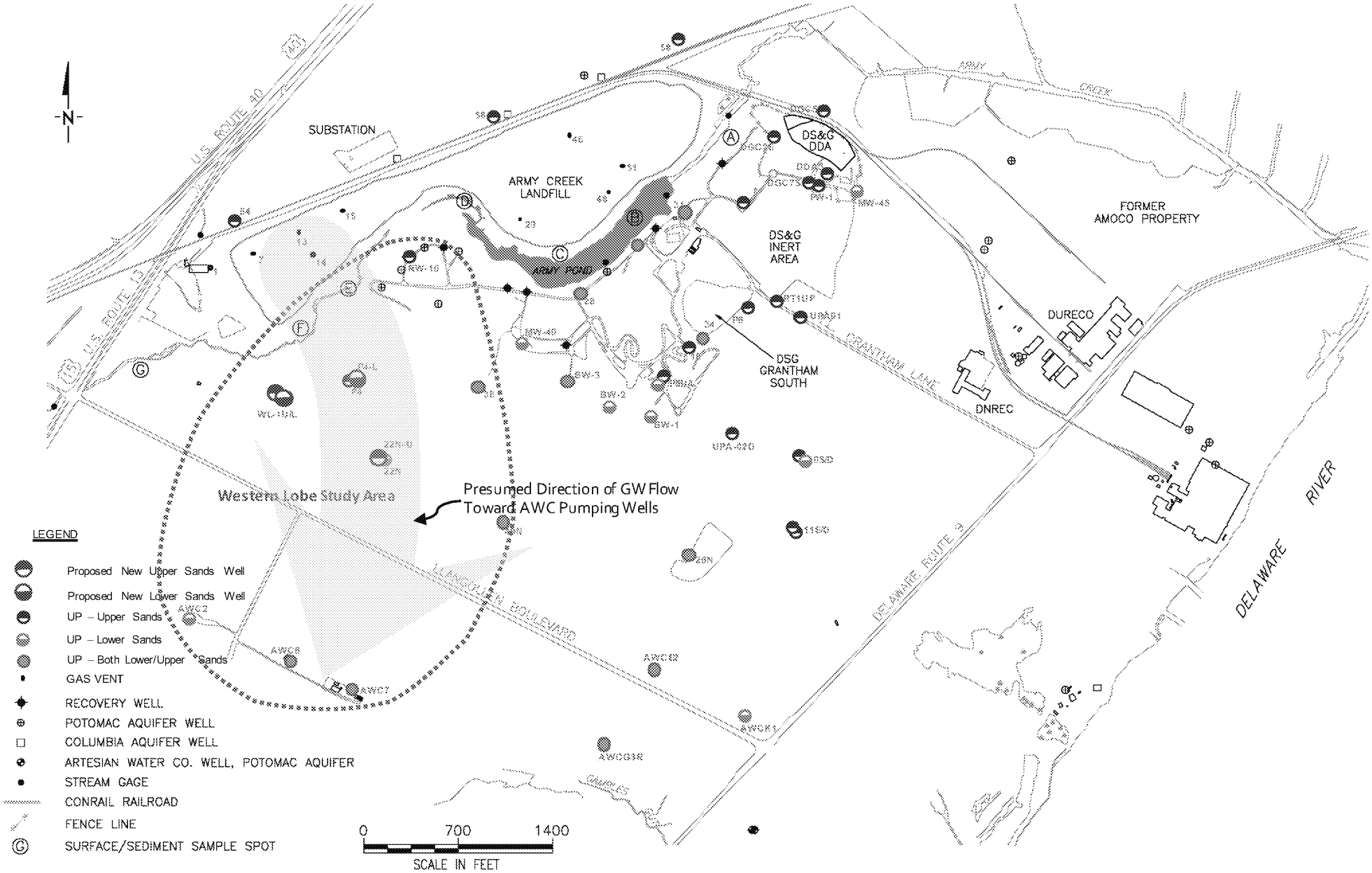
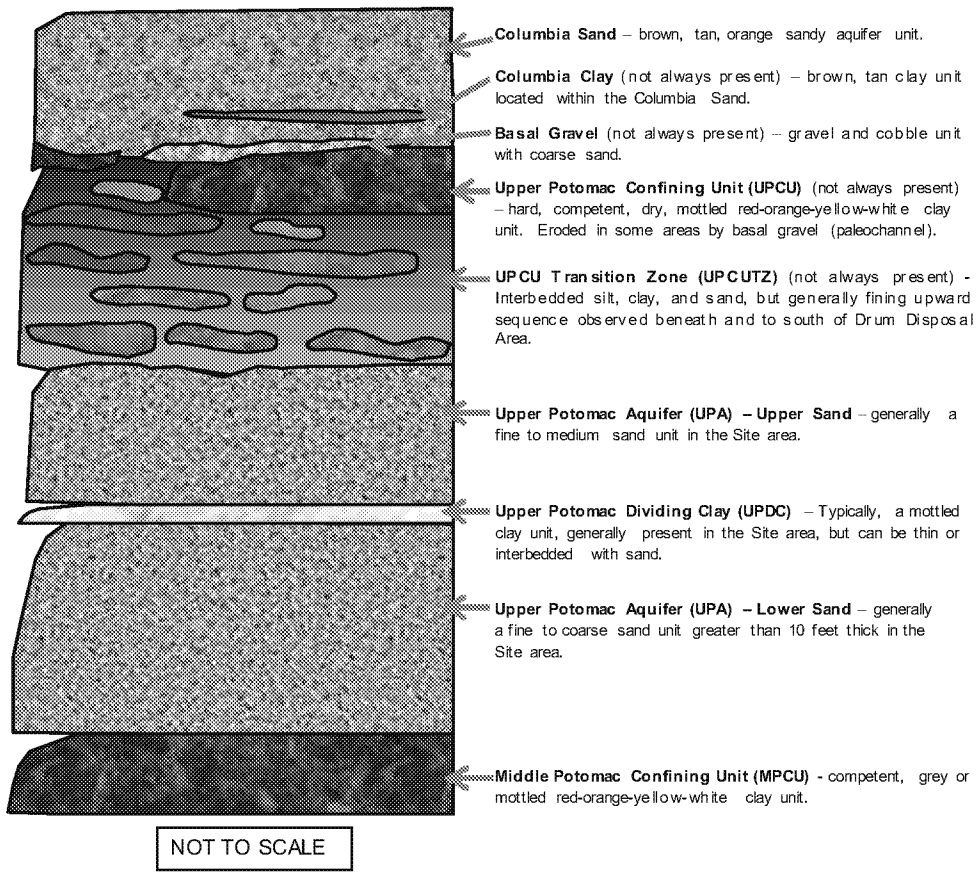


Figure 3.

# Conceptual Site Model Lithologic Diagram



# Figure 4.
# Locations of Proposed Wells to be included in ACL's PFAS Monitoring Program

ATTACHMENT 1

HISTORICAL GROUNDWATER MONITORING RESULTS
DOWNGRADIENT OF WESTERN LOBE STUDY AREA

## Attachment Table 1-1

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* (µg/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* (µg/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* (µg/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 (µs/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 November 29, 2016
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

## Attachment Table 1-1 (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* (µg/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* (µg/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* (µg/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 (µs/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 November 29, 2016
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

## Attachment Table 1-1 (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*** **(µg/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*** **(µg/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*** **(µg/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 (µs/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 November 29, 2016
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

## Attachment Table 1-1 (continued)

st orical Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Gravel Land

| Parameter | P-4 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 10/12 | 4/13 | 10/13 | 10/14 | 10/15 | 2/16 | 10/16 | 10/17 |
| ***Non-Halogenated VOCs* (µg/l)** | | | | | | | | |
| Benzene | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| Ethylbenzene | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| 2-Butanone | 5.0 U | 5.0 U | 5.0 U | 50 UJ | 5.0 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 |
| Carbon Disulfide | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| Isopropylbenzene | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 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 |
| Methylcyclohexane | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| ***Halogenated VOCs* (µg/l)** | | | | | | | | |
| Bromoform | 1.0 U | 1.0 U | 1.0 UJ | 0.50 U | 1.0 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 |
| Carbon Tetrachloride | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| Chloroform | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| 1,2-Dichloroethane | 1.0 U | 1.0 U | 8.1 | 14 | 6.7 | -- | 15 | 16 |
| 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 |
| 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 |
| 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 |
| 1,1-Dichloroethene | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| 1,3-Dichlorobenzene | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| Chloroethane | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| Tetrachloroethene | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| Trichloroethene | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 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 |
| 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 |
| 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 |
| Methylene Chloride | 1.0 U | 1.0 UJ | 1.0 U | 5.0 U | 1.0 U | -- | 0.68 | 0.50 U |
| Trichlorofluoromethane | 1.0 U | 1.0 U | 1.0 U | 0.50 U | 1.0 U | -- | 0.50 U | 0.50 U |
| ***Semi-Volatiles* (µg/l)** | | | | | | | | |
| Bis(2-chloroethyl)Ether | 5 U | 5 U | 5 U | 5 U | 0.10 U | -- | 0.10 U | 0.10 U |
| 1,4-Dioxane | -- | -- | -- | -- | -- | -- | -- | 2.0 U |
| Bis(2-ethylhexyl)phthalate | 5 U | 4.7 J | 7.2 U | 5 U | 5 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 |
| 2,4-Dimethylphenol | 5 U | 5 U | 5 U | 5 U | 5 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 |
| 2-Methylphenol | 5 U | 5 U | 5 U | 5 U | 5 U | -- | 10 U | 10 U |
| 4-Methylphenol | 5 U | 5 U | 5 U | 5 U | 5 U | -- | 10 U | 10 U |
| Acetophenone | 5 U | 5 U | 5 U | 5 U | 5 U | -- | 10 U | 10 U |
| Caprolactam | 5 U | 5 UJ | 5 U | 5 UJ | 1.6 J | -- | 10 U | 10 U |
| Diethylphthalate | 5 U | 5 U | 5 U | 5 U | 5 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 |
| Naphthalene | 5 U | 5 U | 5 U | 5 U | 5 U | -- | 5.0 U | 5.0 U |
| Phenol | 5 U | 5 U | 5 U | 5 U | 5 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 |
| Dissolved Iron | 0.1 U | 29.9 | 34.6 | 45.8 | 33.5 | 77.6 | 81.5 | 81.2 |
| Dissolved Cobalt | -- | -- | -- | -- | 0.108 | 0.24 | 0.223 | 0.246 |
| ***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 |
| Conductivity (µs/cm) | 146 | 895 | 1120 | 1710 | 2410 | 5470 | 7010 | 8710 |
| pH (standard units) | 6.88 | 5.57 | 6.37 | 6.50 | 6.74 | 6.70 | 6.60 | 6.57 |
| Dissolved Oxygen (mg/l) | 4.30 | 1.47 | 0.00 | 0.39 | 0.00 | 0.22 | 0.00 | 0.00 |
| ORP (mV) | 206 | -18 | -61 | -116 | -46 | -75 | -109 | -57 |
| Water-Level Elevation (ft, MSL) | -7.88 | -8.68 | -8.12 | -10.08 | -11.81 | -10.18 | -16.00 | -14.73 |

-- Not analyzed or data not available to RAI as of November 29, 2016
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

## Attachment Table 1-1 (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* (µg/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* (µg/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* (µg/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 (µs/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 November 29, 2016
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

## Attachment Table 1-1 (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* (µg/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* (µg/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* (µg/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 (µs/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 analyzed or data not available to RAI as of November 29, 2016
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

## Attachment Table 1-1 (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 |
| ***Non-Halogenated VOCs* (µg/l)** | | | | | | | | |
| Benzene | 0.50 U | -- | 1.0 U | -- | -- | 0.50 U | -- | 0.50 U |
| Toluene | 0.50 U | -- | 1.0 U | -- | -- | 0.50 U | -- | 0.50 U |
| Ethylbenzene | 0.50 U | -- | 1.0 U | -- | -- | 0.50 U | -- | 0.50 U |
| Xylene (total) | 1.5 U | -- | 3.0 U | -- | -- | 0.50 U | -- | 0.50 U |
| 2-Butanone | 50 UJ | -- | 5.0 U | -- | -- | 10 U | -- | 10 U |
| Acetone | 5.0 UJ | -- | 5.0 U | -- | -- | 10 U | -- | 10 UJ |
| Carbon Disulfide | 0.50 U | -- | 1.0 U | -- | -- | 0.50 U | -- | 0.50 U |
| Cyclohexane | 1.0 U | -- | 1.0 U | -- | -- | 0.50 U | -- | 0.50 U |
| Isopropylbenzene | 1.0 U | -- | 1.0 U | -- | -- | 0.50 U | -- | 0.50 U |
| Methy-tert-butyl ether | 0.54 | -- | 0.53 J | -- | -- | 0.50 | -- | 0.50 U |
| Methylcyclohexane | 0.50 U | -- | 1.0 U | -- | -- | 5.0 U | -- | 5.0 U |
| 4-Methyl-2-pentanone | 5.0 UJ | -- | 5.0 U | -- | -- | 10 U | -- | 10 U |
| ***Halogenated VOCs* (µg/l)** | | | | | | | | |
| Bromoform | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Bromodichloromethane | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Carbon Tetrachloride | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Chlorobenzene | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Chloroform | 0.50 U | -- | 0.25 J | - | - | 0.50 U | - | 0.50 U |
| Dibromochloromethane | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| 1,2-Dichloroethane | 0.50 U | -- | 1.0 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 |
| cis-1,2-Dichloroethene | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| trans-1,2-Dichloroethene | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| 1,1-Dichloroethene | 0.50 U | -- | 1.0 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 |
| 1,3-Dichlorobenzene | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| 1,4-Dichlorobenzene | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Chloroethane | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Chloromethane | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Tetrachloroethene | 5.4 | -- | 3.6 | - | - | 2.7 | - | 2.1 |
| 1,1,1-Trichloroethane | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Trichloroethene | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Vinyl Chloride | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| 1,2,4-Trichlorobenzene | 0.50 UJ | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| cis-1,3-Dichloropropene | 0.50 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Methylene Chloride | 5.0 U | -- | 1.0 U | - | - | 0.50 U | - | 0.50 U |
| Trichlorofluoromethane | 0.50 U | -- | 1.0 U | -- | -- | 0.50 U | -- | 0.50 U |
| ***Semi-Volatiles* (µg/l)** | | | | | | | | |
| Bis(2-chloroethyl)Ether | 4.9 U | -- | 0.10 U | -- | -- | 0.096 U | -- | 0.10 U |
| 1,4-Dioxane | -- | -- | -- | -- | -- | 2.0 U | -- | 2.0 U |
| Bis(2-ethylhexyl)phthalate | 4.9 U | -- | 5.0 U | -- | -- | 4.9 U | -- | 20 |
| 2,2'-oxybis (1-Chloropropane) | 4.9 U | -- | 5.0 U | -- | -- | 9.8 U | -- | 9.5 U |
| 2,4-Dimethylphenol | 4.9 U | -- | 5.0 U | -- | -- | 4.9 U | -- | 4.8 U |
| 2-Methylnaphthalene | 4.9 U | -- | 5.0 U | -- | -- | 4.9 U | -- | 4.8 U |
| 2-Methylphenol | 4.9 U | -- | 5.0 U | -- | -- | 9.8 U | -- | 9.5 U |
| 4-Methylphenol | 4.9 U | -- | 5.0 U | -- | -- | 9.8 U | -- | 9.5 U |
| Acetophenone | 4.9 U | -- | 5.0 U | -- | -- | 9.8 U | -- | 9.5 U |
| Caprolactam | 4.9 UJ | -- | 5.0 U | -- | -- | 9.8 U | -- | 9.5 U |
| Diethylphthalate | 4.9 U | -- | 5.0 U | -- | -- | 4.9 U | -- | 4.8 U |
| N-Nitrosodiphenylamine | 4.9 U | -- | 5.0 U | -- | -- | 4.9 U | -- | 4.8 U |
| Naphthalene | 4.9 U | -- | 5.0 U | -- | -- | 4.9 U | -- | 4.8 U |
| Phenol | 4.9 U | -- | 5.0 U | -- | -- | 9.8 U | -- | 9.5 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 |
| 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 |
| Dissolved Lead | -- | -- | -- | -- | -- | -- | -- | -- |
| Dissolved Cobalt | -- | 0.0500 U | 0.0500 U | 0.0050 U | 0.00034 J | 0.050 U | 0.050 U | 0.0011 J |
| ***Biological Oxygen Demand (mg/l)*** | -- | -- | -- | -- | -- | -- | -- | -- |
| ***Field Parameters*** | | | | | | | | |
| Temperature (Degrees Celcius) | 14.7 | 15.0 | 16.2 | 17.6 | 15.6 | 13.6 | 14.5 | 14.4 |
| Conductivity (µs/cm) | 303 | 323 | 371 | 226 | 229 | 266 | 273 | 214 |
| pH (standard units) | 6.59 | 7.07 | 7.00 | 6.19 | 5.95 | 5.74 | 5.72 | 5.66 |
| Dissolved Oxygen (mg/l) | 3.22 | 3.11 | 2.68 | 2.92 | 3.31 | 2.65 | 3.80 | 2.96 |
| ORP (mV) | 134 | 94 | 206 | 182 | 176 | 224 | 190 | 241 |
| Water-Level Elevation (ft, MSL) | -11.89 | -14.02 | -14.50 | -12.97 | -12.75 | -19.13 | -14.48 | -17.84 |

-- Not analyzed or data not available to RAI as of November 29, 2016
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

**Attachment Table 1-1 (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*** **(µg/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*** **(µg/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*** **(µg/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 (µs/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 November 29, 2016
U - Analyte was not detected above the reporting limit
J - Estimated concentration.
B - Analyte Detected in Method Blank

## Attachment Table 1-1 (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*** **(µg/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*** **(µg/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*** **(µg/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 | 13.45 | 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 (µs/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 |
| pH (standard units) | 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 | 0.59 | -- | 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 November 29, 2016
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

## Attachment Table 1-1 (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*** **(µg/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*** **(µg/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*** **(µg/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 |
| Conductivity (µs/cm) | 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 November 29, 2016
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

## Attachment Table 1-1 (continued)

Summary of Groundwater Quality Data Collected by New Castle County for the Vicinity of the Army Creek and Delaware Sand & Grav

| Parameter | MW-49N | | | | | | |
|---|---|---|---|---|---|---|---|
| | 4/15 | 10/15 | 3/16 | 4/16 | 10/16 | 4/17 | 10/17 |
| ***Non-Halogenated VOCs*** **(µg/l)** | | | | | | | |
| Benzene | -- | -- | -- | -- | -- | -- | -- |
| Toluene | -- | -- | -- | -- | -- | -- | -- |
| Ethylbenzene | -- | -- | -- | -- | -- | -- | -- |
| Xylene (total) | -- | -- | -- | -- | -- | -- | -- |
| 2-Butanone | -- | -- | -- | -- | -- | -- | -- |
| Acetone | -- | -- | -- | -- | -- | -- | -- |
| Carbon Disulfide | -- | -- | -- | -- | -- | -- | -- |
| Cyclohexane | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene | -- | -- | -- | -- | -- | -- | -- |
| Methy tert-butyl ether | -- | -- | -- | -- | -- | -- | -- |
| Methylcyclohexane | -- | -- | -- | -- | -- | -- | -- |
| 4-Methyl-2-pentanone | -- | -- | -- | -- | -- | -- | -- |
| ***Halogenated VOCs*** **(µg/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*** **(µg/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 |
| Dissolved Iron | 0.0794 J | 0.100 U | 0.53 | 0.100 U | 0.100 U | 0.100 U | 0.16 |
| Dissolved Cobalt | 0.0500 U | 0.0500 U | 0.0050 U | 0.0031 J | 0.00020 J | 0.0035 J | 0.0027 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 |
| Conductivity (µs/cm) | 66 | 69 | 97 | 199 | 245 | 119 | 106 |
| pH (standard units) | 6.37 | 6.85 | 6.16 | 5.77 | 5.55 | 5.55 | 5.66 |
| Dissolved Oxygen (mg/l) | 4.32 | 0.51 | 3.38 | 4.21 | 4.14 | 3.71 | 3.98 |
| ORP (mV) | 153 | 178 | 202 | 91 | 228 | 200 | 268 |
| Water-Level Elevation (ft, MSL) | -14.32 | -15.01 | -12.83 | -12.59 | -19.74 | -14.67 | -14.67 |

-- Not analyzed or data not available to RAI as of November 29, 2016
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 reporte
B - Analyte Detected in Method Blank

ATTACHMENT 2

PFAS GROUNDWATER MONITORING RESULTS COLLECTED BY GOLDER
OCTOBER 2016 + APRIL 2017

**Attachment Table 2-1**
**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 | | |

**Attachment Table 2-1 (continued)**
**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 | | |



Golder Associates

**Attachment Table 2-1 (continued)**
**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 | | |

**Attachment Table 2-1 (continued)**
**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 | | |



Golder Associates

ED_004821A_00008431-00031

**Attachment Table 2-1 (continued)**
**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

**Attachment Table 2-2**
**March-April 2017 Semi-Annual Monitoring Program - Summary of Detected PFCs**
**Delaware Sand & Gravel Superfund Site**
**New Castle, Delaware**

| | | | | DDA Monitoring Wells | | | PW-1(U) Monitoring Wells - UPCU Transition Zone | | | PW-1(U) Monitoring Wells - UPA Upper Sand | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | DGC-8C | | | DDA-05 | | | DDA-01 | | | DDA-02 | | | DDA-03 | | | DDA-07-US | | | DDA-10-US | | | DDA-11-LS | | | DDA-11-US | | |
| | | | Sample Date | 4/3/2017 | | | 4/12/2017 | | | 4/12/2017 | | | 4/12/2017 | | | 4/5/2017 | | | 4/13/2017 | | | 4/11/2017 | | | 4/4/2017 | | | 4/4/2017 | | |
| | | | Sample Depth (ft) | - | | | - | | | - | | | - | | | - | | | - | | | - | | | - | | | - | | |
| | | | N=Normal, FD=Field Duplicate | 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 |
| Perfluorohexanoic acid | ng/l | 307-24-4 | NE | 39 | J- | 0.6 | 22 | | 0.6 | 27 | | 0.6 | 24 | | 0.6 | 53 | | 0.6 | 22 | | 0.6 | 49 | J- | 0.6 | 26 | J- | 0.6 | 36 | J- | 0.6 |
| Perfluoroheptanoic acid | ng/l | 375-85-9 | NE | 14 | | 0.5 | 14 | | 0.5 | 20 | | 0.5 | 16 | | 0.5 | 47 | | 0.5 | 14 | | 0.5 | 32 | | 0.5 | 20 | | 0.5 | 26 | J- | 0.5 |
| Perfluoro-n-octanoic acid (PFOA) | ng/l | 335-67-1 | 70 | 30 | | 0.6 | 100 | | 0.6 | 160 | | 0.6 | 140 | | 0.6 | 530 | | 0.6 | 140 | | 0.6 | 170 | | 0.6 | 140 | | 0.6 | 140 | | 0.6 |
| Perfluorononanoic acid | ng/l | 375-95-1 | NE | 3 | | 0.6 | 5 | | 0.6 | 8 | | 0.6 | 8 | | 0.6 | 10 | | 0.6 | 9 | | 0.6 | 7 | | 0.6 | 11 | | 0.6 | 12 | | 0.6 |
| Perfluorodecanoic acid | ng/l | 335-76-2 | NE | 1 | J | 0.5 | 0.6 | J | 0.5 | 2 | | 0.5 | 2 | J- | 0.5 | 5 | | 0.5 | 2 | J | 0.5 | 2 | J | 0.5 | 1 | J | 0.5 | 3 | J- | 0.5 |
| Perfluoroundecanoic acid | ng/l | 2058-94-8 | NE | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | UJ | 1 | | UJ | 1 |
| Perfluorododecanoic acid | ng/l | 307-55-1 | NE | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | UJ | 0.5 |
| Perfluorotridecanoic acid | ng/l | 72629-94-8 | NE | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | UJ | 0.5 |
| Perfluorotetradecanoic acid | ng/l | 376-06-7 | NE | | UJ | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | UJ | 0.5 | 0.6 | J | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | UJ | 0.5 |
| Perfluorobutanesulfonic acid (PFBS) | ng/l | 375-73-5 | NE | 1 | J+ | 0.8 | 1 | J | 0.8 | 1 | J | 0.8 | 1 | J | 0.8 | 1 | J | 0.8 | 2 | J | 0.8 | 2 | J | 0.8 | | U | 0.8 | 2 | J | 0.8 |
| Perfluorohexanesulfonic acid (PFHxS) | ng/l | 355-46-4 | NE | 1 | J | 1 | 7 | J- | 1 | 33 | | 1 | 23 | | 1 | 68 | | 1 | 18 | | 1 | 35 | J- | 1 | 12 | | 1 | 5 | J- | 1 |
| Perfluoro-1-Octanesulfonate (PFOS) | ng/l | 1763-23-1 | 70 | 4 | J | 2 | 10 | | 2 | 33 | | 2 | 28 | | 2 | 77 | J- | 2 | 21 | | 2 | 20 | | 2 | 15 | | 2 | 21 | | 2 |
| N-methyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2355-31-9 | NE | | UJ | 1 | | U | 1 | | U | 1 | | U | 1 | | UJ | 1 | | U | 1 | | UJ | 1 | | UJ | 1 | | U | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2991-50-6 | NE | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | UJ | 1 | | U | 1 |
| Total PFOA + PFOS | ng/l | NA | 70 | 34 | | | 110 | | | 193 | | | 168 | | | 607 | | | 161 | | | 190 | | | 155 | | | 161 | | |

**Attachment Table 2-2 (continued)**
**March-April 2017 Semi-Annual Monitoring Program - Summary of Detected PFCs**
**Delaware Sand & Gravel Superfund Site**
**New Castle, Delaware**

| | | | | PW-1(U) Monitoring Wells - UPA Upper Sand | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | DDA-12-US | | | DDA-15-US | | | DDA-16-US | | | DDA-17 | | | DGC-2S | | | DGC-5 | | | DGC-7S | | | MHW-1D | | |
| | | | Sample Date | 4/12/2017 | | | 4/13/2017 | | | 4/12/2017 | | | 4/5/2017 | | | 4/12/2017 | | | 4/11/2017 | | | 4/10/2017 | | | 4/12/2017 | | |
| | | | Sample Depth (ft) | - | | | - | | | - | | | - | | | - | | | - | | | - | | | - | | |
| | | | 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 | 37 | | 0.6 | 22 | | 0.6 | 26 | | 0.6 | 50 | | 0.6 | 32 | | 0.6 | 50 | | 0.6 | 24 | J- | 0.6 | 39 | | 0.6 |
| Perfluoroheptanoic acid | ng/l | 375-85-9 | NE | 25 | | 0.5 | 18 | | 0.5 | 19 | | 0.5 | 35 | | 0.5 | 23 | | 0.5 | 42 | | 0.5 | 19 | J- | 0.5 | 30 | | 0.5 |
| Perfluoro-n-octanoic acid (PFOA) | ng/l | 335-67-1 | 70 | 150 | | 0.6 | 220 | | 0.6 | 190 | | 0.6 | 340 | | 0.6 | 200 | | 0.6 | 270 | | 0.6 | 160 | J- | 0.6 | 240 | | 0.6 |
| Perfluorononanoic acid | ng/l | 375-95-1 | NE | 6 | | 0.6 | 5 | | 0.6 | 6 | | 0.6 | 10 | | 0.6 | 10 | | 0.6 | 9 | | 0.6 | 11 | | 0.6 | 16 | | 0.6 |
| Perfluorodecanoic acid | ng/l | 335-76-2 | NE | | U | 0.5 | 2 | J | 0.5 | 1 | J- | 0.5 | 3 | J- | 0.5 | 1 | J | 0.5 | 1 | J | 0.5 | 2 | J- | 0.5 | 3 | | 0.5 |
| Perfluoroundecanoic acid | ng/l | 2058-94-8 | NE | | U | 1 | | U | 1 | | U | 1 | | UJ | 1 | | U | 1 | | U | 1 | | UJ | 1 | | U | 1 |
| Perfluorododecanoic acid | ng/l | 307-55-1 | NE | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 |
| Perfluorotridecanoic acid | ng/l | 72629-94-8 | NE | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 |
| Perfluorotetradecanoic acid | ng/l | 376-06-7 | NE | | U | 0.5 | 0.6 | J | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 |
| Perfluorobutanesulfonic acid (PFBS) | ng/l | 375-73-5 | NE | | U | 0.8 | 1 | J | 0.8 | 1 | J | 0.8 | 1 | J | 0.8 | 1 | J | 0.8 | 3 | J | 0.8 | 1 | J | 0.8 | 2 | J | 0.8 |
| Perfluorohexanesulfonic acid (PFHxS) | ng/l | 355-46-4 | NE | 4 | | 1 | 25 | J- | 1 | 14 | | 1 | 57 | J- | 1 | 4 | | 1 | 16 | | 1 | 10 | J- | 1 | 14 | | 1 |
| Perfluoro-1-Octanesulfonate (PFOS) | ng/l | 1763-23-1 | 70 | 3 | J | 2 | 24 | | 2 | 17 | | 2 | 47 | | 2 | 10 | | 2 | 10 | | 2 | 22 | | 2 | 31 | | 2 |
| N-methyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2355-31-9 | NE | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | UJ | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2991-50-6 | NE | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 |
| Total PFOA + PFOS | ng/l | NA | 70 | 153 | | | 244 | | | 207 | | | 387 | | | 210 | | | 280 | | | 182 | | | 271 | | |

**Attachment Table 2-2 (continued)**
**March-April 2017 Semi-Annual Monitoring Program - Summary of Detected PFCs**
**Delaware Sand & Gravel Superfund Site**
**New Castle, Delaware**

| | | | | PW-1(U) Monitoring Wells - UPA Upper Sand | | | | | | Downgradient UPA Wells | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | PW-1(U) | | | PW-1(U) | | | AWC-E1 | | | AWC-E1 | | | AWC-E2 | | | AWC-E2 | | | DGC-10D | | | DGC-10S | | | DGC-11D | | |
| | | | Sample Date | 3/28/2017 | | | 4/11/2017 | | | 4/17/2017 | | | 4/17/2017 | | | 4/17/2017 | | | 4/17/2017 | | | 4/7/2017 | | | 4/7/2017 | | | 4/5/2017 | | |
| | | | Sample Depth (ft) | - | | | - | | | 132 | | | 156 | | | 140 | | | 165 | | | - | | | - | | | - | | |
| | | | N=Normal, FD=Field Duplicate | 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 |
| Perfluorohexanoic acid | ng/l | 307-24-4 | NE | 29 | | 0.6 | 25 | | 0.6 | 22 | | 0.6 | 26 | | 0.6 | 23 | | 0.6 | 21 | | 0.6 | 20 | | 0.6 | 30 | J- | 0.6 | 27 | | 0.6 |
| Perfluoroheptanoic acid | ng/l | 375-85-9 | NE | 18 | | 0.5 | 17 | | 0.5 | 14 | | 0.5 | 19 | | 0.5 | 14 | | 0.5 | 15 | | 0.5 | 13 | | 0.5 | 17 | | 0.5 | 18 | | 0.5 |
| Perfluoro-n-octanoic acid (PFOA) | ng/l | 335-67-1 | 70 | 170 | | 0.6 | 140 | | 0.6 | 80 | | 0.6 | 100 | | 0.6 | 93 | | 0.6 | 100 | | 0.6 | 120 | | 0.6 | 44 | | 0.6 | 52 | | 0.6 |
| Perfluorononanoic acid | ng/l | 375-95-1 | NE | 9 | | 0.6 | 7 | | 0.6 | 7 | | 0.6 | 10 | | 0.6 | 5 | | 0.6 | 6 | | 0.6 | 4 | | 0.6 | 10 | | 0.6 | 18 | | 0.6 |
| Perfluorodecanoic acid | ng/l | 335-76-2 | NE | 2 | J | 0.5 | 2 | J- | 0.5 | 2 | J | 0.5 | 3 | | 0.5 | 2 | J | 0.5 | 2 | | 0.5 | 5 | | 0.5 | 5 | | 0.5 | 4 | | 0.5 |
| Perfluoroundecanoic acid | ng/l | 2058-94-8 | NE | | U | 1 | | U | 1 | | U | 1 | 1 | J | 1 | | U | 1 | | U | 1 | 1 | J | 1 | 2 | J | 1 | 1 | J | 1 |
| Perfluorododecanoic acid | ng/l | 307-55-1 | NE | | U | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | 1 | J- | 0.5 | | U | 0.5 |
| Perfluorotridecanoic acid | ng/l | 72629-94-8 | NE | | U | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 |
| Perfluorotetradecanoic acid | ng/l | 376-06-7 | NE | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 |
| Perfluorobutanesulfonic acid (PFBS) | ng/l | 375-73-5 | NE | 1 | J | 0.8 | 1 | J | 0.8 | 2 | J | 0.8 | 2 | J | 0.8 | 1 | J+ | 0.8 | 1 | J | 0.8 | 0.9 | J | 0.8 | 2 | J+ | 0.8 | 3 | J | 0.8 |
| Perfluorohexanesulfonic acid (PFHxS) | ng/l | 355-46-4 | NE | 22 | | 1 | 18 | J- | 1 | 7 | | 1 | 8 | J- | 1 | 16 | | 1 | 18 | | 1 | 36 | | 1 | 12 | | 1 | 4 | J- | 1 |
| Perfluoro-1-Octanesulfonate (PFOS) | ng/l | 1763-23-1 | 70 | 21 | | 2 | 21 | | 2 | 14 | | 2 | 15 | | 2 | 11 | | 2 | 16 | | 2 | 27 | | 2 | 16 | | 2 | 9 | | 2 |
| N-methyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2355-31-9 | NE | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | UJ | 1 | | UJ | 1 | | UJ | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2991-50-6 | NE | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | UJ | 1 | | U | 1 |
| Total PFOA + PFOS | ng/l | NA | 70 | 191 | | | 161 | | | 94 | | | 115 | | | 104 | | | 116 | | | 147 | | | 60 | | | 61 | | |

**Attachment Table 2-2 (continued)**
**March-April 2017 Semi-Annual Monitoring Program - Summary of Detected PFCs**
**Delaware Sand & Gravel Superfund Site**
**New Castle, Delaware**

| | | | | NCC UPA Monitoring Wells and P-6 Vicinity | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | BW-1 | | | BW-2 | | | MW-18 | | | MW-26N | | | MW-28 | | | MW-29 | | | MW-29 | | | MW-31 | | |
| | | | Sample Date | 4/3/2017 | | | 4/3/2017 | | | 3/30/2017 | | | 4/5/2017 | | | 3/29/2017 | | | 3/29/2017 | | | 3/29/2017 | | | 3/29/2017 | | |
| | | | Sample Depth (ft) | - | | | - | | | - | | | - | | | - | | | - | | | - | | | - | | |
| | | | N=Normal, FD=Field Duplicate | N | | | N | | | N | | | N | | | N | | | FD | | | 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 | 39 | | 0.6 | 27 | J- | 0.6 | 26 | | 0.6 | 28 | | 0.6 | 40 | | 0.6 | 31 | | 0.6 | 36 | | 0.6 | 39 | | 0.6 |
| Perfluoroheptanoic acid | ng/l | 375-85-9 | NE | 26 | | 0.5 | 21 | | 0.5 | 19 | | 0.5 | 15 | | 0.5 | 20 | | 0.5 | 25 | | 0.5 | 25 | | 0.5 | 26 | | 0.5 |
| Perfluoro-n-octanoic acid (PFOA) | ng/l | 335-67-1 | 70 | 150 | | 0.6 | 120 | | 0.6 | 150 | | 0.6 | 130 | | 0.6 | 50 | | 0.6 | 180 | | 0.6 | 190 | | 0.6 | 180 | | 0.6 |
| Perfluorononanoic acid | ng/l | 375-95-1 | NE | 15 | | 0.6 | 11 | | 0.6 | 8 | | 0.6 | 5 | | 0.6 | 4 | | 0.6 | 13 | | 0.6 | 14 | | 0.6 | 6 | | 0.6 |
| Perfluorodecanoic acid | ng/l | 335-76-2 | NE | 0.6 | J | 0.5 | 2 | | 0.5 | 2 | J | 0.5 | 2 | | 0.5 | 1 | J | 0.5 | 3 | | 0.5 | 3 | | 0.5 | 1 | J- | 0.5 |
| Perfluoroundecanoic acid | ng/l | 2058-94-8 | NE | | U | 1 | 1 | J | 1 | | U | 1 | | UJ | 1 | | U | 1 | | U | 1 | | U | 1 | | UJ | 1 |
| Perfluorododecanoic acid | ng/l | 307-55-1 | NE | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 |
| Perfluorotridecanoic acid | ng/l | 72629-94-8 | NE | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 |
| Perfluorotetradecanoic acid | ng/l | 376-06-7 | NE | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 |
| Perfluorobutanesulfonic acid (PFBS) | ng/l | 375-73-5 | NE | 6 | | 0.8 | 2 | J | 0.8 | 3 | J | 0.8 | 2 | J | 0.8 | 4 | | 0.8 | 3 | J | 0.8 | 3 | J | 0.8 | 3 | J | 0.8 |
| Perfluorohexanesulfonic acid (PFHxS) | ng/l | 355-46-4 | NE | 17 | | 1 | 12 | | 1 | 18 | | 1 | 23 | | 1 | 9 | | 1 | 11 | | 1 | 10 | | 1 | 9 | | 1 |
| Perfluoro-1-Octanesulfonate (PFOS) | ng/l | 1763-23-1 | 70 | 41 | | 2 | 33 | | 2 | 41 | | 2 | 15 | | 2 | 12 | | 2 | 120 | | 2 | 130 | | 2 | 99 | | 2 |
| N-methyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2355-31-9 | NE | | UJ | 1 | | UJ | 1 | | UJ | 1 | | UJ | 1 | | U | 1 | | U | 1 | | UJ | 1 | | U | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2991-50-6 | NE | | UJ | 1 | | UJ | 1 | | U | 1 | | UJ | 1 | | U | 1 | 1 | J | 1 | 1 | J | 1 | 14 | | 1 |
| Total PFOA + PFOS | ng/l | NA | 70 | 191 | | | 153 | | | 191 | | | 145 | | | 62 | | | 300 | | | 320 | | | 279 | | |

**Attachment Table 2-2 (continued)**
**March-April 2017 Semi-Annual Monitoring Program - Summary of Detected PFCs**
**Delaware Sand & Gravel Superfund Site**
**New Castle, Delaware**

| | | | | NCC UPA Monitoring Wells and P-6 Vicinity | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | BW-1 | | | BW-2 | | | MW-18 | | | MW-26N | | | MW-28 | | | MW-29 | | | MW-29 | | | MW-31 | | |
| | | | Sample Date | 4/3/2017 | | | 4/3/2017 | | | 3/30/2017 | | | 4/5/2017 | | | 3/29/2017 | | | 3/29/2017 | | | 3/29/2017 | | | 3/29/2017 | | |
| | | | Sample Depth (ft) | - | | | - | | | - | | | - | | | - | | | - | | | - | | | - | | |
| | | | N=Normal, FD=Field Duplicate | N | | | N | | | N | | | N | | | N | | | FD | | | 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 | 39 | | 0.6 | 27 | J- | 0.6 | 26 | | 0.6 | 28 | | 0.6 | 40 | | 0.6 | 31 | | 0.6 | 36 | | 0.6 | 39 | | 0.6 |
| Perfluoroheptanoic acid | ng/l | 375-85-9 | NE | 26 | | 0.5 | 21 | | 0.5 | 19 | | 0.5 | 15 | | 0.5 | 20 | | 0.5 | 25 | | 0.5 | 25 | | 0.5 | 26 | | 0.5 |
| Perfluoro-n-octanoic acid (PFOA) | ng/l | 335-67-1 | 70 | 150 | | 0.6 | 120 | | 0.6 | 150 | | 0.6 | 130 | | 0.6 | 50 | | 0.6 | 180 | | 0.6 | 190 | | 0.6 | 180 | | 0.6 |
| Perfluorononanoic acid | ng/l | 375-95-1 | NE | 15 | | 0.6 | 11 | | 0.6 | 8 | | 0.6 | 5 | | 0.6 | 4 | | 0.6 | 13 | | 0.6 | 14 | | 0.6 | 6 | | 0.6 |
| Perfluorodecanoic acid | ng/l | 335-76-2 | NE | 0.6 | J | 0.5 | 2 | | 0.5 | 2 | J | 0.5 | 2 | | 0.5 | 1 | J | 0.5 | 3 | | 0.5 | 3 | | 0.5 | 1 | J- | 0.5 |
| Perfluoroundecanoic acid | ng/l | 2058-94-8 | NE | | U | 1 | 1 | J | 1 | | U | 1 | | UJ | 1 | | U | 1 | | U | 1 | | U | 1 | | UJ | 1 |
| Perfluorododecanoic acid | ng/l | 307-55-1 | NE | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 |
| Perfluorotridecanoic acid | ng/l | 72629-94-8 | NE | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 | | U | 0.5 |
| Perfluorotetradecanoic acid | ng/l | 376-06-7 | NE | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 |
| Perfluorobutanesulfonic acid (PFBS) | ng/l | 375-73-5 | NE | 6 | | 0.8 | 2 | J | 0.8 | 3 | J | 0.8 | 2 | J | 0.8 | 4 | | 0.8 | 3 | J | 0.8 | 3 | J | 0.8 | 3 | J | 0.8 |
| Perfluorohexanesulfonic acid (PFHxS) | ng/l | 355-46-4 | NE | 17 | | 1 | 12 | | 1 | 18 | | 1 | 23 | | 1 | 9 | | 1 | 11 | | 1 | 10 | | 1 | 9 | | 1 |
| Perfluoro-1-Octanesulfonate (PFOS) | ng/l | 1763-23-1 | 70 | 41 | | 2 | 33 | | 2 | 41 | | 2 | 15 | | 2 | 12 | | 2 | 120 | | 2 | 130 | | 2 | 99 | | 2 |
| N-methyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2355-31-9 | NE | | UJ | 1 | | UJ | 1 | | UJ | 1 | | UJ | 1 | | U | 1 | | U | 1 | | UJ | 1 | | U | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2991-50-6 | NE | | UJ | 1 | | UJ | 1 | | U | 1 | | UJ | 1 | | U | 1 | 1 | J | 1 | 1 | J | 1 | 14 | | 1 |
| Total PFOA + PFOS | ng/l | NA | 70 | 191 | | | 153 | | | 191 | | | 145 | | | 62 | | | 300 | | | 320 | | | 279 | | |

**Attachment Table 2-2 (continued)**
**March-April 2017 Semi-Annual Monitoring Program - Summary of Detected PFCs**
**Delaware Sand & Gravel Superfund Site**
**New Castle, Delaware**

| | | | | NCC UPA Monitoring Wells and P-6 Vicinity | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | MW-34 | | | MW-40 | | | P-4_UPA | | | P-5L | | | P-5U | | | P-6_UPA | | | P-6_UPA | | | RW-10 | | | RW-10 | | |
| | | | Sample Date | 3/30/2017 | | | 4/11/2017 | | | 4/11/2017 | | | 3/30/2017 | | | 3/30/2017 | | | 4/3/2017 | | | 4/3/2017 | | | 4/11/2017 | | | 4/11/2017 | | |
| | | | Sample Depth (ft) | - | | | - | | | - | | | - | | | - | | | - | | | - | | | - | | | - | | |
| | | | N=Normal, FD=Field Duplicate | N | | | N | | | N | | | N | | | N | | | FD | | | N | | | FD | | | 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 |
| Perfluorohexanoic acid | ng/l | 307-24-4 | NE | 17 | | 0.6 | 14 | | 0.6 | 16 | J- | 0.6 | 11 | | 0.6 | 33 | | 0.6 | 34 | J- | 0.6 | 34 | J- | 0.6 | 45 | | 0.6 | 46 | | 0.6 |
| Perfluoroheptanoic acid | ng/l | 375-85-9 | NE | 10 | | 0.5 | 10 | | 0.5 | 11 | | 0.5 | 6 | | 0.5 | 18 | | 0.5 | 24 | J- | 0.5 | 19 | | 0.5 | 20 | | 0.5 | 19 | | 0.5 |
| Perfluoro-n-octanoic acid (PFOA) | ng/l | 335-67-1 | 70 | 71 | | 0.6 | 45 | | 0.6 | 20 | J- | 0.6 | 45 | | 0.6 | 76 | | 0.6 | 110 | | 0.6 | 100 | | 0.6 | 92 | | 0.6 | 93 | | 0.6 |
| Perfluorononanoic acid | ng/l | 375-95-1 | NE | 5 | | 0.6 | 4 | | 0.6 | 14 | | 0.6 | 2 | J | 0.6 | 8 | | 0.6 | 8 | | 0.6 | 8 | | 0.6 | 29 | | 0.6 | 32 | | 0.6 |
| Perfluorodecanoic acid | ng/l | 335-76-2 | NE | 1 | J | 0.5 | 0.7 | J | 0.5 | 7 | J- | 0.5 | 0.6 | J | 0.5 | 1 | J | 0.5 | 7 | | 0.5 | 6 | | 0.5 | 2 | | 0.5 | 3 | | 0.5 |
| Perfluoroundecanoic acid | ng/l | 2058-94-8 | NE | | U | 1 | | U | 1 | 3 | J- | 1 | | U | 1 | 2 | J | 1 | 3 | J- | 1 | 3 | J- | 1 | | U | 1 | | U | 1 |
| Perfluorododecanoic acid | ng/l | 307-55-1 | NE | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | 1 | J- | 0.5 | 1 | J- | 0.5 | | UJ | 0.5 | | U | 0.5 |
| Perfluorotridecanoic acid | ng/l | 72629-94-8 | NE | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | UJ | 0.5 | | U | 0.5 |
| Perfluorotetradecanoic acid | ng/l | 376-06-7 | NE | | U | 0.5 | 0.5 | J | 0.5 | | UJ | 0.5 | | U | 0.5 | | U | 0.5 | | UJ | 0.5 | | UJ | 0.5 | 0.7 | J- | 0.5 | | UJ | 0.5 |
| Perfluorobutanesulfonic acid (PFBS) | ng/l | 375-73-5 | NE | 2 | J | 0.8 | 0.8 | J | 0.8 | 1 | J | 0.8 | | U | 0.8 | 4 | | 0.8 | 2 | J+ | 0.8 | | UJ | 0.8 | 9 | | 0.8 | 8 | | 0.8 |
| Perfluorohexanesulfonic acid (PFHxS) | ng/l | 355-46-4 | NE | 13 | J- | 1 | 11 | | 1 | 6 | | 1 | 8 | | 1 | 4 | | 1 | 52 | J- | 1 | 35 | | 1 | 93 | J- | 1 | 85 | | 1 |
| Perfluoro-1-Octanesulfonate (PFOS) | ng/l | 1763-23-1 | 70 | 19 | | 2 | 17 | | 2 | 5 | J | 2 | 8 | | 2 | 3 | J | 2 | 21 | | 2 | 19 | | 2 | 11 | | 2 | 11 | | 2 |
| N-methyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2355-31-9 | NE | | U | 1 | | U | 1 | | UJ | 1 | | U | 1 | | U | 1 | | UJ | 1 | | UJ | 1 | | UJ | 1 | | U | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2991-50-6 | NE | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | U | 1 | | UJ | 1 | | U | 1 | | U | 1 | | U | 1 |
| Total PFOA + PFOS | ng/l | NA | 70 | 90 | | | 62 | | | 25 | | | 53 | | | 79 | | | 131 | | | 119 | | | 103 | | | 104 | | |

**Attachment Table 2-2 (continued)**
**March-April 2017 Semi-Annual Monitoring Program - Summary of Detected PFCs**
**Delaware Sand & Gravel Superfund Site**
**New Castle, Delaware**

| | | | | NCC UPA Monitoring Wells and P-6 Vicinity | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | UPA-101-TZ | | | UPA-101-US | | |
| | | | Sample Date | 3/29/2017 | | | 4/4/2017 | | |
| | | | Sample Depth (ft) | - | | | - | | |
| | | | N=Normal, FD=Field Duplicate | N | | | N | | |
| Parameter | Unit | CAS | HA | Result | Qual | RDL | Result | Qual | RDL |
| Perfluorohexanoic acid | ng/l | 307-24-4 | NE | 39 | J- | 0.6 | 57 | J- | 0.6 |
| Perfluoroheptanoic acid | ng/l | 375-85-9 | NE | 20 | | 0.5 | 45 | J- | 0.5 |
| Perfluoro-n-octanoic acid (PFOA) | ng/l | 335-67-1 | 70 | 150 | | 0.6 | 240 | | 0.6 |
| Perfluorononanoic acid | ng/l | 375-95-1 | NE | | U | 0.6 | 7 | | 0.6 |
| Perfluorodecanoic acid | ng/l | 335-76-2 | NE | | U | 0.5 | 5 | J- | 0.5 |
| Perfluoroundecanoic acid | ng/l | 2058-94-8 | NE | | U | 1 | | UJ | 1 |
| Perfluorododecanoic acid | ng/l | 307-55-1 | NE | | U | 0.5 | | UJ | 0.5 |
| Perfluorotridecanoic acid | ng/l | 72629-94-8 | NE | | U | 0.5 | | UJ | 0.5 |
| Perfluorotetradecanoic acid | ng/l | 376-06-7 | NE | | UJ | 0.5 | | UJ | 0.5 |
| Perfluorobutanesulfonic acid (PFBS) | ng/l | 375-73-5 | NE | 2 | J+ | 0.8 | | UJ | 0.8 |
| Perfluorohexanesulfonic acid (PFHxS) | ng/l | 355-46-4 | NE | 6 | | 1 | 94 | J- | 1 |
| Perfluoro-1-Octanesulfonate (PFOS) | ng/l | 1763-23-1 | 70 | 5 | J | 2 | 44 | | 2 |
| N-methyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2355-31-9 | NE | | U | 1 | | UJ | 1 |
| N-ethyl perfluorooctanesulfonamidoacetic Acid | ng/l | 2991-50-6 | NE | | U | 1 | | UJ | 1 |
| Total PFOA + PFOS | ng/l | NA | 70 | 155 | | | 284 | | |

ATTACHMENT 3

HISTORICAL SURFACE-WATER QUALITY MONITORING RESULTS
ARMY CREEK

## Attachment Table 3-1

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

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## Attachment Table 3-1 (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.

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## Attachment Table 3-1 (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

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## Attachment Table 3-1 (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.

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## Attachment Table 3-1 (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

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## Attachment Table 3-1 (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.

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## Attachment Table 3-1 (continued)

Summary of Surface-Water Quality Data for Army Creek and Army Pond

| Parameter | BTAG Screening Level | SWD | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | µg/l | 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

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## Attachment Table 3-1 (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.

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## Attachment Table 3-1 (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

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## Attachment Table 3-1 (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.

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## Attachment Table 3-1 (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

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## Attachment Table 3-1 (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.

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## Attachment Table 3-1 (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

1/16/2018

## Attachment Table 3-1 (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.

1/16/2018

ATTACHMENT 4

SAMPLING AND ANALYSIS PLAN

# ATTACHMENT 4

# SAMPLING AND ANALYSIS PLAN

## Army Creek Landfill Superfund Site
## New Castle, Delaware

**Submitted To:** USEPA, Region III
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Philadelphia, PA 19103-2029

**Submitted By:** Army Creek Landfill Trust
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**February 2018**
**Revision 0**

**Project No.: 013-6052**

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Signature

February 14, 2018
Date

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Signature

February 14, 2018
Date

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Theresa A. Miller

February 14, 2018
Date

Theresa A. Miller, PG, LSP, Senior Consultant
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# 1.0 INTRODUCTION AND PROJECT INVOLVEMENT

This Sampling and Analysis Plan (SAP) was prepared for the Army Creek Landfill (ACL) Superfund Site (Site) in New Castle, Delaware (Site; as shown in Figure 1) for use with the Additional Investigation Work Plan (referred to herein as "Work Plan") dated February 2018. This SAP includes the following proposed activities and quality assurance (QA) protocols:

- Soil boring advancement via roto-sonic techniques and installation of monitoring wells in the Upper Potomac Aquifer (UPA)
- Monitoring well development, purging and sampling techniques and associated QA protocols for groundwater
- Monitoring program for the groundwater assessment associated with the western lobe of the ACL and per- and polyfluoroalkyl substances (PFAS) assessment associated with the Site

The following sections of this SAP present the requirements necessary to implement data collection activities in accordance with United States Environmental Protection Agency (USEPA) Requirements for Quality Assurance Project Plans EPA QA/R-5 (March 2001). More specifically:

- Section 2 - Project Background and Administrative Information
- Section 3 - Quality Objectives and Criteria
- Section 4 - Methods for Data Generation and Acquisition
- Section 5 - Assessment and Oversight
- Section 6 - Data Validation and Usability

# 2.0 PROJECT BACKGROUND AND ADMINISTRATIVE INFORMATION

This SAP was prepared in support of the Work Plan; therefore, a brief project background including a description of the additional assessment requested by the USEPA and a summary of the proposed scope of work for the assessment is provided in this section. For additional details, refer to the Work Plan. This section also provides information regarding project organization, training, documents and records that are necessary for the execution of this SAP.

## 2.1 Problem Definition/Background

In the USEPA's letter dated September 28, 2017, the USEPA requested that the Army Creek Private Settlors (ACPS) and New Castle County (NCC) perform additional Site characterization field work "to determine: 1) the extent of the dissolved metals and 1,2-DCA [1,2,-dichloroethane] contamination in groundwater within the Upper Potomac Aquifer downgradient of the western lobe of the Army Creek Landfill: 2) whether the Army Creek Landfill is a source of PFAS in groundwater within the Upper Potomac Aquifer; and 3) the vulnerability of the Llangollen well field to contaminant releases from the western love of the Army Creek Landfill." Based on this request and subsequent discussions and correspondence as documented in the Work Plan, the ACPS and NCC prepared the Work Plan to evaluate the need for additional remedial actions at the Site associated with impacted groundwater observed downgradient of the Site. Figure 2 shows the existing monitoring well locations. The groundwater at and downgradient of the Site is impacted with inorganics (predominantly iron, manganese and cobalt) and volatile organic compounds (VOCs) (primarily 1,2-dichloroethane [1,2-DCA]). Regionally, the groundwater is impacted with PFAS, predominantly perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), by various facilities in the area.

## 2.2 Project/Task Description

The primary objective of this SAP is to present monitoring, assessment and data analysis procedures designed to implement sampling programs. The resulting data will be used to address data gaps associated with groundwater impacts at the Site. To meet these objectives, ACPS and NCC will install additional monitoring wells downgradient of the western lobe of ACL and collect groundwater samples from new and existing wells to provide additional Site information. The sampling locations and parameters are listed on Table 1 and the locations are shown on Figures 2 and 3.

## 2.3 Project Organization

The lead regulatory agency for the Site is the USEPA with involvement of the State of Delaware Department of Natural Resources and Environmental Control (DNREC). The following summarizes the organizations involved in this project:

| SAP Recipients | Organization |
|---|---|
| Debra Rossi | USEPA Region III Project Manager |
| Christina Wirtz | Delaware DNREC |
| Michael Sherrier | Chairperson, ACPS |
| Susanna Mays | Administrator, ACPS |
| Mike Harris | New Castle County (NCC) |

The environmental consultant (EC) and field services contractor are yet to-be-determined. Analytical chemistry services are anticipated to be provided by TestAmerica of Edison, New Jersey (TestAmerica Edison), Shealy Environmental of West Columbia, SC or Eurofins Lancaster Laboratories, Inc. (Eurofins) of Lancaster, Pennsylvania. If use of a different laboratory is required to satisfy project needs, the laboratory quality manual and the laboratory standard operating procedures will be forwarded to the USEPA for review prior to use of the laboratory.

## 2.4 Special Training/Certification

EC project team members with appropriate experience, technical skills and training will be selected to perform the project tasks. The subcontractors selected for laboratory analysis were selected based on qualifications and experience of the subcontractor to perform the required work. The subcontractors will meet the general requirements of the USEPA Region III to perform these tasks. The EC's project personnel responsible for data collection and data quality reviews will be trained in relevant procedures and analytical methodologies.

## 2.5 Documents and Records

The organization and their personnel listed in the SAP Distribution List and the EC will receive the most current approved version of this SAP. This SAP includes the revision number and date, and will be updated as needed.

The EC will maintain electronic copies of all laboratory deliverables as part of the project file. A copy of these electronic deliverables will be incorporated into the Site chemical database. No printed reports of the laboratory data will be maintained, because multiple copies of the portable document format (PDF) report version will be maintained and backed up (by EC as well as each subcontracted laboratory). The EC will retain chain-of-custody (COC) forms, field documentation forms, including sample field information forms and field notebooks. The EC will file and maintain data and other records (including interim progress reports) in an accessible location on its premises or in an off-site secured file storage facility for a period of at least 5 years.

For laboratory analytical data, PDF deliverables will be produced from the laboratory in a standard reduced deliverable format and the electronic data deliverables (EDD) will be in the EQuIS 4-file and Microsoft Excel database format.

The laboratory report format for all analytical data analyses performed by the selected laboratory will consist of the items listed below.

Case Narrative:

- Date of issuance
- Laboratory analysis performed
- Work order batch number
- Numbers of samples and respective matrices
- QC procedures utilized and also references to the acceptance criteria
- Laboratory report contents
- Project name and number
- Condition of samples 'as-received'
- Discussion of whether or not sample holding times were met
- Any deviations from intended analytical strategy
- Any deviations or modifications of the laboratory standard operating procedures (SOPs)
- Discussion of technical problems or other observations which may have created analytical difficulties
- Discussion of any laboratory quality control (QC) checks which failed to meet project criteria and the corrective actions pursued
- Signature of the Laboratory QA Officer or designee

Chemistry Data Package:

- COC documentation
- Case narrative for each analyzed batch of samples
- Summary page indicating dates of analyses for samples and laboratory QC checks
- Cross referencing of laboratory sample to project sample identification numbers
- Description of data qualifiers to be used
- Sample preparation and analyses for samples
- Sample results (results between the method detection limit (MDL) and quantitation limit (QL) will be reported as estimated values)
- QC summary package including the results of laboratory control samples (LCSs), matrix spike/matrix spike duplicates (MS/MSDs), interference check samples, serial dilutions, laboratory duplicates, and method blanks
- Electronic data deliverable containing the results for field and QC samples

# 3.0 QUALITY OBJECTIVES AND CRITERIA

This section describes the approach to the Measurement Performance Criteria which uses data quality indicators expressed as precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS). Where possible, acceptance criteria are specified to help delineate minimum acceptability levels for use of data in the overall decision making process.

## 3.1 Precision

Precision refers to the degree to which repeated measurements are similar to one another. It measures the agreement (reproducibility) among individual measurements, obtained under prescribed similar conditions. Measurements that are precise are in close agreement with one another.

Field precision is assessed through the collection and measurement of field duplicates. A field duplicate sample is defined as two or more representative portions taken from the same sampling location, homogenized, split and submitted for identical analyses.

Precision in the laboratory is assessed through the calculation of relative percent differences (RPDs) between sample results. The RPD is calculated according to the following formula.

$$RPD = \frac{2 \times |\text{Amount in Sample 1} - \text{Amount in Sample 2}|}{(\text{Amount in Sample 1} + \text{Amount in Sample 2})} \times 100$$

Precision control limits for all analyses are provided in the Measurement Performance Criteria, Tables 2 through 5. The precision control limits provided are based on the laboratory QC limits, which are routinely re-evaluated following the procedures in the laboratory quality assurance policies and the requirements of the analytical methods. Should the laboratory QC limits change between the submission of this SAP and the sample analyses, the limits in place at the time of sample analysis will be used to evaluate the data, and reported with the data usability summary.

## 3.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference or true value. The accuracy measurement is generally determined by the percent recovery (%R) of a known value. Accuracy as %R is determined by the following equation:

$$\%R = \frac{(\text{Amount in Spiked Sample} - \text{Amount in Sample})}{\text{Known Amount Added}} \times 100$$

Accuracy in the field is assessed through the use of equipment rinsate and trip blanks to assess the potential of cross contamination. In addition, field accuracy is assessed by the adherence to all sample handling, preservation, and holding time criteria.

Laboratory accuracy and bias will be assessed through the analysis of standard reference materials (SRMs), LCSs, MS/MSDs, surrogate compounds, and the determination of the %R for these measurements. General accuracy control limits are provided in the Measurement Performance Tables, Tables 2 through 5. Where accuracy criteria are not met, data will be qualified as either estimated (minor deviation from accuracy criteria) or rejected (major deviation from accuracy criteria). Data qualified as rejected should not be used for decision making purposes.

## 3.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plan is followed and that proper sampling techniques are used. The sampling program was designed to provide data representative of Site conditions. During development of this program, consideration was given to historical activities, existing analytical data, physical setting and processes. Using the proper analytical procedures, appropriate methods, meeting sample holding times and meeting QC criteria for each parameter affirms representativeness in the laboratory. An additional assessment of representativeness will be made through field duplicates. While field duplicates are primarily used to assess precision, they also indicate sample homogeneity and therefore the representativeness of the data to the Site.

## 3.4 Comparability

Comparability is an expression of the confidence with which one data set can be compared to another. Comparability of data is achieved by ensuring Site-wide sample collection and analyses follow the same protocol. Comparability depends upon the proper design of the sampling program and will be satisfied by following the Work Plan, SOPs, and using the proper sampling techniques. The field manager will routinely oversee field activities and verify compliance with field sampling procedures identified in the Work Plan.

Analytical data are comparable when similar analytical methods are used. Appropriate laboratory personnel will review and have a working knowledge of the laboratory SOPs to be used during the analysis of samples for the investigation. Additionally, the laboratory QA Manager will review data generated, determine compliance with method requirements, and attest that QA objectives are met.

## 3.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data that was expected under normal conditions. Data are considered valid and complete

if QC elements have met the criteria established in this SAP. Qualified data may be considered usable and will be considered complete on a case by case basis.

Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\textit{Completeness} = \frac{\textit{(number of valid measurements)}}{\textit{(number of measurements planned)}} \times 100$$

The laboratory and field completeness goal for this project is greater than 85 percent. Field measurements not collected from a specified location, or samples not collected due to environmental conditions, will be identified in the report. Data qualified by the laboratory or data reviewer as estimated is usable and therefore considered complete; however, data qualified as rejected are not usable and do not count toward completeness goals.

## 3.6 Sensitivity

Sensitivity is defined as the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. Two measurement responses of interest in assessing sensitivity are the MDL and the QL. The MDL is defined as the minimum concentration of a substance that can be identified, measured and reported with a 99 percent confidence that the substance concentration is greater than zero, for a specific matrix containing the substance. The MDLs are determined as outlined in 40 CFR Part 136. The QL is defined as the level of measurement that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operations. The QLs are generally 2 to 5 times greater than the MDLs.

The sensitivity for field measurements will be determined, in part, by the limitations of field instrumentation as described in the manufacturer's manual and specific field measurement SOPs. Other factors that will influence sensitivity include matrix and environmental conditions.

The MDL and QL requirements for this project are identified in Table 5. The laboratory will verify analytical QLs defined by a point on the calibration curve which is below the stated QL. Additionally the laboratory will provide MDL studies for each compound upon request by the USEPA and/or EC's QA officer. Should the laboratory MDL or QL change between the submission of this SAP and the sample analyses, the limits in place at the time of sample analysis will be used to evaluate the data and reported with the data usability summary.

# 4.0 DATA GENERATION AND ACQUISITION

This section provides the details regarding the field sampling program including: drilling/soil boring advancement, monitoring well installation and development, groundwater sampling and analysis, equipment calibration and decontamination, handling of investigation-derived waste (IDW), and data management.

## 4.1 Sampling Process Design

The monitoring program includes collection of groundwater samples for analysis of various parameters. The sample locations are being reviewed as part of the Work Plan submitted to the USEPA with this SAP. These data will be used to address data gaps and evaluate the need for remedial actions at the Site. All work will be conducted following Health and Safety Protocols and a Health and Safety Plan (HASP) will be developed by the EC.

## 4.2 Locations, Frequencies and Matrices

This section summarizes the sampling locations, frequencies and matrices detailed in the Work Plan for the assessment downgradient of ACL's western lobe and the assessment of PFAS in water within the ACL and UPA groundwater in the vicinity of the Site.

### *4.2.1 Western Lobe*

The proposed sampling locations to address the UPA groundwater data gaps include four wells to be installed into the UPA downgradient of ACL's western lobe and sampling of five existing wells. The proposed locations of the new wells (P-4L, MW-22NU, WL-1U, and WL-1L) and existing wells included in the sampling program are shown on Figure 2 and are listed on Table 1. After installation and development of the new wells, groundwater from the nine wells will be sampled quarterly, as outlined in this SAP, for VOCs, metals, and natural attenuation parameters. Due to the long screen intervals (wells screened across both the upper sand and the lower sand of the UPA) on wells MW-38N and MW-49N, these wells will be purged and sampled from two locations within the screened interval to assess potential differences in concentrations across the two units. Table 1 lists the locations, frequency and parameters. Section 4.3.3.2 describes the low-flow purging and sampling methodology for these wells.

### *4.2.2 PFAS in Groundwater*

The proposed program to assess the PFAS in groundwater includes sampling and analysis of groundwater samples from 18 monitoring wells, including the four wells to be installed into the UPA downgradient of ACL's western lobe, and up to 10 gas vents within the ACL. Due to the limited water generally available within the gas vents and difficulties associated with purging and collecting water samples from the gas

vents within the ACL[1], it may not be possible to collect samples from 10 gas vents. It is anticipated that the gas vent samples will be collected following the volume averaging technique using bailers described in Section 4.3.3.3. Section 4.3.3.2 describes the low-flow purging and sampling methodology for the newly installed wells and existing UPA wells.

The proposed locations in the sampling program are shown on Figure 3 and are listed on Table 1. These wells and gas vents will be sampled for PFAS one time, and the sampling event will be contemporaneous with the annual PFAS sampling event for the adjacent Delaware Sand & Gravel Superfund Site.

## 4.3 Sampling Methods

### *4.3.1 Soil Boring Advancement*

Prior to advancing boreholes, the drill rig and all drilling and sampling equipment coming in contact with subsurface soils will be decontaminated in accordance with procedures contained in Section 4.4.

Soil borings will be advanced using Rotosonic drilling methods. Rotosonic drilling is a dual-cased system that employs high frequency vibration to obtain continuous core samples of unconsolidated formations and many consolidated formations (including bedrock), and/or to advance casing for well construction and other purposes. Rotosonic rigs have been used successfully in the area of the Site.

A driller licensed by the State of Delaware will be utilized for the work. Soil lithology will be logged by the EC field staff; and field screened using a photoionization detector (PID).

### *4.3.2 Groundwater Monitoring Well Installation/Development*

The Delaware-licensed driller will obtain drilling permits for the monitoring wells.

#### 4.3.2.1 Monitoring Wells

The proposed UPA monitoring wells will be installed by advancing a boring using Rotosonic drilling techniques which will allow for a collection of continuous soil core. An 8-inch diameter, threaded, steel isolation casing will be advanced. Once the UPCU (clay layer) is encountered, the steel isolation casing will be advanced two feet into the clay layer. The isolation casing will then be pressure tremie-grouted to the ground surface. If the UPCU is absent, the isolation casing will be grouted into a lower conductivity portion of the UPCUTZ.

Upon curing of the grout, the boring will be advanced either to the Upper Potomac Dividing Clay (UPDC) or to the top of the Middle Potomac Confining Unit (MPCU), depending if the well to be installed in the

[1] The landfill gas vents were not installed for the purpose of monitoring leachate within the landfill or collecting aqueous samples. Aspects of their construction could affect data quality. Previous monitoring of leachate in the gas vents indicates that the liquids which enter then screened interval of the gas vents will be thicker than water and must be removed via bailer rather than pumped to the surface.

borehole will be screened in the UPA upper sand or UPA lower sand, respectively. It is recommended that the first boring installed in the location of a proposed UPA upper and lower sand well pair be advanced to the top of the MPCU and be completed with a UPA lower sand well. To avoid the potential for communication between the UPA upper sand and UPA lower sand wells within a pair, the wells will be installed in borings that are separated from each other by between 15 and 25 feet horizontally.

Recovered soil cores will be screened with a PID for evaluation of impacts from organic compounds. A 10-foot screened interval will be selected for each well based on visual, olfactory or PID evidence of impacts. In the absence of impact evidence, the well will be screened across interval with the coarsest material in either the UPA upper or lower sand. More specifically, the placement of the well screens will be determined in the field, based on: 1) observed volatile organic impact based on organic vapor (i.e., PID) readings and/or 2) visual evidence of impacts. If there is no evidence of either, then the screen interval will be set across the portion of the UPA (either upper sand or lower sand) with the coarsest materials.

Monitoring wells will be constructed with 2-inch diameter, 0.010-slot PVC screen and solid PVC riser. A sand (filter) pack comprised of clean quartz sand will be placed in the annulus from 6-inches below to 2 feet above the well screen interval. The sand pack material will be a #1 silica sand. A minimum of 0.5-foot thick #00 filter pack sand will be placed on top of the #1 sand pack, followed by a 2-foot thick seal of bentonite pellets tremied on top of the sand, and completed by a pressure tremie-grouted cement/5% bentonite slurry. Surface casings and concrete pads will be placed around each well, no sooner than 24 hours following well grouting. Surface completion, either flush-mount road boxes or standpipes with steel protective casings, will be dependent on the locations of the monitoring well.

#### 4.3.2.2 Well Development

All new wells will be developed prior to the initiation of any groundwater sampling. Wells will be developed using surge blocks and continuous cycles of over-pumping and recovery until relatively clear water is produced, and field parameters (pH, specific conductance and turbidity) stabilize indicating good hydraulic communication with the surrounding water bearing zone. Field parameters will be measured with a calibrated water quality meter. Because these wells will be sampled for PFAS, PFAS-free extraction equipment and high density polyethylene (HDPE) tubing should be used during development.

#### 4.3.2.3 Well Elevation and Location Survey

Monitoring wells will be surveyed by a surveyor licensed in the State of Delaware after installation for location and elevation including ground surface, top of PVC and top of steel casing elevations. Certain wells for which discrepancies exist between the ACL and DS&G survey data, or which may otherwise be suspect, will be re-surveyed. The survey datum will be consistent with existing datum used for the Site as follows: horizontal datum is Delaware State Plan Coordinate System North American Datum (NAD) 1983; and vertical datum is National Geodetic Vertical Datum (NGVD) 1929.

### 4.3.3 Groundwater Monitoring Well Sampling Procedures

After well construction and development, the new monitoring wells will be allowed to stabilize and equilibrate with the aquifer for a minimum of two weeks prior to sampling. Due to the extremely low method detection limits associated with PFAS analysis and the numerous potential sources of trace concentrations of PFAS, sampling programs for PFAS require the development and implementation of detailed operating procedures to reduce the potential for cross contamination and false positive sample results. Therefore, all PFAS sampling activities will be performed in accordance with the general methods and procedures described in *SOP – 1: General Field Methods for PFAS Sampling Programs* (Attachment A).

#### 4.3.3.1 Groundwater Elevation Measurement Procedures

Groundwater level measurements should be taken from all wells within a time period (not to exceed 48 hours) that is not interrupted by severe changes in barometric pressure or by precipitation events. All groundwater measurements will be made in reference to a control point of known elevation at the top of the well casing. If a total depth measurement is necessary, to confirm well construction information for example, it will be taken after any scheduled sample collection to minimize potential cross-contamination and disturbance to sediments, which may have accumulated in the bottom of the well. For PFAS sampling events, the contemporaneous round of water level measurements will be performed after collection of groundwater samples in all wells to be sampled for PFAS is complete.

#### 4.3.3.2 Low-Flow Groundwater Sampling Procedures

Groundwater samples will be collected using the low-flow purge and sampling technique[2] consistent with previous work at the Site. Prior to sampling, each monitoring well will be purged using a dedicated or decontaminated 2-inch submersible pump (Grundfos RediFlo, Proactive or equivalent) and Teflon®-lined polyethylene tubing (with the exception of the groundwater PFAS sampling event) dedicated to each well. The pump intake will be placed at the midpoint of the well screen. Wells are typically purged at a rate of approximately 200 to 500 milliliters per minute (ml/min) with a goal of less than 0.1 meters (0.3 feet) of drawdown during purging. Best efforts will be made to minimize well drawdown by adjusting the flow when necessary and frequently monitoring the water level during purging. A minimum of 3 feet of water will be maintained over the pump intake at all times to avoid the risk of entrainment of air and pump overheating.

For the PFAS groundwater sampling event, the EC will purge each well using low-flow sampling procedures in accordance with the Work Plan and this SAP dated February 2018 and in accordance with *SOP-2: PFAS Program Monitoring Well Purging and Sampling Protocols* (Attachment A) prior to groundwater sample collection. Groundwater samples will be collected using standard low-flow techniques.

[2] The procedure is based upon either the USEPA Region II document entitled "Groundwater Sampling Procedure, Low Stress (Low Flow) Purging and Sampling" dated March 20, 1998 or the USEPA document entitled "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures" dated April 1996.

During purging, field parameters [temperature, pH, oxidation-reduction potential (ORP) (measured using a platinum electrode), turbidity, specific conductance and dissolved oxygen [DO] will be monitored with a Horiba U-52 instrument (or equivalent). Measurements will be collected using a flow-through cell device in order to minimize sample exposure to the atmosphere. All measurements will be recorded on the Low-Flow Groundwater Purge/Sample Field Information Form (Attachment B) or other equivalent low-flow purge and sampling forms. Measurements will be collected approximately every 5 minutes until the parameters stabilize based on three consecutive readings within the following ranges:

- Temperature: +/- 10%
- pH: +/- 0.1 Standard Units
- Conductivity: +/- 3%
- ORP: +/- 10 millivolts (mV)
- DO: +/- 10% (or +/- 0.1 milligrams per liter [mg/L] if less than 1.0 mg/L)
- Turbidity: +/- 10% (or three consecutive readings below 50 Nephelometric Turbidity Units [NTUs])

Once purging is complete, the discharge tubing will be disconnected from the flow-through cell and samples will be collected directly from the end of the discharge tubing. Certified-clean sample bottles, provided by the laboratory, will be filled by allowing the pump discharge to flow gently down the inside of the bottle with minimal agitation. Each pre-labeled bottle will be capped as it is filled. VOC samples will be collected first, at a flow rate of 100 to 250 ml/min, taking steps to eliminate all headspace in the vials. Immediately after filling, each VOC vial will be checked by inverting the vial and tapping the side of the vial to check for air bubbles. If air bubbles are discovered, additional groundwater will be added to the vial until the bubbles are removed.

During the PFAS sampling event, samples for PFAS analysis will be collected subsequent to VOC sample collection, otherwise samples for metals analyses will be collected subsequent to VOC sample collection. The filtered (dissolved) metals samples will be collected by forcing groundwater through a 0.45-micron filter attached to the end of the discharge tubing.

The samples will be preserved according to method-specific requirements, and promptly placed in a cooler with wet ice and maintained at approximately 4°C. Following sampling, the samples will be shipped under COC procedures to the analytical laboratory(ies).

#### 4.3.3.3 Volume Average Purging Using Bailers

Depending upon site-specific conditions (e.g., the formation will not support the use of submersible pumps as groundwater recharge is too slow) or other project requirements, then volume average purging will be

utilized. The well will be purged of 3 to 5 well volumes and sampled using a dedicated or disposable, bottom-filling, Teflon-lined (with the exception of the PFAS groundwater sampling event) bailer.

Using the well construction information, the volume of standing water in each casing will be calculated using the following equation:

***Standing Water Volume = ((Well depth) – (Water level))*(Casing Volume/foot))***

**Casing Volumes**

| 2-inch casing | 4-inch casing | 6-inch casing | 8-inch casing |
|---|---|---|---|
| 0.163 gal/ft | 0.653 gal/ft | 1.47 gal/ft | 2.61 gal/ft |

Nylon well rope will be securely tied to a new or dedicated Teflon (with the exception of the PFAS groundwater sampling event) bailer. The bailer will be gently lowered into the water column in order to minimize disturbance. Once the bailer fills, it will be slowly pulled up. Field parameter readings (pH, DO, conductivity, temperature, ORP, and turbidity) will be collected from the initial bailer of water, and following removal of each well volume. All measurements will be recorded on the Volume Average Groundwater Purge/Sample Field Information Form (Attachment C) and/or in field notebooks. This will be repeated until at least 3 (minimum if field parameters meet stabilization criteria), but no more than 5 standing water volumes have been evacuated.

Alternatively, 3 to 5 well volumes can be removed by over-pumping with a submersible pump. If the well runs dry during purging, the pump will remain within screened interval and the groundwater in the well will be allowed to recharge to approximately 80 percent of its initial water level measurement prior to the restart of purging. This process will proceed until the 3 to 5 well volume removal criteria is accomplished. Water quality parameters will be recorded in the same manner as described above.

If the water level is lowered to the top of screen during purging, the samples will be collected as soon as there is a sufficient recharge volume to fill the sample bottles. The bailer will be slowly lowered down the well into the top of the water column such that unnecessary disturbance to the groundwater sample does not take place.

VOCs will be collected within 2 hours, if possible and all other parameters will be collected within 24 hours. Samples will be collected directly from the bailer port. Samples for VOC analysis will be collected first, by allowing the water to gently flow down the inside of the vial, taking steps to eliminate all headspace in the vials. Immediately after filling, each VOC vial will be checked by inverting the vial and tapping the side of the vial to check for air bubbles. If air bubbles are discovered, additional groundwater will be added to the vial until the bubbles are removed.

During the PFAS sampling event, samples for PFAS analysis will be collected subsequent to VOC sample collection, otherwise samples for metals analyses will be collected subsequent to VOC sample collection.

The unfiltered metals sample bottle will be filled directly from the bailer. The filtered metals sample will be collected by attaching the filter to the end of the bailer and allowing the sample to gravity feed from the bailer into the sample bottle. Alternatively, the sample to be filtered will be placed in a FF-8200 transfer vessel (or equivalent) and filtered prior to placement in the sample bottle. Each sample collected for filtered metals analysis will be poured from the bailer into a transfer vessel and forced through a 0.45-micron filter prior to placement into the sample bottle. The sample will be forced through the filter using a hand pump or pressurized nitrogen. The transfer vessel will be decontaminated prior to each use in accordance with the procedures presented in Section 4.4.

The samples will be preserved according to method-specific requirements, and promptly placed in a cooler with wet ice and maintained at approximately 4°C. Following sampling, the samples will be shipped under COC procedures to the analytical laboratory(ies).

## 4.4 Decontamination

Decontamination procedures in this section are intended for use by field personnel for cleaning sampling, drilling and other equipment in the field. Deviations from these procedures should be documented in the field records and investigative reports. Specifications for standard decontamination materials follow. These materials will be used, as appropriate, for non-dedicated equipment used during sample collection (e.g., pumps).

- Soap will be a phosphate-free laboratory detergent such as Liquinox® or Alconox®. Use of other detergent must be documented in the field log books and investigative reports.
- Solvent will be pesticide-grade isopropanol. Use of a solvent other than pesticide-grade isopropanol for equipment cleaning purposes must be justified and documented in field log books and investigation reports.
- Tap water may be used from the municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.
- Deionized water is tap water that has been run through a standard deionizing resin column. It is commercially available.
- Distilled water is tap water that has been distilled. It is commercially available.
- Analyte-free water is tap water that has been treated with activated carbon and a standard deionizing resin column. At a minimum, the finished water should contain no constituents above the laboratory reporting limits that are being analyzed for as part of the remedial investigation.
- Other solvents may be substituted for a particular purpose if required. For example, removal of concentrated waste materials may require the use of either pesticide-grade hexane or petroleum ether. After the waste material is removed, the equipment must be subjected to the standard cleaning procedure. Because these solvents are not miscible with water, the equipment must be completely dry prior to use.

Solvents, laboratory detergent, and rinse waters used to clean equipment will not be re-used during field decontamination and will be stored in DOT-approved 55-gallon drums. These materials will be treated as investigation-derived waste (IDW). See Section 4.5 for proper handling and disposal of these materials.

### *4.4.1 PFAS Decontamination*

When decontaminating non-dedicated equipment used to sample PFAS, use the following procedure:

- Rinse thoroughly with Citranox solution
- Rinse thoroughly with de-ionized (DI) water
- Rinse with methanol
- Rinse with DI water
- Allow to air dry and store in a clean Ziploc® storage bag until needed for sampling

### *4.4.2 Drilling Equipment*

The procedures in this section are to be used for all non-dedicated drilling equipment. All decontamination procedures in this section will be performed on a decontamination pad, constructed to the specifications in this section.

#### 4.4.2.1 Decontamination Pad Specifications

Decontamination pads constructed for field cleaning of sampling and drilling equipment should meet the following minimum specifications:

- The pad should be constructed in an area known or believed to be free of surface contamination.
- Ideally, the pad should be located very close to a potable water source.
- The pad should not leak excessively.
- If possible, the pad should be constructed on a level, paved surface and should facilitate the removal of wastewater. This may be accomplished by either constructing the pad with one corner lower than the rest, or by creating a sump or pit in one corner or along one side. Any sump or pit should also be lined.
- Water should be removed from the decontamination pad as needed.
- A temporary pad should be lined with a water impermeable material. This material should be either easily replaced (disposable) or repairable.

At the completion of site activities, the decontamination pad should be deactivated. The pit or sump should be backfilled with the appropriate material designated by the project field leader. No solvent rinsates will be placed on the pad. Solvent rinsates should be collected in separate containers for proper disposal.

#### 4.4.2.2 Decontamination Procedures

1. Clean with tap water and soap using a brush to remove obvious particulate matter and surface films;
2. Rinse thoroughly and power wash with potable water; and
3. Rinse non-dedicated equipment that might contact samples with distilled water. If distilled water is not available, equipment should be allowed to completely dry.

### *4.4.3 Sampling Equipment*

1. The procedures in this section are to be used for all non-dedicated sampling equipment used to collect groundwater;
2. Clean with tap water and soap using a brush to remove obvious particulate matter and surface films;
3. Rinse thoroughly with tap water;
4. Rinse thoroughly with DI or distilled water;
5. Rinse thoroughly with solvent (pesticide-grade isopropanol) unless made of PVC or plastic. These items are not to be solvent rinsed; and
6. Rinse thoroughly with analyte-free water. If analyte-free water is not available, equipment should be allowed to completely dry.

### *4.4.4 Groundwater Sampling Equipment (Non-Dedicated Submersible Pump)*

Non-dedicated groundwater sampling equipment used for the low-flow purging and sampling technique (such as the submersible pump) will be decontaminated prior to sampling each well. The submersible pump will not be removed from the well between purging and sampling operations. The pump and tubing (including support cable and electrical wires that are in contact with the sample) will be decontaminated by the procedure described below. It should be noted that the outside of the pump will be decontaminated consistent with the procedure described above. In addition, decontamination fluids will be pumped from buckets through the pump as follows:

1. Flush the pump with potable water to remove any sediment that may be trapped in the pump;
2. Flush the pump with a weak, non-phosphate detergent solution (approximately 5 gallons);
3. Flush the pump with tap water to remove all the detergent solution. Generous amounts of tap water (at least 3 pump volumes) should be used to ensure that detergent and any sediment that may be trapped in the pump does not remain in the pump;
4. Flush the pump with deionized or distilled water;
5. Flush the pump with isopropyl alcohol. Use sparingly to minimize presence of this decontamination fluid in the samples; and
6. Flush the pump with analyte-free water. Generous amounts of water (at least three pump volumes) should be used to remove as much of the isopropyl alcohol as practical.

### 4.4.5 Water Level Meters and Flow-Through Cells

Water level meters will be thoroughly rinsed with distilled or deionized water prior to each use. Decontamination water should be containerized and as described in Section 4.5.

## 4.5 Investigation-Derived Waste

IDW generated during remedial investigation field activities include: soil, decontamination water and solvent, purge water, well development water, and PPE. Each type of IDW will be handled as described below and stored on-Site until off-Site disposal arrangement are made:

***Soil:*** All excess soil generated from drilling activities will be retained in 55-gallon drums and labeled as "Drill Cuttings". Once a drum has been filled, it will be sealed, dated, numbered, labeled, and recorded in the field log book.

***Water:*** All decontamination, purge, and well development water will be collected in five-gallon buckets, then transferred to 55-gallon drums and labeled as "IDW-Water". Once a drum has been filled, it will be sealed, dated, numbered, labeled, and recorded in the field log book.

***PPE:*** All PPE generated during investigations will be placed in a 55-gallon and labeled "PPE". Once a drum has been filled, it will be sealed, dated and numbered, labeled, and recorded in the field log book.

IDW container labels will include:

- Nature of the IDW (soil, purge water, etc.)
- ID of the well or wells that provided the IDW
- Date filled
- Container number, as recorded in the field log book

The drums will be staged on-Site. At the end of the field activities, IDW will be disposed of in accordance with all applicable state and federal regulations.

## 4.6 Sample Handling and Custody

Table 6 presents the types of analytical SOP reference, methods, containers, volumes, preservations, and hold times that are required for samples. The laboratory QMs are provided in Attachment D. Sample container labels will include the following information:

- Project (site) name
- Sample point identification number
- Date and time the sample was collected
- Preservative (if any)

- Analyses to be performed
- Initials of the sampler

Immediately after sample collection, sample bottles will be placed in a cooler with wet ice and completed COC form. The samples must be maintained at approximately 4° C after collection. COC forms will be completed and will accompany the samples at all times. The COC form and field log book should include:

- Sample identification number and matrix
- Project or site name or number
- Sampler's name or initials
- Sample collection date and time (military time)
- Designation as a grab or composite sample
- Requested analysis
- Any special comments (i.e., samples will be filtered by laboratory upon receipt)
- Any preservatives added to the sample

When shipping samples to the laboratory, sample bottles and requested analyses should be noted on the COC form. The field team leader is responsible for sample handling and documentation requirements. One member of the sampling team should sign the COC form relinquishing custody to the laboratory. If using an overnight courier service, record the tracking number on the COC. The COC form should be sealed inside the shipping container with the samples. The paperwork should be sealed inside a plastic bag to prevent damage from water condensation. The courier does not need to sign the COC form if it is sealed within the shipping container using custody seals. Once samples are transported to the analytical laboratory, custodial responsibility is transferred to the laboratory.

## 4.7 Analytical Methods

The laboratories will perform sample analyses in accordance with the following USEPA method guidelines:

- VOCs following USEPA SW846[3] Method 8260B Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) (December, 1996)
- Total TAL metals, dissolved manganese, and dissolved iron following USEPA SW846 Method 6010B Inductively Coupled Plasma-Atomic Emission Spectrometry (December, 1996), SW846 Method 7470A Mercury in Liquid Waste (Manual Cold-Vapor Technique) (September 1994), and SW846 Method 7471A Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique) (February, 2007)

[3] USEPA, 1996, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846): 3rd edition, Environmental Protection Agency, National Center for Environmental Publications, Cincinnati, Ohio, accessed at URL http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm.

- PFAS following USEPA Method 537, Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), Rev 1.1, modified (September 2009)
- Sulfide following Standard Method 4500-S2-F Sulfide, Iodometric Method (2000)
- Alkalinity following USEPA Methods for Chemical Analysis of Water and Wastes (MCAWW)[4] Method 310.2 Alkalinity (Colorimetric, Automated, Methyl Orange) (December 1976)
- Nitrogen, ammonia following USEPA Method 350.1 Determination of Ammonia Nitrogen by Semi-Automated Colorimetry (August 1993)
- Chloride, Nitrate, Nitrite, and Sulfate following USEPA MCAWW Method 300.0 Determination of Inorganic Anions by Ion Chromatography (August 1993)
- Ferrous Iron following Standard Method 3500-Fe Iron (1997)

SOP documentation from TestAmerica and Eurofins[5] for each of these methods are included in Attachment E. The SOP for Shealy Environmental will be provided if this laboratory is selected. Please see Table 7, Analytical SOP References, for the analytical group, reference number and title of each included SOP. American Society for Testing and Materials (ASTM) methods are not included in this SAP due to copyright restrictions.

## 4.8 Quality Control

This section describes the various QA/QC samples that will be collected in the field and analyzed in the laboratory and the frequency at which they will be performed. QA/QC samples which will be collected will consist of field duplicates, trip blanks, rinsate blanks, and MS/MSD (see Table 8). As QA/QC sample requirements vary by analytical method, SAP Tables 2 through 5 detail specific QC sample requirements. These QA/QC samples are described briefly in the following sections.

During the PFAS groundwater sampling event, the EC will collect equipment blanks, field duplicates, field blanks, and trip blanks, as summarized on Table 5 for QA/QC purposes. QA/QC samples will be collected in accordance with *SOP-3: Quality Assurance / Quality Control Protocols for PFAS Sampling Programs* (Attachment A). These samples will be submitted to Eurofins or Shealy Environmental for analysis of PFAS via USEPA Method 537 Revision 1.1 Modified.

### *4.8.1 Field Duplicates*

Field duplicates will be collected at a frequency of one per 20 primary samples per matrix. Field duplicates are collected by sampling the same location twice, but are assigned a unique sample identification number.

[4] USEPA, 1983, Methods for Chemical Analysis of Water and Wastes, EPA600/4-79-20, Office of Research and Development, Washington, D.C.

[5] Eurofin's SOPs for the PFAS method are confidential and proprietary, as is the case with other labs at this time, because it is a modified version of EPA Method 537. Method 537 as written is strictly a drinking water method. Eurofins provided a coversheet demonstrating that the SOP exists, as well as their more generalized boiler plate documents outlining the analysis summary and PFAS collection considerations.

When collecting field duplicate samples, the sample containers for each analytical parameter should be filled for both the primary and duplicate sample before the jars for the next analytical parameter are filled.

### 4.8.2 Trip Blanks

Trip blanks will be collected at a frequency of one per shipping event. Trip blanks are used to verify that the VOC bottles and samples are not contaminated in transit between the lab to the Site, while on Site, and from the Site back to the lab. The lab will supply pre-prepared trip blanks. Trip blanks should accompany the VOC samples throughout the event from collection through shipment to the laboratory and are recorded on the COC along with the primary samples. Trip blanks are shipped along with each cooler that contains aqueous VOC samples. For the PFAS sampling event, see SOP-3 for additional requirements.

### 4.8.3 Rinsate Blanks

Rinsate blanks are collected for all required analyses at a frequency of one per day per type of non-dedicated sampling equipment which comes in contact with the sample. Rinsate blanks are used to verify that decontamination of field equipment was sufficient. Rinsate blanks are prepared in the field using lab supplied demonstrated analyte-free water. The water is poured over and through each type of sampling equipment and collected in labeled laboratory supplied bottles. Rinsate blanks are recorded on the COC along with the primary samples. For the PFAS sampling event, see SOP-3 for additional requirements.

### 4.8.4 Field Blanks

For the PFAS sampling event, see SOP-3 for additional requirements.

### 4.8.5 MS/MSD

MS/MSDs are collected for all required analyses at a frequency of one per 20 primary samples per matrix. MS/MSD samples are prepared and run by the laboratory to verify the effectiveness of sample preparation procedures in measuring chemicals of interest from the matrix material. Additional sample volume is collected from a location and submitted to the laboratory for analysis. MS/MSD samples are recorded on the COC along with the primary samples. For the PFAS sampling event, see SOP-3 for additional requirements.

### 4.8.6 Internal QC Samples

Internal QC checks have been developed to help ensure accuracy and precision during field sampling and measurement as well as laboratory analysis. Field checks will be performed regularly. Laboratory QC checks will be performed in accordance with the specific analytical methods.

Field measurements will be made in duplicate at a frequency of one in twenty measurements taken. These duplicate measurements must agree +20 percent. If the duplicate measurements do not meet this criterion,

the instrument will be recalibrated and the measurements will be retaken. Field measurements will be recorded in the field notebooks or field information forms and later entered into summary tables.

Details of the internal QC checks utilized by the laboratory will be found in each specific laboratory Quality Manual (QM) and the published analytical methods. Laboratory QC samples will be analyzed at a frequency of one per twenty analytical samples or at a frequency dictated by the methods. These QC samples will be used to determine if results may have been affected by field activities or procedures used in sample transportation or if matrix interferences are an issue. Assessment of laboratory QC will take into account the PARCCS criteria specified in Tables 2 through 5.

Applicable statistics will be calculated following the laboratory SOPs, which can be found in Attachment E, and Section 3 Quality Objectives and Criteria. The laboratories routinely re-evaluate QC criteria using the procedures in their respective laboratory QMs. Analytical data that fall outside QC criteria will be qualified as discussed in Section 5.0 Data Validation and Usability.

## 4.9 Instrument/Equipment Testing, Inspection, and Maintenance

Preventive maintenance of equipment is essential if project resources are to be utilized in a cost-effective manner. Preventive maintenance will sustain the accuracy of measurement systems, minimize downtime, and provide inventory control of critical spare parts, backup systems, and other necessary equipment. The field sampling team will maintain an inventory of replacement parts for field instruments, and will routinely perform preventive maintenance or repair. Spare parts that often require replacement will be kept on hand at the Site during field activities. The preventive maintenance approach for equipment used in field for sampling, monitoring, and testing includes checking batteries and electrodes, checking condition of meters, checking sample bottles for cleanliness and breakage, and that a reasonable supply of bottles, batteries, probes, calibration solution, and supplies are on-hand to avoid unnecessary delays in the field.

Preventive maintenance of laboratory equipment and hardware are described in specific sections of each laboratory QM included in Attachment D. TestAmerica discusses these procedures in Section 20 of their laboratory QM. More than one instrument is generally available for each type of analysis in case the initial instrument malfunctions or does not meet the required measurement criteria. Laboratory personnel or qualified manufacturer representatives will perform preventive maintenance and repair. The laboratory will retain logbooks documenting preventative maintenance and repair for each instrument.

## 4.10 Instrument Calibration and Frequency

### *4.10.1 Field Calibration*

The calibration and maintenance of field equipment will be the responsibility of the field sampling team. Field instruments, such as meters for measuring field parameters, will be standardized/calibrated in accordance with the manufacturers' recommendations against National Institute of Standards and

Technology (NIST) traceable standards, where appropriate. During sampling, calibration checks will occur at a minimum of two times a day (beginning of each day and at least every four hours of operation). Appropriate calibration records will be maintained in project field log books, groundwater sample field information forms, or on calibration forms. A minimum of a two point calibration will be performed for each parameter being calibrated. The field team leader is responsible for ensuring that calibrations are properly performed at the appropriate frequency.

### *4.10.2 Photovac Microtip Photoionization Detector (PID)*

A MiniRAE 3000 (or equivalent) will be used to monitor VOC concentrations in ambient air during intrusive field activities (i.e., groundwater sampling and well installation). The MiniRAE 3000 is a microprocessor controlled PID. The instrument normally operates with a 10.6 electron volt (eV) lamp; however, 9.8 and 11.7 eV lamps are available as options. The detector is capable of measuring concentrations down to about 1 parts per million (ppm) sensitivity for certain compounds. A 10.6 eV lamp will be used on the PID as gross screen for VOCs since the primary VOCs at the Site have good responses to the 10.6 eV lamp. The PID cannot be used to identify unknown substances, it can only quantify/estimate VOC vapors. Winds and high humidity will affect measurement readings. Foggy or high humidity conditions can cause condensation on the lamp, thus affecting measurements.

#### 4.10.2.1 Operational Information

The instrument will be taken into the field fully charged and operated according to manufacturer's instructions. Turn the instrument on by pressing the "MODE" key for one second and release. The pump will start and the message "Warming up now, please wait" will be displayed for about one minute.

The MiniRAE 3000 has two operation modes:

- Search – With the instrument in Search Mode, it only samples when the use activates sampling.
- Hygiene – the instrument is programmed to operate in Hygiene Mode as its default. This provides the most commonly needed features while requiring the fewest parameter adjustments.

The MiniRAE is factory calibrated with standard calibration gas, and is programmed with default alarm limits and will be field-calibrated using Isobutylene gas. The keypad is used to set up and calibrate the MiniRAE. The instrument must be calibrated against a dynamic standard in order to display concentrations in units equivalent to parts per million by volume (ppmv). Clean outdoor air is suitable as 'zero gas'. Isobutylene should be used as the calibration gas and calibration should be conducted in a well ventilated clean air environment. Note that cylinders of compressed gas must be handled with care.

#### 4.10.2.2 Instrument Calibration and Frequency

Following is a description of the calibration procedure:

- Ensure that you are in an area with clean air, away from any exhaust or other potential vapor sources
- Press [N-] and [MODE] simultaneously for 3 seconds to enter Programming Mode
- Press [Y+] to select "Calibrate/Select Gas" menu item
- Press [Y+] to select "Zero Cal?" The display will then read "Apply zero gas"
- Press [Y+] the display will read "Zeroing" for 30 seconds
- While the MiniRAE is collecting the fresh air calibration, prepare the span gas:
  1. Attach a Tedlar bag to the canister of Isobutylene via tubing and regulator
  2. Open the bag valve
  3. Open the gauge valve. DO NOT ALLOW TEDLAR BAG TO OVERFILL
  4. When bag is filled, close regulator valve, then close bag valve
- When zero span is completed, attach Tedlar bag to MiniRAE via tubing
- Press [Y+] to select "Span Cal?"
- When display reads "Apply gas now!", open bag valve. Display will then show "wait …30" with a countdown timer while monitor performs the calibration.
- When done, the display should read calibrated value (for Isobutylene, this should be 100 ppm)
- The instrument is calibrated and ready for use

The MiniRAE will alarm for the following conditions:

- Measured gas concentration exceeds the programmed alarm limits, which for Isobutylene are:

| Calibration Gas | Calibration Span Concentration | | Low | High | Time Weighted Average | Short Term Exposure Limit |
|---|---|---|---|---|---|---|
| Isobutylene | 100 ppm | Concentration | 50 | 100 | 100 | 250 |
| | | Alarm | 2 beeps/flashes per second | 3 beeps/flashes per second | 1 beep/flash per second | 1 beep/flash per second |

- Battery voltage falls below 4.4 V (there will then be approximately 20-30 minutes of operating time remaining)
- UV lamp failure
- Pump stalls
- Datalog memory is full

### 4.10.3 Laboratory Calibration

Sample results should be within the calibration range of the instrument. Samples which do not contain concentrations of target analytes that exceed the instrument calibration range should be analyzed undiluted to achieve the lowest possible reporting limits. However, samples containing elevated levels of target analytes cannot be analyzed undiluted because the calibration range of the method would be exceeded. Such samples will require analysis at dilutions which would result in elevated reporting limits.

The major chemical analytical equipment used for this project are described in each laboratory's QM and the individual analytical methods, provided as Attachments D and E. Each laboratory's QM provides information regarding types of equipment used by the laboratory facility. Calibration procedures will follow published analytical methodologies. Each laboratory's QM references the specific methodologies or laboratory SOPs for calibration procedures. The laboratory will document sources for calibration material; for example, USEPA repository, Supelco© or equivalent. The laboratory QM also describes the procedures used to document equipment repair and maintenance.

## 4.11 Inspection/Acceptance of Supplies and Consumables

Sampling equipment will be inspected prior to use to ascertain proper operation and create a safe working environment. The laboratories chosen for this project has preventative maintenance and health and safety programs to ensure proper execution of project work.

## 4.12 Non-direct Measurements

Non-direct means of data acquisition refers to the use of non-measurement sources such as computer databases, spreadsheets, programs and literature files. ACL does not intend to obtain information from non-measurement sources for decision-making regarding this project.

## 4.13 Data Management

Data collection during this project will be retained in an electronic format. Specific data management activities are as follows:

- Field Sample Collection Forms:
  - Data will be transcribed from field forms or notebooks and tabulated, as appropriate, using a spreadsheet or database program.
  - Data entry will be checked to ensure no transcription errors occurred.
- COC forms:
  - COC forms will be reviewed by the field staff prior to sample submission to the laboratory to verify that the COC matches the cooler contents.
  - COC forms will also be reviewed after sample submission to the laboratory by the QA manager or designee to verify that the sampling plan is being followed.

- Laboratory sample receipt documentation:
  - The QA manager or designee will review the laboratory sample receipt documentation and compare to the COC. If discrepancies are found, the QA manager or designee will contact the field staff and laboratory to resolve any inconsistencies.
  - Communications concerning changes to the sample identifications and required analysis, including telephone memoranda and emails, will be saved to project files by the EC.
- Final Chemistry Analytical Data documentation:
  - Analytical data packages will be verified internally by the laboratory performing the work for completeness prior to submittal to the EC.
  - The QA manager or designee will verify that the analytical data packages contain the information required for data validation upon receipt.
  - The data package elements required are described in Section 2.8 Documents and Records.
  - An electronic database, as well as validated qualifiers, will be kept on the project database, by the EC. Database entries will be checked for correctness and completeness.

# 5.0 ASSESSMENT AND OVERSIGHT

## 5.1 Assessments and Response Actions

Assessment of activities or procedures will be the responsibility of the personnel performing such activities and procedures. For field measurements, the field team leader will be responsible for assessment while the laboratory analyst and sample custodian will be responsible for assessment within the laboratory. The assessment of activities or procedures must comply with the requirements specified in this SAP. Any deviation of a technical procedure or reference method must be noted within the appropriate logbook and, for laboratory analyses, in the Case Narrative of the analytical report.

Performance will be monitored in the field through the use of QC checks as previously discussed in Section 4.6. Performance will be monitored in the laboratory through the use of QC checks discussed in each laboratory QM and the PARCCS criteria presented in Tables 2 through 5.

As described in the guidance documents, assessment includes surveillance, peer review, management systems review, readiness review, technical systems audit, performance evaluation, data quality audit, and data quality assessment. The following assessment activities are planned:

- Peer review
- Technical systems audit
- Data quality assessment

### *5.1.1 Peer Review*

Throughout the project, the EC will maintain a system of peer review by which generated data can be checked and verified. Data that are transcribed and tabulated will be checked for accuracy and completeness.

### *5.1.2 Audits*

The QA/QC audit is an independent systematic on-site review of facilities, equipment, training procedures, record keeping, data validation, data management, and reporting aspects of the field and laboratory QA/QC program. Audits may be performed on field operations and sampling procedures, laboratory analyses and documentation.

### *5.1.3 Field/Sampling Audit*

ACL does not plan to conduct an audit of sampling activities. The field team leader will be responsible for following applicable quality assurance procedures described in this SAP.

### 5.1.4 Laboratory Audits

The laboratory will be expected to have a QA program whereby the QA department will routinely conduct internal audits. The laboratory QM discusses internal laboratory audits. ACL does not anticipate performing audits of the laboratory during this project. If an external audit is deemed necessary by the USEPA, then the USEPA will consult with ACL and the EC regarding an appropriate approach.

### 5.1.5 Data Quality Assessment

Analytical data will be assessed through a series of evaluation procedures. The details regarding data evaluation and validation are discussed in Section 6.

## 5.2 Reports to Management

Timely quality assurance reports are necessary to the successful completion of this project. Quality assurance deficiencies in the field must be reported to the field team leader and the EC's QA and Project Manager. Quality assurance deficiencies in the laboratory must be reported in a timely manner to laboratory and project management personnel. The laboratory's policies and procedures for reporting quality assurance activities to management are included in each laboratory's QM and/or SOPs. Corrective actions for field and laboratory activities will be reported to the EC's QA and Project Manager, ACPS Chairman, and, if necessary, the USEPA Project Manager.

# 6.0 DATA VALIDATION AND USABILITY

## 6.1 Data Review, Verification, and Validation

The laboratory analytical data will be reviewed for completeness, QA/QC forms and holding times will be checked to ensure data quality. The data quality review will follow guidelines provided by USEPA Region III data validation guidance, which defers to the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic and Inorganic Methods Data Review (January 2017)[6], and professional judgment, where necessary. Project specific data quality objectives (DQOs) are presented in Section 3. The laboratory will perform data reduction in accordance with the individual analytical methodologies used for this project. The laboratory QMs or SOPs will have more detailed information regarding the laboratory data reduction procedures.

In general, data reduction of field measurements will not be necessary because readings will be recorded in field notebooks or field forms directly from the field instruments. If reduction of data is necessary because units of measurement are not comparable (e.g., Fahrenheit vs. Celsius), then these conversions will be performed in the office using standard spreadsheet software. Field measurements will be tabulated using spreadsheet or data base software. Field measurements are anticipated to be recorded as follows:

- DO is to be recorded to the nearest 0.01 mg/L
- pH is to be recorded to the nearest 0.01 std pH units
- Turbidity is to be recorded to the nearest 1 NTU
- ORP is to be recorded to the nearest 1 mV
- Specific conductance is to be recorded to the nearest 1 microsiemens (or umhos/cm)
- Temperature is to be recorded to the nearest 0.1°C

## 6.2 Verification and Validation Methods

Data validation techniques include screening, accepting, rejecting or qualifying data on the basis of specific quality control criteria for holding times, blank results, spike results, surrogates, and field duplicates. Data validation is a process whereby erroneous data may be identified prior to entering the project record. Data Verification of field measurements will be performed by field personnel in consultation with the QA and Project Manager. Field personnel will verify the field data through review of calibration and duplicate data readings. The data will be reviewed to determine if there are anomalous readings. Anomalies will be resolved immediately by means such as re-calibration or re-acquisition of the measurement.

[6] Current USEPA National Functional Guidelines are shown. Data review will be performed in accordance with the most current versions of the guidance documents available at the time of data evaluation.

For field samples associated with this project that are sent to a laboratory, the laboratory will produce data packages that will contain the information needed for formal validation of the data. Data will undergo a data evaluation process by which accuracy, precision and completeness are assessed.

The data will be evaluated based upon holding times, blank results, and QC results assessing accuracy and precision. Analytical data packages will be reviewed for completeness and QC summaries will be evaluated. Data review required for this project will be performed under the direction of the QA Manager.

If, based upon this data review, the QA Manager believes that a more extensive data validation should be performed, then a subset of the data will undergo full data validation. Data validation will be performed using the guidelines cited in Section 6.1 and the specific analytical methodologies or SOPs. PARCCS, as defined in Section 3, will be evaluated based upon field sampling documentation, adherence to sample hold times, and analysis of QC samples. Qualifiers will be applied to the data using the logic specified in the validation guidelines cited in Section 6.1, as well as Tables 2 through 5.

Qualified results will be reported for validated samples on the analytical reporting forms provided in the data packages or as data summary tables accompanying the laboratory deliverable data package. Qualified results, data packages and analytical results will be stored electronically in the EC's project files and will also be entered into the project database.

The PARCCS criteria and criteria specified in applicable guidelines may not always be achievable. The data validation guidelines provide directions for the determination of data usability. Qualified data can often provide useful information, although the degree of certainty associated with the result may not be as planned. Professional judgment, in conjunction with appropriate guidance documents, will be used to determine data usability.

## 6.3 Reconciliation with User Requirements

Throughout the project, the EC will determine if project DQOs are being met and assess whether the data that is being collected is sufficient and appropriate. Periodic evaluations of the sampling program will be made to determine if a change in frequency or analytical parameters is appropriate. Individuals making measurements throughout the process will also make assessments of whether the DQOs are being met.

Individuals making field measurements will determine whether or not field quality control criteria were met. The field QA/QC will be overseen by the field team leader. Corrective actions will be initiated in the field as necessary. This corrective action may include recalibration of instruments or use of a different type of instrument.

The analysts in the laboratory will determine if analytical QC criteria are achieved. Corrective action in the form of re-analysis or re-calibration may be warranted. Laboratory analytical data and field data will be

assessed by a data validation specialist under the direction of the QA Manager to determine usability with regard to the DQOs.

As noted in the data validation guidelines, data may not always meet precision and accuracy requirements but may still be considered usable. The data will be assessed with regard to the project DQOs, and professional judgment used in conjunction with guidance documents will determine data usability.

The EC will assess collected data and ascertain whether objectives of the project are being met. The USEPA will be informed in writing of changes to the program that may be warranted.

## 7.0 ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| %R | percent recovery |
| °C | degrees Celcius |
| 1,2-DCA | 1,2-dichloroethane |
| ACL | Army Creek Landfill |
| ACPS | Army Creek Private Settlors |
| ASTM | American Society for Testing and Materials |
| CFR | Code of Federal Regulations |
| COC | chain-of-custody |
| DI | de-ionized |
| DNREC | State of Delaware Department of Natural Resources and Environmental Control |
| DO | dissolved oxygen |
| DOT | Department of Transportation |
| DQOs | data quality objectives |
| EC | Environmental Consultant |
| EDD | electronic data deliverable |
| eV | electron volt |
| Fe | iron |
| FID | flame ionization detector |
| gal/ft | gallons per feet |
| GC/MS | gas chromatograph/mass spectrometer |
| HASP | Health and Safety Plan |
| HDPE | high-density polyethylene |
| IDW | investigation-derived waste |
| LCS | laboratory control sample |
| LEL | lower explosive limit |
| MCAWW | Methods for Chemical Analysis of Water and Wastes |
| MDL | method detection limit |
| mg/L | milligrams per liter |
| ml/min | milliliters per minute |
| Mn | manganese |
| MPCU | Middle Potomac Confining Unit |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| mV | millivolt |
| MW | monitoring well |
| NAD | North American Datum |
| NAPs | natural attenuation parameters |
| NCC | New Castle County |
| NGVD | National Geodetic Vertical Datum |
| NIST | National Institute of Standards and Technology |
| NTUs | Nephelometric Turbidity Units |
| OD | outer diameter |
| ORP | oxidation-reduction potential |
| PARCCS | Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity |
| PDF | portable document format |
| PFAS | per- and poly-fluoroalkyl substances |
| PFOA | perfluorooctanoic acid |
| PFOS | perfluorooctane sulfonate |
| PID | photoionization detector |
| PPE | personal protective equipment |
| ppm | parts per million |
| PRT | post-run tubing |
| PVC | polyvinyl chloride |

| | |
|---|---|
| QA | Quality Assurance |
| QA/QC | Quality Assurance / Quality Control |
| QAPP | Quality Assurance Project Plan |
| QC | Quality Control |
| QL | quantitation limit |
| QM | Quality Manual |
| RPD | relative percent difference |
| SAP | Sampling and Analysis Plan |
| SOP | Standard Operating Procedures |
| SOW | Statement of Work |
| SRM | Standard Reference Material |
| TAL | Target Analyte List |
| umhos/cm | micromhos per centimeter |
| UPA | Upper Potomac Aquifer |
| UPA | Upper Potomac Aquifer |
| UPCU | Upper Potomac Confining Unit |
| UPDC | Upper Potomac Dividing Clay |
| USEPA | United States Environmental Protection Agency |
| VOCs | Volatile Organic Compounds |

# TABLES

**TABLE 1**
**PROPOSED MONITORING PROGRAM**
**ARMY CREEK LANDFILL, NEW CASTLE, DELAWARE**

| Monitoring Location | Well Type | PFAS | Western Lobe | Water Levels |
|---|---|---|---|---|
| MW-28 | Former Recovery | X | | X |
| MW-29 | Former Recovery | X | | X |
| MW-31 | Former Recovery | X | | X |
| RW-10 | Former Recovery | X | X | X |
| BW-1 | Existing Monitoring | X | | X |
| BW-2 | Existing Monitoring | X | | X |
| BW-3 | Existing Monitoring | X | | X |
| MW-40 | Existing Monitoring | X | | X |
| MW-38N | Existing Monitoring | X | X | X |
| P-4 | Existing Monitoring | X | X | X |
| P-4L | Proposed Monitoring | X | X | X |
| WL-1U | Proposed Monitoring | X | X | X |
| WL-1L | Proposed Monitoring | X | X | X |
| P-5U | Existing Monitoring | | | X |
| P-5L | Existing Monitoring | | | X |
| P-6 | Existing Monitoring | | | X |
| MW-22N | Existing Monitoring | X | X | X |
| MW-22NU | Proposed Monitoring | X | X | X |
| MW-26N | Existing Monitoring | | | X |
| MW-49N | Existing Monitoring | X | X | X |
| MW-54 | Existing Background | X | | X |
| MW-56 | Existing Background | X | | X |
| MW-58 | Existing Background | X | | X |
| MW-18 | Existing Monitoring | | | X |
| DGC-10S | Existing Monitoring | | | X |
| DGC-10D | Existing Monitoring | | | X |
| DGC-11S | Existing Monitoring | | | X |
| DGC-11D | Existing Monitoring | | | X |
| GV-1 | Gas Vent | X | | X |
| GV-7 | Gas Vent | X | | X |
| GV-9 | Gas Vent | X | | X |
| GV-13 | Gas Vent | X | | X |
| GV-14 | Gas Vent | X | | X |
| GV-17 | Gas Vent | X | | X |
| GV-29 | Gas Vent | X | | X |
| GV-46 | Gas Vent | X | | X |
| GV-48 | Gas Vent | X | | X |
| GV-51 | Gas Vent | X | | X |

2/10/2018

Notes:

X - Groundwater samples will be analyzed for PFAS suite, consistent with the PFAS suite for DS&G, plus field parameters.
Samples from gas vents will be analyzed for PFAS suite only.

X - Analytical parameters will include total and dissolved iron, total and dissolved manganese, total and dissolved cobalt, and field parameters. The smi-annual events (April and Octobber) will also include VOCs and cations and anions as follows: calcium, magnesium, potassium, sodium, ammonia, nitrate, nitrite, sulfate, sulfide, chloride, and bicarbonate.

X - A complete round of water levels will be measured synoptically at all wells.

(1) - PFAS monitoring event will be conducted synoptically during the first DS&G event performed after the new wells are installed.

(2) - Western Lobe Study will be conducted quarterly for four quarters, two of which will be done at same time as annual/semi-annual events.

(3) - Field Indicator Parameters include temperature, specific conductance, pH, oxidation-reduction potential, dissolved oxygen and turbidity.

TABLE 2
VOC ANALYSIS - GROUNDWATER MEASUREMENT PERFORMANCE CRITERIA
ARMY CREEK LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

| | |
|---|---|
| Matrix | Groundwater |
| Analytical Group | VOCs |
| Analytical Method | SW846 8260B |
| Analytical Organization | TestAmerica |

| QC Sample: | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | 1 per extraction batch | No results above QL. | If sufficient sample volume is available, reanalyze the samples. | Laboratory Analyst | Accuracy | No results above QL. |
| Method Blank | 1 per extraction batch | None. | Qualify data as required. | Data Validator | Accuracy | No results above QL. |
| Rinsate Blank | 1 rinsate blank per 20 samples, whenever field decontaminated equipment is used. | None. | Qualify data as required. | Data Validator | Accuracy | No results above QL. |
| Trip Blank | 1 trip blank each day VOC samples are collected. | None. | Qualify data as required. | Data Validator | Accuracy | No results above QL. |
| Field Duplicates | 1 per 20 samples | None. | Qualify data as required. | Data Validator | Precision | <40% RPD |
| Surrogate Spike | Every sample | Meets method criteria. | If sufficient sample volume is available, reanalyze the samples. | Laboratory Analyst | Accuracy | Surrogate recovery meets QC limits as specified in the method. |
| Surrogate Spike | Every sample | Meets method criteria. | Qualify data as required. | Data Validator | Accuracy | Surrogate recovery meets QC limits as specified in the method. |
| MS | 1 per 20 samples | See Table 6, when sample concentration is <4x the spike added. | When the recovery is outside of control limits and the sample result is < 4x the spike added, a post-digestion spike must be performed. An aliquot of the unspiked sample will be spiked at 2x the indigenous level or 2x the CRQL, whichever is greater. | Data Validator | Accuracy | See Table 6, when sample concentration is <4x the spike added. |
| MSD | 1 per 20 samples | See Table 6, when sample concentration is <4x the spike added. | When the recovery is outside of control limits and the sample result is < 4x the spike added, a post-digestion spike must be performed. An aliquot of the unspiked sample will be spiked at 2x the indigenous level or 2x the CRQL, whichever is greater. | Data Validator | Accuracy | See Table 6, when sample concentration is <4x the spike added. |
| MS/MSD %R | 1 per 20 samples | See Table 6 | Qualify data as required. | Data Validator | Precision | See Table 6 |

TABLE 3
INORGANICS ANALYSIS - GROUNDWATER MEASUREMENT PERFORMANCE CRITERIA
ARMY CREEK LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

| | |
|---|---|
| Matrix | Groundwater |
| Analytical Group | Inorganics |
| Analytical Method | SW846 6010B |
| Analytical Organization | TestAmerica |

| QC Sample: | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Rinsate Blank | 1 rinsate blank per 20 samples, whenever field decontaminated equipment is used. | No results above IDL. | Qualify data as required. | Data Validator | Accuracy | No results above IDL. |
| ICP Interference Check Sample | 1 at the beginning and end of each sample analysis run, or a minimum of twice per 8-hour shift, whichever is more frequent. | ±20% of true value | Analysis terminated and affected samples reanalyzed. | Laboratory Analyst | Accuracy | ±20% of true value |
| Initial Calibration Blank | Method specific | No results above IDL. | Qualify data as required. | Data Validator | Accuracy | No results above IDL. |
| Continuing Calibration Blank | 1 per 10 samples | No results above IDL. | Reanalyze sample bracketed by compliant continuing calibration blank. | Data Validator | Accuracy | No results above IDL. |
| Preparation Blank | 1 per extraction batch | No results above IDL. | Qualify data as required. | Data Validator | Accuracy | No results above IDL. |
| Field Duplicates | 1 per 20 samples | none | Qualify data as required. | Data Validator | Precision | <40% RPD |
| MS | 1 per 20 samples. | 75-125% of true value, when sample concentration is <4x the spike added. | When the recovery is outside of control limits and the sample result is < 4x the spike added, a post-digestion spike must be performed. An aliquot of the unspiked sample will be spiked at 2x the indigenous level or 2x the CRQL, whichever is greater. | Data Validator | Accuracy | 75-125% of true value, when sample concentration is <4x the spike added. |
| Post-Digestion spike | If warranted following MS analysis | 75-125% of true value | Qualify data as required. | Data Validator | Accuracy | Minimum level of 10 times and a maximum of 100 times the lower limit of quantitation. |
| LCS | 1 per 20 samples. | 80-120% of true value. | Qualify data as required. | Data Validator | Accuracy | 80-120% of true value. |
| Lab Duplicate | 1 per 20 samples. | ±20% of true value. | ± CRDL when the sample value is < 5x CRDL, including when only one of the duplicate sample values is < 5x CRDL. | Data Validator | Accuracy | ±20% of true value. |
| Initial Calibration Verification | Method specific | 90-110% of true value for all analytes except mercury (90-120%) and cyanide (85-115%). | Qualify data as required. | Data Validator | Accuracy | 90-110% of true value for all analytes except mercury (90-120%) and cyanide (85-115%). |
| Continuing Calibration Verification | 1 per 10 samples | 90-110% of true value for all analytes except mercury (90-120%) and cyanide (85-115%). | Reanalyze sample bracketed by compliant continuing calibration verification. | Data Validator | Accuracy | 90-110% of true value for all analytes except mercury (90-120%) and cyanide (85-115%). |
| ICP Serial Dilution | When warranted. | When analyte concentration is minimally a factor of 50 above the IDL, an analysis of a 5-fold diltuion must agree within 10% difference of the original results. | Qualify data as required. | Data Validator | Precision | When analyte concentration is minimally a factor of 50 above the IDL, an analysis of a 5-fold diltuion must agree within 10% difference of the original results. |

TABLE 4
NATURAL ATTENUATION PARAMETERS - GROUNDWATER MEASUREMENT PERFORMANCE CRITERIA
ARMY CREEK LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

| | |
|---|---|
| Matrix | Groundwater |
| Analytical Group | Natural Attenuation Parameters |
| Analytical Method | See Table 7, Reference Numbers: 3.5.1.1, 3.5.17.1, 3.5.22.1 |
| Analytical Organization | TestAmerica |

| QC Sample: | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | 1 per extraction batch | No results above QL. | If sufficient sample volume is available, reanalyze the samples. | Laboratory Analyst | Accuracy | No results above QL. |
| Method Blank | 1 per extraction batch | None. | Qualify data as required. | Data Validator | Accuracy | No results above QL. |
| Continuing Calibration Blank | 1 per 10 samples | No results above QL. | Reanalyze sample bracketed by compliant Continuing Calibration Blank. | Laboratory Analyst | Accuracy | No results above QL. |
| Continuing Calibration Verification | 1 per 10 samples | 90-110% of true value | Reanalyze sample bracketed by compliant Continuing Calibration Verification. | Laboratory Analyst | Accuracy | 90-110% of true value |
| Field Duplicates | 1 per 20 samples | None. | Qualify data as required. | Data Validator | Precision | <40% RPD |
| LCS | 1 per extraction batch | Meets laboratory QC limits in SOPs, Attachment E. | Analysis terminated and affected samples reanalyzed, if additional sample volume is available. | Laboratory Analyst | Accuracy | Meets laboratory QC limits in SOPs, Attachment E. |
| LCS | 1 per extraction batch | Meets laboratory QC limits in SOPs, Attachment E. | Qualify data as required. | Data Validator | Accuracy | Meets laboratory QC limits in SOPs, Attachment E. |
| Matrix Spike | 1 per 20 samples | Meets laboratory QC limits in SOPs, Attachment E. | If the LCS meets acceptance criteria, no corrective action is required. Otherwise, if sufficient sample volume is available, re-extract and reanalyze the samples. | Laboratory Analyst | Accuracy | Meets laboratory QC limits in SOPs, Attachment E. |
| Matrix Spike | 1 per 20 samples | Meets laboratory QC limits in SOPs, Attachment E. | Qualify data as required. | Data Validator | Accuracy | Meets laboratory QC limits in SOPs, Attachment E. |

TABLE 5
PFAS - GROUNDWATER MEASUREMENT PERFORMANCE CRITERIA
ARMY CREEK LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

| | |
|---|---|
| Matrix | Groundwater |
| Analytical Group | Per- and Polyfluoroalkyl Substances (PFAS) |
| Analytical Method | EPA 537 Rev. 1.1, Modified |
| Analytical Organization | Eurofins |

| QC Sample: | Frequency/ Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Rinsate Blank | 1 rinsate blank per 20 samples, whenever field decontaminated | None. | Qualify data as required. | Data Validator | Accuracy | No results above QL. |
| Trip Blank | 1 trip blank each day PFAS samples are collected. | None. | Qualify data as required. | Data Validator | Accuracy | No results above QL. |
| Field Blank | 1 field blank each day PFAS samples are collected. | None. | Qualify data as required. | Data Validator | Accuracy | No results above QL. |
| Method Blank | 1 per extraction batch | No results above QL. | If sufficient sample volume is available, reanalyze the samples. | Laboratory Analyst | Accuracy | No results above QL. |
| Method Blank | 1 per extraction batch | None. | Qualify data as required. | Data Validator | Accuracy | No results above QL. |
| Continuing Calibration Verification | 1 per 10 samples | 70-130% of true value | Reanalyze sample bracketed by compliant Continuing Calibration Verification. | Laboratory Analyst | Accuracy | 70-130% of true value |
| Field Duplicates | 1 per 20 samples | None. | Qualify data as required. | Data Validator | Precision | <40% RPD |
| Surrogate Spike | Every sample | Meets method criteria. | If sufficient sample volume is available, reanalyze the samples. | Laboratory Analyst | Accuracy | Surrogate recovery meets QC limits as specified in the method. |
| Surrogate Spike | Every sample | Meets method criteria. | Qualify data as required. | Data Validator | Accuracy | Surrogate recovery meets QC limits as specified in the method. |
| LCS | 1 per extraction batch | Meets laboratory QC limits in SOPs, Attachment E. | Analysis terminated and affected samples reanalyzed, if additional sample volume is available. | Laboratory Analyst | Accuracy | Meets laboratory QC limits in SOPs, Attachment E. |
| LCS | 1 per extraction batch | Meets laboratory QC limits in SOPs, Attachment E. | Qualify data as required. | Data Validator | Accuracy | Meets laboratory QC limits in SOPs, Attachment E. |
| Matrix Spike | 1 per 20 samples | Meets laboratory QC limits in SOPs, Attachment E. | If the LCS meets acceptance criteria, no corrective action is required. Otherwise, if sufficient sample volume is available, re-extract and reanalyze the samples. | Laboratory Analyst | Accuracy | Meets laboratory QC limits in SOPs, Attachment E. |
| Matrix Spike | 1 per 20 samples | Meets laboratory QC limits in SOPs, Attachment E. | Qualify data as required. | Data Validator | Accuracy | Meets laboratory QC limits in SOPs, Attachment E. |
| MS/MSD %R | 1 per 20 samples | See Table 6 | Qualify data as required. | Data Validator | Precision | See Table 6 |

TABLE 6
REFERENCE LIMITS - GROUNDWATER
ARMY CREEK LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

| Analytical Group | CAS | Analyte | Units | Achievable Laboratory Limits | |
|---|---|---|---|---|---|
| | | | | MDLs | QLs |
| Inorganics | 7429-90-5 | Aluminum | ug/l | 28.5 | 50 |
| Inorganics | 7440-36-0 | Antimony | ug/l | 1.4 | 2.5 |
| Inorganics | 7440-38-2 | Arsenic | ug/l | 1.5 | 2.5 |
| Inorganics | 7440-39-3 | Barium | ug/l | 3.2 | 5 |
| Inorganics | 7440-41-7 | Beryllium | ug/l | 0.61 | 1 |
| Inorganics | 7440-43-9 | Cadmium | ug/l | 1.7 | 2.5 |
| Inorganics | 7440-70-2 | Calcium | ug/l | 233 | 250 |
| Inorganics | 7440-47-3 | Chromium | ug/l | 3.1 | 5 |
| Inorganics | 7440-48-4 | Cobalt | ug/l | 3.1 | 5 |
| Inorganics | 7440-50-8 | Copper | ug/l | 3.3 | 5 |
| Inorganics | 7439-89-6 | Iron | ug/l | 97.8 | 150 |
| Inorganics | 7439-89-6 | Iron - dissolved | ug/l | 97.8 | 150 |
| Inorganics | 7439-92-1 | Lead | ug/l | 0.93 | 1.5 |
| Inorganics | 7439-95-4 | Magnesium | ug/l | 155 | 250 |
| Inorganics | 7439-96-5 | Manganese | ug/l | 6.1 | 10 |
| Inorganics | 7439-96-5 | Manganese - dissolved | ug/l | 6.1 | 10 |
| Inorganics | 7439-97-6 | Mercury | ug/l | 0.17 | 0.2 |
| Inorganics | 7440-02-0 | Nickel | ug/l | 3.1 | 5 |
| Inorganics | 7440-09-7 | Potassium | ug/l | 143 | 250 |
| Inorganics | 7782-49-2 | Selenium | ug/l | 1.4 | 2.5 |
| Inorganics | 7440-22-4 | Silver | ug/l | 3 | 5 |
| Inorganics | 7440-23-5 | Sodium | ug/l | 213 | 250 |
| Inorganics | 7440-28-0 | Thallium | ug/l | 0.6 | 1 |
| Inorganics | 7440-62-2 | Vanadium | ug/l | 3 | 5 |
| Inorganics | 7440-66-6 | Zinc | ug/l | 16.3 | 20 |
| NAPs | 7664-41-7 | Ammonia as N | mg/l | 0.015 | 0.2 |
| NAPs | ALKB-C | Bicarbonate | mg/l | 5 | 5 |
| NAPs | 16887-00-6 | Chloride | mg/l | 0.031 | 0.12 |
| NAPs | Fe2+ | Ferrous Iron | ug/l | 120 | 400 |
| NAPs | 14797-55-8-N | Nitrate as N | mg/l | 0.026 | 0.1 |
| NAPs | 14797-65-0-N | Nitrite as N | mg/l | 0.012 | 0.05 |
| NAPs | 14808-79-8 | Sulfate as S04 | mg/l | 0.23 | 1 |
| NAPs | 18496-25-8 | Sulfide, total | mg/l | 0.32 | 1 |
| PFAS | 2991-50-6 | N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | ng/l | 1 | 3 |
| PFAS | 2355-31-9 | N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | ng/l | 1 | 3 |
| PFAS | 1763-23-1 | Perfluorooctane sulfonate (PFOS) | ng/l | 2 | 6 |
| PFAS | 375-73-5 | Perfluorobutane sulfonate (PFBS) | ng/l | 0.8 | 3 |
| PFAS | 335-76-2 | Perfluorodecanoic acid (PFDA) | ng/l | 0.5 | 2 |
| PFAS | 307-55-1 | Perfluorododecanoic acid (PFDoA) | ng/l | 0.5 | 2 |
| PFAS | 375-85-9 | Perfluoroheptanoic acid (PFHpA) | ng/l | 0.5 | 2 |
| PFAS | 355-46-4 | Perfluorohexane sulfonate (PFHxS) | ng/l | 1 | 3 |
| PFAS | 307-24-4 | Perfluorohexanoic acid (PFHxA) | ng/l | 0.6 | 2 |
| PFAS | 375-95-1 | Perfluorononanoic acid (PFNA) | ng/l | 0.6 | 2 |
| PFAS | 335-67-1 | Perfluorooctanoic acid (PFOA) | ng/l | 0.6 | 2 |
| PFAS | 376-06-7 | Perfluorotetradecanoic acid (PFTA) | ng/l | 0.5 | 2 |
| PFAS | 72629-94-8 | Perfluorotridecanoic acid (PFTrDA) | ng/l | 0.5 | 2 |
| PFAS | 2058-94-8 | Perfluoroundecanoic acid (PFUnA) | ng/l | 1 | 3 |
| VOCs | 71-55-6 | 1,1,1-Trichloroethane | ug/l | 0.28 | 1 |
| VOCs | 79-34-5 | 1,1,2,2-Tetrachloroethane | ug/l | 0.19 | 1 |
| VOCs | 79-00-5 | 1,1,2-Trichloroethane | ug/l | 0.08 | 1 |
| VOCs | 75-34-3 | 1,1-Dichloroethane | ug/l | 0.24 | 1 |
| VOCs | 75-35-4 | 1,1-Dichloroethene | ug/l | 0.34 | 1 |
| VOCs | 526-73-8 | 1,2,3-Trimethylbenzene | ug/l | 0.11 | 1 |
| VOCs | 95-63-6 | 1,2,4-Trimethylbenzene | ug/l | 0.23 | 1 |
| VOCs | 107-06-2 | 1,2-Dichloroethane | ug/l | 0.25 | 1 |
| VOCs | 78-87-5 | 1,2-Dichloropropane | ug/l | 0.18 | 1 |
| VOCs | 108-67-8 | 1,3,5-Trimethylbenzene | ug/l | 0.25 | 1 |

TABLE 6
REFERENCE LIMITS - GROUNDWATER
ARMY CREEK LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

| Analytical Group | CAS | Analyte | Units | Achievable Laboratory Limits | |
|---|---|---|---|---|---|
| | | | | MDLs | QLs |
| VOCs | 123-91-1 | 1,4-Dioxane | ug/l | 0.2 | 0.4 |
| VOCs | 78-93-3 | 2-Butanone | ug/l | 2.2 | 5 |
| VOCs | 591-78-6 | 2-Hexanone | ug/l | 0.72 | 5 |
| VOCs | 108-10-1 | 4-Methyl-2-pentanone | ug/l | 0.63 | 5 |
| VOCs | 67-64-1 | Acetone | ug/l | 1.1 | 5 |
| VOCs | 71-43-2 | Benzene | ug/l | 0.09 | 1 |
| VOCs | 75-27-4 | Bromodichloromethane | ug/l | 0.15 | 1 |
| VOCs | 75-25-2 | Bromoform | ug/l | 0.18 | 1 |
| VOCs | 74-83-9 | Bromomethane | ug/l | 0.18 | 1 |
| VOCs | 75-15-0 | Carbon disulfide | ug/l | 0.22 | 1 |
| VOCs | 56-23-5 | Carbon tetrachloride | ug/l | 0.33 | 1 |
| VOCs | 108-90-7 | Chlorobenzene | ug/l | 0.24 | 1 |
| VOCs | 75-00-3 | Chloroethane | ug/l | 0.37 | 1 |
| VOCs | 67-66-3 | Chloroform | ug/l | 0.22 | 1 |
| VOCs | 74-87-3 | Chloromethane | ug/l | 0.22 | 1 |
| VOCs | 156-59-2 | cis-1,2-Dichloroethene | ug/l | 0.26 | 1 |
| VOCs | 10061-01-5 | cis-1,3-Dichloropropene | ug/l | 0.16 | 1 |
| VOCs | 110-82-7 | Cyclohexane | ug/l | 0.26 | 1 |
| VOCs | 124-48-1 | Dibromochloromethane | ug/l | 0.22 | 1 |
| VOCs | 75-43-4 | Dichlorofluoromethane | ug/l | 0.21 | 1 |
| VOCs | 60-29-7 | Ethyl ether | ug/l | 0.11 | 1 |
| VOCs | 100-41-4 | Ethylbenzene | ug/l | 0.3 | 1 |
| VOCs | 496-11-7 | Indane | ug/l | 0.12 | 1 |
| VOCs | 98-82-8 | Isopropylbenzene | ug/l | 0.32 | 1 |
| VOCs | 108-87-2 | Methylcyclohexane | ug/l | 0.22 | 1 |
| VOCs | 75-09-2 | Methylene Chloride | ug/l | 0.21 | 1 |
| VOCs | 1634-04-4 | MTBE | ug/l | 0.13 | 1 |
| VOCs | 103-65-1 | N-Propylbenzene | ug/l | 0.29 | 1 |
| VOCs | 100-42-5 | Styrene | ug/l | 0.17 | 1 |
| VOCs | 127-18-4 | Tetrachloroethene | ug/l | 0.12 | 1 |
| VOCs | 109-99-9 | Tetrahydrofuran | ug/l | 0.36 | 2 |
| VOCs | 108-88-3 | Toluene | ug/l | 0.25 | 1 |
| VOCs | 156-60-5 | trans-1,2-Dichloroethene | ug/l | 0.18 | 1 |
| VOCs | 10061-02-6 | trans-1,3-Dichloropropene | ug/l | 0.19 | 1 |
| VOCs | 79-01-6 | Trichloroethene | ug/l | 0.22 | 1 |
| VOCs | 75-01-4 | Vinyl chloride | ug/l | 0.06 | 1 |
| VOCs | 1330-20-7 | Xylenes, Total | ug/l | 0.28 | 2 |

MDLs and QLs were based on QC limits as of October 21, 2010 and updated January 24, 2018 for analysis of samples following the various analytical methods as listed in Table 6. TestAmerica Edison and Eurofins routinely re-evaluates QC criteria using the procedures in the laboratory QM.

TABLE 7
ANALYTICAL REQUIREMENTS
ARMY CREEK LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

| PARAMETER | ANALYTICAL AND PREPARATION SOP REFERENCE[1] | METHODOLOGY | CONTAINER | MINIMUM SAMPLE VOLUME REQUIRED | PRESERVATION | FIELD FILTERED | HOLD TIME [2] |
|---|---|---|---|---|---|---|---|
| **Groundwater** | | | | | | | |
| Ammonia | 3.5.2.1 | EPA 350.1 | 1-500 ml polyethylene | 500 ml | Cool $\leq 6^{\circ}$ C, $H_2SO_4$; pH<2 | No | 28 days |
| Bicarbonate | 3.5.1.1 | SM2320B | 1-100ml polyethylene | 100ml | Cool $\leq 6^{\circ}$ C | No | 14 days |
| Chloride | 325.2 | EPA 300.0 | 1-250 ml polyethylene | 200ml | Cool $\leq 6^{\circ}$ C | No | 28 days |
| Ferrous Iron | 3.5.23.1 | SM 3500 FE D | 1-125 ml polyethylene | 50 ml | Cool $\leq 6^{\circ}$ C; HCl, pH<2 | No | ASAP |
| TAL Metals (dissolved) | 3.2.1.4, 3.2.1.6 | SW-846 6010C | 1-500 ml polyethylene | 300ml | Cool $\leq 6^{\circ}$ C; $HNO_3$, pH<2 after filter | Yes | 180 days |
| TAL/RCRA[4] Metals | 3.2.1.4, 3.2.1.6 | SW-846 6010B/SW-846 7470 | 1-500 ml polyethylene | 300ml | Cool $\leq 6^{\circ}$ C; $HNO_3$, pH<2 | No | 180 days |
| Nitrate | 3.5.22.1 | EPA 300.0 | 1-100 ml polyethylene | 100 ml | Cool $\leq 6^{\circ}$ C | No | 48 hours |
| Nitrite | 3.5.22.1 | EPA 300.0 | 1-100 ml polyethylene | 100 ml | Cool $\leq 6^{\circ}$ C | No | 48 hours |
| PFAS | 1-P-QM-WI-9039651 | EPA 537 Rev 1.1, Modified | 1-100 ml PFAS-free polyethylene; Teflon-free lids | 100 ml | Cool $\leq 6^{\circ}$ C | No | 14 days (extraction); 28 days (analysis) |
| Phosphate (ortho) | 3.5.22.1 | EPA 300.0 | 1-100 ml polyethylene | 100 ml | Cool $\leq 6^{\circ}$ C | No | 48 hours |
| Sulfate | 3.5.22.1 | EPA 300.0 | 1-100 ml polyethylene | 100ml | Cool $\leq 6^{\circ}$ C | No | 28 days |
| Sulfide | 3.5.17.1 | EPA 376.1 | 1-500 ml polyethylene | 500 ml | Cool $<6^{\circ}$ C; ZnAc/NaOH, pH>9 | No | 7 days |
| VOCs | 1.3.2.2 | SW-846 8260B | 3-40 ml glass vial | 3-40 ml | Cool $\leq 6^{\circ}$ C; HCl, pH<2 | No | 14 days |

Notes:
1. Reference number from Table 8.
2. Hold time based upon day of sample collection not Verified Time of Sample Receipt.
3. RCRA 8 Metals list includes: arsenic, barium, cadmium, chromium, lead, mercury, silver, selenium
4. The total metals holding time is 28 days for mercury, 180 days for all other metals.
5. (X) in the ASTM standard indicates exact soil oxidant demand method will be determined following selection of remedial technologies under consideration.

TABLE 8
ANALYTICAL SOP REFERENCES
ARMY CREEK LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

| Reference Number | Title, Revision Date, and/or Number | Analytical Group |
|---|---|---|
| 1.3.2.2 | Analysis of Volatile Organic Compounds in Aqueous and Medium/High Concentration Soil Samples by SW-846, Revision 14, 04/05/2010 | VOCs |
| 3.2.1.4 | Digestion Block Preparation of Aqueous Samples for ICP Analysis of Total or Dissolved Metals by SW-846, MCAWW, and Standard Methods | Inorganics |
| 3.2.1.6 | Inductively Coupled Plasma Atomic Emission Spectroscopy by SW-846 Methods 6010B and 6010C | Inorganics |
| 3.5.1.1 | Alkalinity in Water and Leachate by Standard Method 2320B and Lachate Method 10-303-31-1-A, Revision 9, 09/30/2009 | NAPs |
| 3.5.17.1 | Determination of Sulfide in Aqueous Samples, Revision 4, 09/22/2007 | NAPs |
| 3.5.2.1 | Ammonia (Phenolate) in Water by MCAWW Method 350.1 and Lachat Method 10-107-06-1-A, Revision 10, 04/05/2010 | NAPs |
| 3.5.21.1 | Ferric/Ferrous Iron Phenanthroline Method, Revision 2, 12/11/2006 | NAPs |
| 3.5.22.1 | Determination of Inorganic Anions by Ion Chromatography, Revision 8, 04/05/2010 | NAPs |
| BR-AT-004 | Determination of VOCs in Ambient Air EPA Compendium Methods TO14 and TO15, Revision: 7, 09/25/2009 | VOCs |
| 1-P-QM-WI-9039651 | PFAS | PFAS |

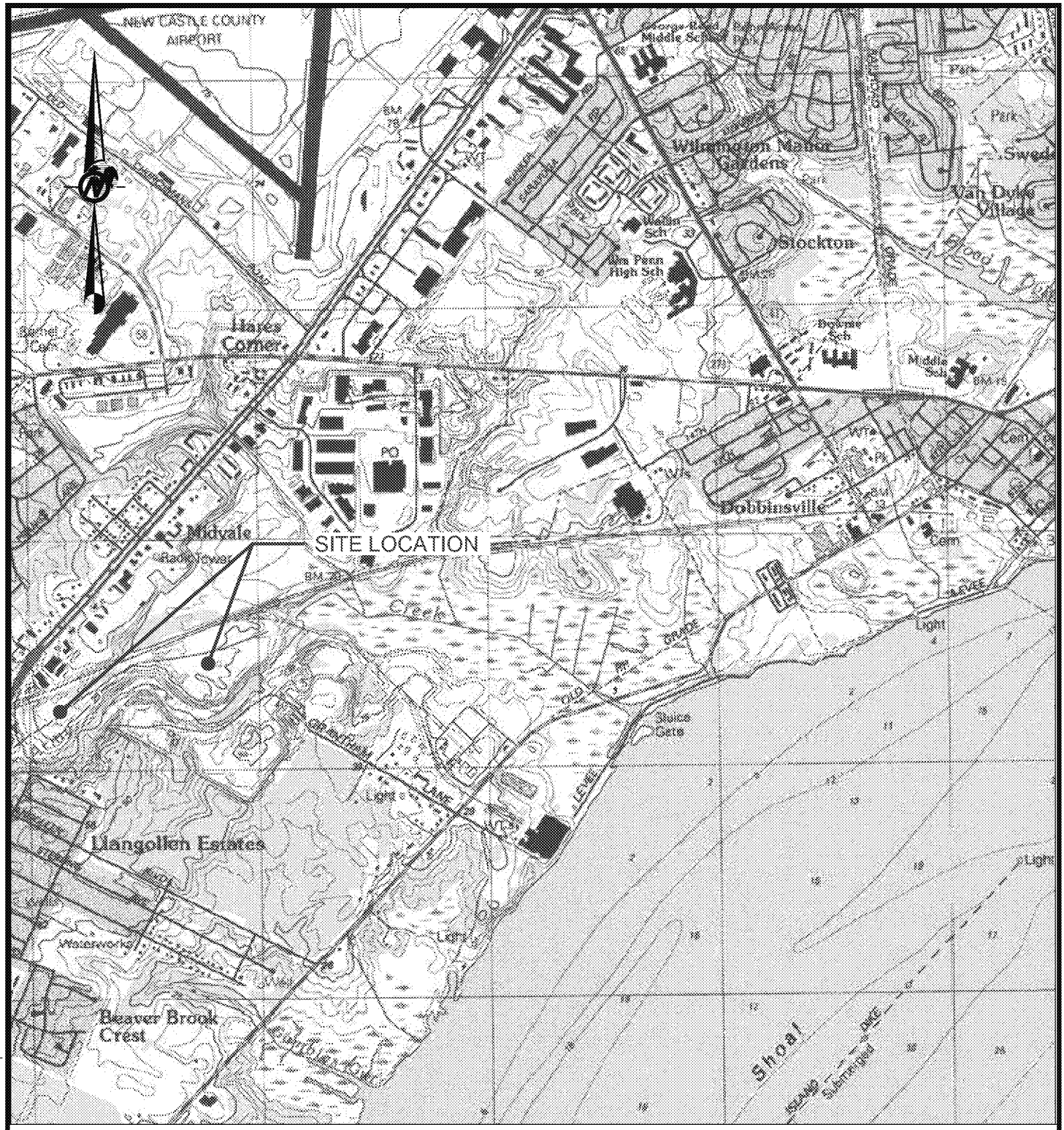
TABLE 9
MS/MSD DATA SUMMARY REQUIREMENTS
ARMY CREEK LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

| Compound | MS/MSD % R | MS/MSD RPD |
|---|---|---|
| Inorganic Aqueous Samples | | |
| Aluminum | 70-130 | -- |
| Antimony | 70-130 | -- |
| Arsenic | 70-130 | -- |
| Barium | 70-130 | -- |
| Beryllium | 70-130 | -- |
| Cadmium | 70-130 | -- |
| Calcium | 70-130 | -- |
| Chromium | 70-130 | -- |
| Cobalt | 70-130 | -- |
| Copper | 70-130 | -- |
| Iron | 70-130 | -- |
| Iron - dissolved | 70-130 | -- |
| Lead | 70-130 | -- |
| Magnesium | 70-130 | -- |
| Manganese | 70-130 | -- |
| Manganese - dissolved | 70-130 | -- |
| Mercury | 70-130 | -- |
| Nickel | 70-130 | -- |
| Potassium | 70-130 | -- |
| Selenium | 70-130 | -- |
| Silver | 70-130 | -- |
| Sodium | 70-130 | -- |
| Thallium | 70-130 | -- |
| Vanadium | 70-130 | -- |
| Zinc | 70-130 | -- |
| NAP Aqueous Samples | | |
| Ammonia as N | 65-135 | -- |
| Bicarbonate | 85-115 | -- |
| Chloride | 90-110 | -- |
| Ferrous Iron | 90-110 | -- |
| Nitrate as N | 90-110 | -- |
| Nitrite as N | 90-110 | -- |
| Sulfate as S04 | 90-110 | -- |
| Sulfide, total | 90-110 | -- |
| PFAS Aqueous Samples | | |
| N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA) | 70-130 | 30 |
| N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA) | 70-130 | 30 |
| Perfluorooctane sulfonate (PFOS) | 70-130 | 30 |
| Perfluorobutane sulfonate (PFBS) | 70-130 | 30 |
| Perfluorodecanoic acid (PFDA) | 70-130 | 30 |
| Perfluorododecanoic acid (PFDoA) | 70-130 | 30 |
| Perfluoroheptanoic acid (PFHpA) | 70-130 | 30 |
| Perfluorohexane sulfonate (PFHxS) | 70-130 | 30 |
| Perfluorohexanoic acid (PFHxA) | 70-130 | 30 |
| Perfluorononanoic acid (PFNA) | 70-130 | 30 |
| Perfluorooctanoic acid (PFOA) | 70-130 | 30 |
| Perfluorotetradecanoic acid (PFTA) | 70-130 | 30 |

TABLE 9
MS/MSD DATA SUMMARY REQUIREMENTS
ARMY CREEK LANDFILL SUPERFUND SITE
NEW CASTLE, DELAWARE

| | | |
|---|---|---|
| Perfluorotridecanoic acid (PFTrDA) | 70-130 | 30 |
| Perfluoroundecanoic acid (PFUnA) | 70-130 | 30 |
| VOC Aqueous Samples | | |
| 1,1,1-Trichloroethane | 75-125 | 30 |
| 1,1,2,2-Tetrachloroethane | 74-120 | 30 |
| 1,1,2-Trichloroethane | 78-120 | 30 |
| 1,1-Dichloroethane | 77-123 | 30 |
| 1,1-Dichloroethene | 74-123 | 30 |
| 1,2,3-Trimethylbenzene | 70-130 | 30 |
| 1,2,4-Trimethylbenzene | 78-122 | 30 |
| 1,2-Dichloroethane | 76-121 | 30 |
| 1,2-Dichloropropane | 77-123 | 30 |
| 1,3,5-Trimethylbenzene | 80-120 | 30 |
| 1,4-Dioxane | 10-150 | 30 |
| 2-Butanone | 64-120 | 30 |
| 2-Hexanone | 71-125 | 30 |
| 4-Methyl-2-pentanone | 78-124 | 30 |
| Acetone | 39-150 | 30 |
| Benzene | 77-121 | 30 |
| Bromodichloromethane | 76-120 | 30 |
| Bromoform | 53-120 | 30 |
| Bromomethane | 10-150 | 30 |
| Carbon disulfide | 69-133 | 30 |
| Carbon tetrachloride | 70-132 | 30 |
| Chlorobenzene | 80-120 | 30 |
| Chloroethane | 52-150 | 30 |
| Chloroform | 80-120 | 30 |
| Chloromethane | 56-131 | 30 |
| cis-1,2-Dichloroethene | 80-120 | 30 |
| cis-1,3-Dichloropropene | 77-120 | 30 |
| Cyclohexane | 56-150 | 30 |
| Dibromochloromethane | 73-120 | 30 |
| Dichlorofluoromethane | 71-145 | 30 |
| Ethyl ether | 68-136 | 30 |
| Ethylbenzene | 80-120 | 30 |
| Indane | 80-120 | 30 |
| Isopropylbenzene | 80-123 | 30 |
| Methylcyclohexane | 61-145 | 30 |
| Methylene Chloride | 77-123 | 30 |
| MTBE | 79-122 | 30 |
| N-Propylbenzene | 80-123 | 30 |
| Styrene | 80-120 | 30 |
| Tetrachloroethene | 78-122 | 30 |
| Tetrahydrofuran | 79-122 | 30 |
| Toluene | 80-120 | 30 |
| trans-1,2-Dichloroethene | 79-120 | 30 |
| trans-1,3-Dichloropropene | 76-120 | 30 |
| Trichloroethene | 77-120 | 30 |
| Vinyl chloride | 62-138 | 30 |
| Xylenes, Total | 80-120 | 30 |

**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

Golder Associates
Manchester, New Hampshire

| | |
|---|---|
| SCALE | AS SHOWN |
| DATE | 02/06/18 |
| DESIGN | RWB |
| CADD | RWC |
| CHECK | RWB |
| REVIEW | TAM |

FILE No. 0136052Z006B.dwg
PROJECT No. P1793358 REV. 0

TITLE

# SITE LOCUS MAP

ARMY CREEK LANDFILL SUPERFUND SITE

FIGURE 1

Drawing file: 0136052Z006B.dwg Feb 06, 2018 – 2:03pm

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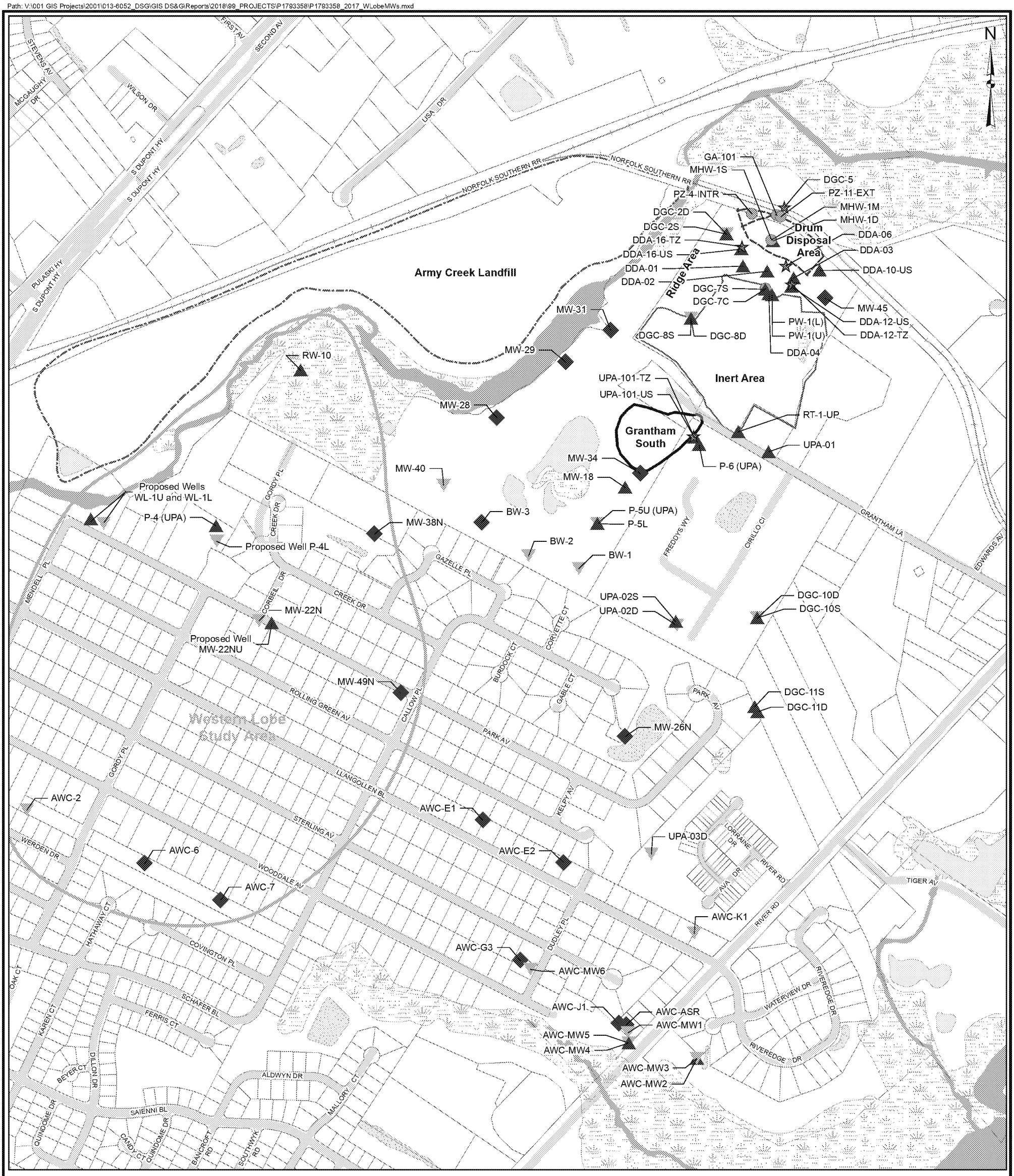


## LEGEND

- Western Lobe Study Area
- Well screened in UPCU Transition Zone
- Well screened in UPA Upper Sand
- Well screened in UPA Lower Sand
- Well screened across UPA Upper Sand and Lower Sand
- Well screened in Columbia Aquifer

## REFERENCE

Base data taken from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 07/29/2013.

0 300 600 1,200 Feet

1 inch = 600 feet

FIGURE 2

| | | |
|---|---|---|
| REVIEW | TAM | 2/6/2018 |
| CHECK | RWB | 2/6/2018 |
| GIS | SHL | 2/6/2018 |
| DESIGN | TAM | 2/6/2018 |
| REV. 0 | SCALE: AS SHOWN | |
| FILE No. | P1793358_2017_WLobeMWs | |
| PROJECT No. | P1793358 | |

TITLE

**PROPOSED WESTERN LOBE MONITORING WELL LOCATIONS**

PROJECT

**Army Creek Landfill Superfund Site New Castle, Delaware**

Golder Associates
Manchester, New Hampshire

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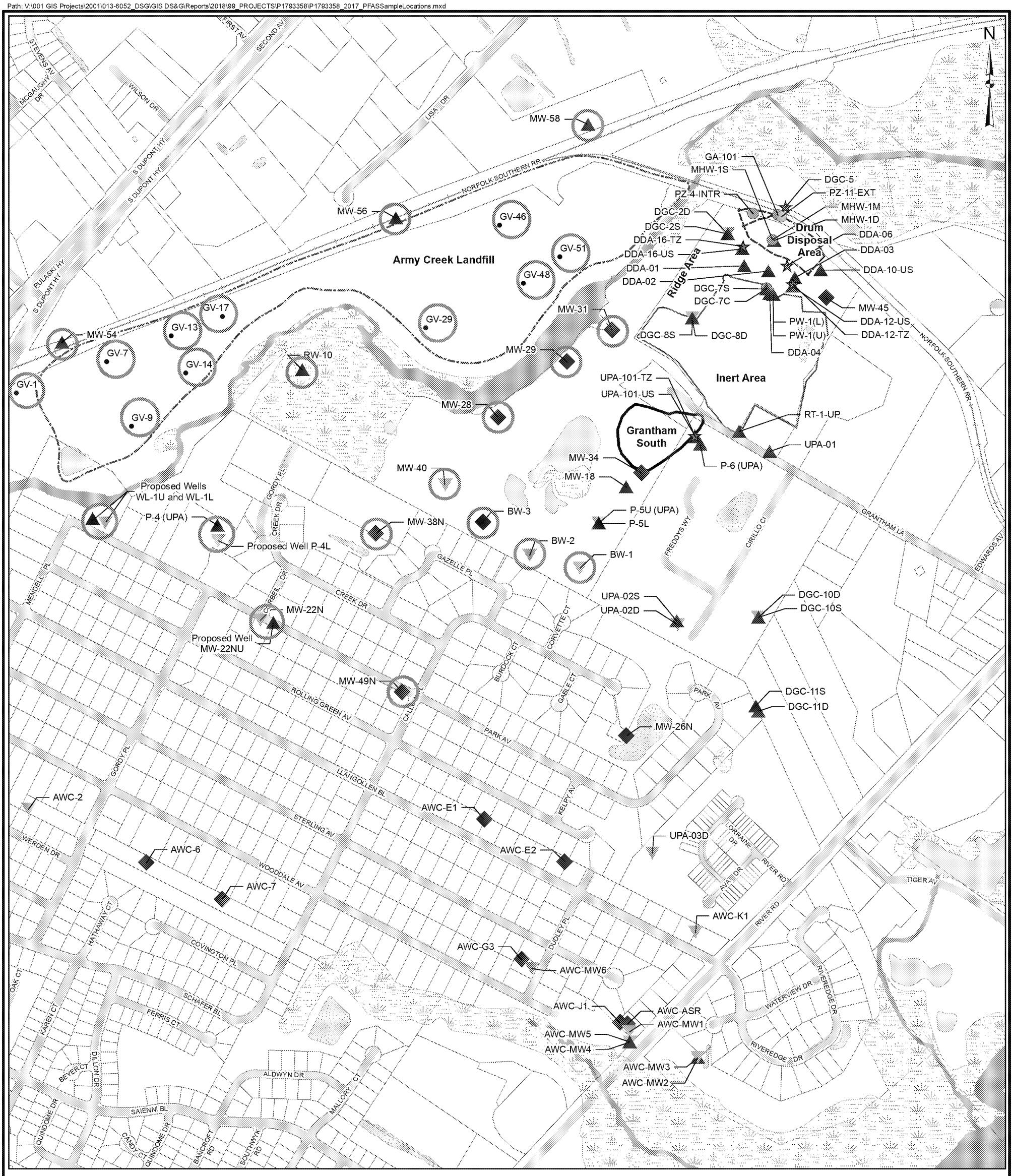


## LEGEND

- ★ Well screened in UPCU Transition Zone
- ▲ Well screened in UPA Upper Sand
- ▼ Well screened in UPA Lower Sand
- ◆ Well screened across UPA Upper Sand and Lower Sand
- ● Well screened in Columbia Aquifer
- • Gas Vent
- ○ Proposed PFAS Sampling Location

## REFERENCE

Base data taken from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 07/29/2013.

0 300 600 1,200 Feet

1 inch = 600 feet

FIGURE 3

| | | |
|---|---|---|
| REVIEW | TAM | 2/6/2018 |
| CHECK | RWB | 2/6/2018 |
| GIS | SHL | 2/6/2018 |
| DESIGN | TAM | 2/6/2018 |
| REV. 0 | SCALE: AS SHOWN | |
| FILE: Nos99_2017_PFASSampleLocations | | |
| PROJECT No. | P1793358 | |

TITLE

**PROPOSED PFAS GROUNDWATER SAMPLING LOCATIONS**

PROJECT

**Army Creek Landfill Superfund Site New Castle, Delaware**

Golder Associates
Manchester, New Hampshire

# ATTACHMENT A

# STANDARD OPERATING PROCEDURES (SOPS) FOR PFAS SAMPLING EVENT

**Title:** General Field Methods for PFAS Sampling Programs 

## 1.0 GENERAL APPLICABILITY

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures that shall be used during implementation of this per- and polyfluoroalkyl substances (PFAS) sampling program.

Due to the extremely low method detection limits associated with PFAS analysis (i.e., nanograms per liter [ng/l]) and the many potential sources of trace levels of PFAS, field personnel shall employ the greatest caution by strictly following the protocols described herein. Frequent replacement of nitrile gloves and decontamination of non-dedicated sampling equipment in accordance with the appropriate procedures will reduce the potential for false detections of PFAS.

This SOP includes the following:

- Considerations regarding food packaging and food consumption during PFAS sampling programs
- Field gear and clothing restrictions
- Personal hygiene requirements
- Sample area access restrictions
- Field equipment decontamination

Some of the provisions of the PFAS sampling program requirements described herein may conflict with standard health and safety procedures (e.g., use of insect repellant or sunscreen). Therefore, prior to implementation of a field program subject to these General Provisions, an Addendum to the site-specific Health and Safety Plan (HASP) shall be prepared to address any potential conflicts between the requirements described herein and standard health and safety procedures.

## 2.0 RESPONSIBILITIES

The Field Team Leader and field personnel have the shared responsibility to oversee and ensure that the PFAS sampling program is performed in accordance with the program-specific protocols described in this SOP. The Field Team Leader shall ensure that on-site personnel, including subcontractors and third parties that may have direct access to the sampling area, understand and comply with this SOP. Field personnel shall be notified of these requirements a minimum of three days prior to the start of field work in order to have the time to appropriately comply with many of the food and clothing requirements prior to arriving at the site.

## 3.0 GENERAL FIELD METHODS

### 3.1 Food Consumption

Components of some food packages have been treated to resist wetting. Historically, this is achieved through the use of PFAS. Accordingly, field personnel shall avoid the use of paper bags and other paper packaging to transport food to the site, including pre-wrapped foods and snacks (e.g., chocolate bars, energy bars, granola bars, potato chips, etc.). Field personnel shall not bring any fast food to the site that uses any form of paper wrapping such as sandwiches or paper drinking cups. If possible, field personnel shall use hard plastic or stainless steel food containers. Field personnel shall not use aluminum foil, wax paper, or coated textiles to transport food to the site.

The Teflon® coating on some frying pans contains fluorinated compounds and as such represents a potential source of PFAS. Field personnel shall not transport to or consume food at the site that has been prepared using a Teflon® coated cooking utensil.

Field personnel shall not consume food or beverages in the field vehicle or in the immediate vicinity of the sample location. Prior to consuming food or beverages, field personnel shall remove their nitrile gloves and coveralls and move to a location a minimum distance of 35 feet away from the sample location, preferably in the downwind direction. When finished eating or drinking, field personnel shall wash their hands, put their coveralls back on and put on a new pair of nitrile gloves prior to returning to the work area.

## 3.2 Field Gear and Clothing Restrictions

Because treatments to provide water resistant, water proof, or stain-resistant clothing include the use of PFAS, field personnel shall not wear any water resistant, water proof, stain-resistant treated clothing or Tyvek clothing during the field program. Permissible field clothing for PFAS sampling programs includes clothing made from natural fibers, preferably cotton. Clothing made of synthetic fibers shall be avoided (i.e., reflective vests).

Field clothing shall be laundered with a minimal amount of detergent and no fabric softener or scented products shall be used. Once field clothing has been washed appropriately, field clothing shall be washed a second time on a rinse-only cycle, using only water, prior to drying. Anti-static dryer sheets shall not be used when drying field clothing. Field clothing shall preferably be old cotton clothing that has been laundered many times, as new clothing may contain PFAS related treatments. Clothing containing Gore-Tex™ shall not be worn during the sampling program, as Gore-Tex™ clothing contains a PFAS membrane.

Waterproof field books shall not be used; field notes shall be recorded on loose paper using aluminum clip boards. Plastic clip boards, self-sticking notes, binders or spiral hard cover notebooks shall not be used. Field notes shall be recorded in pen or pencil. Markers shall not be used.

Most safety footwear is constructed of leather and synthetic materials that have been treated to provide some degree of waterproofing and/or increased durability. Therefore, footwear materials represent a potential source of trace PFAS. Field personnel contact with safety footwear including donning footwear or tying laces shall not occur within 35-feet of the sampling area. If footwear must be adjusted, field personnel shall re-locate to an area a minimum of 35-feet from the sampling area, preferably in a downwind direction, and make the necessary adjustments. Nitrile gloves shall be worn when contacting footwear. The nitrile gloves worn while contacting footwear shall be removed and new nitrile gloves shall be put on prior to re-entering the sampling area.

Disposable nitrile gloves shall be worn at all times. A new pair of nitrile gloves shall be donned prior to the following activities at each sample location:

- Contact with laboratory-suppled sample containers or PFAS-free water containers
- Decontamination of sampling equipment
- Insertion of anything into the well (e.g., HDPE tubing, HydraSleeve, bailer, etc.)
- Insertion of silicon tubing into the peristaltic pump

- Completion of monitoring well purging
- Sample collection
- Handling of QA/QC samples including field blanks and equipment blanks
- After the handling of any non-dedicated sampling equipment or contact with non-decontaminated surfaces

Because field vehicle seats may have been treated with PFAS-containing products for stain resistance, the seats of field vehicles shall be covered with a well laundered cotton sheet or blanket for the duration of the field program in order to avoid direct contact between field personnel clothing and vehicle seat fabric. Measures taken to mitigate field personnel contact with field vehicle seat fabric shall not in any way interfere with the functionality or impede the use of vehicle safety belts.

## 3.3 Personal Hygiene

Field personnel shall not use shampoo, conditioner, body gel, cosmetic cream, or hand cream as part of their personal showering routine on the day of a sampling event, as these products may contain surfactants and represent a potential source of PFAS. Field personnel shall follow their normal hygiene routine the night before a sampling event and then rinse with water only the morning before a sampling event. The use of bar soap is acceptable; however, bar soap including moisturizers shall be avoided.

Field personnel shall not use moisturizers, cosmetics, dental floss, sunscreen, and/or insect repellent for the duration of the field program, either on-site or off-site, as these products may contain trace PFAS. Appropriate accommodation to address the prohibition of the use of these substances must be incorporated into a site-specific HASP.

## 3.4 Sample Area Access

Visitors, including contractors or site personnel, who are not following these general PFAS sampling program protocols shall not be allowed to approach within 35 feet of the sample area until PFAS sample collection activities are complete and the PFAS sample container has been enclosed in a Ziploc® storage bag and placed in the sample cooler.

## 3.5 Field Equipment Decontamination

Use the procedures in this section to decontaminate all non-dedicated sampling equipment (e.g., submersible pumps, bladder pump components, tubing shears, etc.) used to collect samples:

- Rinse thoroughly with Citranox solution
- Rinse thoroughly with de-ionized (DI) water
- Rinse with methanol
- Rinse with DI water
- Allow to air dry
- Store equipment in clean Ziploc® storage bag until needed for sampling

Decontamination fluids used to clean equipment including Citranox, DI water, and methanol shall not be reused during field decontamination and shall be collected and drummed for off-site disposal.

**Title:** PFAS Program Monitoring Well Purging and Sampling Protocols 

## 1.0 GENERAL APPLICABILITY

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures that shall be followed during monitoring well purging and the collection of groundwater samples for analysis of per- and polyfluoroalkyl substances (PFAS).

This SOP includes the following:

- Monitoring Well Groundwater Elevation Measurement
- Monitoring Well Purge
- Sample Container Considerations
- Groundwater Sample Collection Procedures
- Sample Shipping Requirements

With the exceptions provided in these SOPs, field personnel shall follow the monitoring well purge protocols included in Section 4 of the Sampling and Analysis Plan (SAP) dated January 2018. Sampling depths for the monitoring wells included in this sampling program are included on Table 1.

## 2.0 RESPONSIBILITIES

The Field Team Leader and field personnel have the shared responsibility to oversee and ensure that the monitoring well purge and PFAS groundwater sampling program is performed in accordance with the program-specific protocols described in this SOP. The Field Team Leader shall ensure that field personnel understand and comply with this SOP.

## 3.0 PURGING AND SAMPLING PROCEDURES

### 3.1 Water Level Measurement

Under normal conditions, the first step in conducting a groundwater sampling program is to collect a synoptic round of static water level measurements and monitoring well sounded depths. However, due to the extremely low detection limits for PFAS, collection of a synoptic round of groundwater elevation measurements shall only be conducted after the groundwater sampling program has been completed to help mitigate the possibility of cross-contamination.

Field personnel shall record a depth to water measurement in each well prior to initiating well purge procedures.

### 3.2 Monitoring Well Purge

Field personnel shall not use Teflon® or low-density polyethylene (LDPE) tubing or other equipment containing these materials for purging or sample collection. High-density polyethylene (HDPE) tubing is preferred. Field personnel shall not re-use materials between well sample locations. Following completion of monitoring well purge activities at a monitoring well location, field personnel shall place all disposable materials in heavy-duty (i.e., lawn waste) garbage bags for disposal. Field personnel shall wear nitrile gloves at all times.

Field personnel shall purge monitoring wells using a submersible pump and HDPE tubing. Field personnel shall inquire of the manufacturer and identify a submersible pump model whose construction does not include any Teflon® components (e.g., check balls, O-rings, compression fittings, etc.). New HDPE tubing shall be used to purge groundwater at each bedrock well. Field personnel shall determine and cut the appropriate length of HDPE tubing to be used in each well using the previously measured arm span of the individual performing the monitoring well purge to avoid contact with any materials other than the well and submersible pump. Field personnel shall decontaminate non-dedicated components and sampling equipment (including pumps, tubing shears, etc.) in accordance with SOP-1 between well purge locations.

Purge water shall be collected and discharged to the publicly-owned treatment works at the on-site treatment building.

## 3.3 Sample Containers

Groundwater samples shall be collected in HDPE sample containers provided by the laboratory specifically for use in the collection samples for analysis of PFAS (i.e., HDPE without a Telfon® liner). Glass containers shall not be used due to the potential for loss of PFAS through adsorption.

Groundwater sample container lids shall remain on the sample container until immediately prior to sample collection and lids shall be resealed immediately following sample collection. Field personnel shall hold the sample container lid in their hand until the lid is replaced on the sample container. Field personnel shall not rinse groundwater sample container bottles during groundwater sample collection. Groundwater sample container labels shall be completed using a pen or a pencil after the lid has been re-secured on the sample container. Field personnel shall not use markers to complete sample container labels.

## 3.4 Sample Collection

With the exceptions provided in these SOPs, field personnel shall follow the groundwater sampling protocols included in Section 4 of the SAP dated January 2018. Field personnel shall wash their hands and put on a new pair of nitrile gloves prior to sample collection. Once the nitrile gloves are put on, field personnel shall not handle papers, pens, clothes, etc. prior to the collection of groundwater samples. If field personnel need to take notes or handle anything other than the sample container prior to collecting the sample, the old nitrile gloves with which contact was made shall be removed and new nitrile gloves put on.

Field personnel shall hold the sample container in such a manner that the sample container does not come in direct contact with the HDPE tubing or pump equipment. The sampling container shall be filled completely. If field personnel observe suspended solids in the collected groundwater sample, a new sample shall be collected, if possible. If it is not possible to collect a sample with minimal suspended solids (i.e., no evidence of solids settling at the bottom of the sampling container), field personnel shall contact the project manager and, if the sample is submitted for analysis, indicate the presence of suspended solids as a note on the chain-of-custody.

Groundwater samples shall be placed directly into the laboratory-supplied HDPE containers. Once the groundwater sample container lid has been resealed, groundwater sample containers are to be placed into individual new Ziploc® storage bags. Following groundwater sample collection, groundwater sample containers enclosed within their Ziploc® storage bags shall be placed on ice in the laboratory-

provided sample cooler. Field personnel shall minimize sample exposure to sunlight during sample handling and storage.

All sampling materials shall be treated as single use and disposed of following completion of groundwater sampling at each monitoring well location.

## 3.5 Sample Shipping

Groundwater sample containers shall be stored on ice and maintained at approximately 4 degrees Celsius (°C) and transported by overnight courier to the laboratory. Field personnel shall only use new, fresh ice. Reusable chemical or gel ice packs shall not be used, as these may contain PFAS. Tracking numbers for all shipments shall be provided once the sample coolers have been shipped to ensure their timely delivery.

**Title:** Quality Assurance / Quality Control Sampling Program Protocols 

## 1.0 GENERAL APPLICABILITY

The purpose of this Standard Operating Procedure (SOP) is to describe the Quality Assurance / Quality Control (QA/QC) samples that shall be collected during a per- and poly-fluoroalkyl substances (PFAS) sampling program.

This SOP includes protocols for the collection of the following QA/QC samples:

- Equipment Blanks
- De-ionized Water Blanks
- Field Duplicates
- Field Blanks
- Trip Blanks
- Analytical QA/QC

## 2.0 RESPONSIBILITIES

The Field Team Leader and field personnel have the shared responsibility to oversee and ensure that the PFAS QA/QC sampling program is performed in accordance with the program-specific protocols described in this SOP. The Field Team Leader shall ensure that field personnel understand and comply with this SOP.

Field personnel shall inquire of the submersible pump manufacturer and identify a pump model whose construction does not include any Teflon® components (e.g., check balls, O-rings, compression fittings, etc.).

## 3.0 QA/QC PROTOCOLS

### 3.1 Equipment Blanks

Equipment blanks shall be collected at a rate of one per setup per event for non-dedicated sampling equipment (i.e., submersible pumps). Equipment blanks shall be collected using laboratory-supplied De-ionized (DI) water and shall be collected in laboratory-supplied high-density polyethylene (HDPE) containers.

After decontamination of the submersible pump in accordance with the procedure described in SOP-1, equipment blanks will be collected by pouring the laboratory supplied DI water into a new and unused HDPE sample bottle and then pumping the DI water through new HDPE tubing and new silicon tubing with the submersible pump into the sample container. When the sample container is full, replace the sample container lid and re-seal. Equipment blank container lids shall remain in the hand of field personnel until replaced on the sample container. Sample container labels shall be completed using a pen or pencil after the sample container lid has been resealed. Field personnel shall not use markers to complete sample container labels.

## 3.2 De-ionized Water Blanks

DI water blanks shall be collected at a rate of one per setup per event for non-dedicated sampling equipment (i.e., submersible pumps). DI water blanks shall be collected using DI water and shall be collected in laboratory-supplied HDPE containers.

After decontamination of the submersible pump in accordance with the procedure described in SOP-1, DI water blanks will be collected by pouring the DI water used for decontamination over the external portion of the submersible pump into the sample container. When the sample container is full, replace the sample container lid and re-seal. DI water blank container lids shall remain in the hand of field personnel until replaced on the sample container. Sample container labels shall be completed using a pen or pencil after the sample container lid has been resealed. Field personnel shall not use markers to complete sample container labels.

## 3.3 Field Duplicates

Field personnel shall collect one blind field duplicate for every 20 primary field samples collected. Field personnel shall collected field duplicates immediately after collection of the primary field samples. Field duplicates shall be collected in the laboratory-supplied PFAS-free HDPE sample containers. Field duplicate container lids shall remain in the hand of field personnel until replaced on the sample container. Sample container labels shall be completed as described above.

Field personnel shall collect groundwater field duplicates for analysis of PFAS using the following procedures:

- Field personnel shall stabilize groundwater parameters in accordance with the AIWP SAP and SOP-2.
- Field personnel shall collect the primary sample in accordance with the AIWP SAP and SOP-2.
- Following collection of the primary sample, change gloves and prepare to collect the field duplicate.
- Field duplicates shall be collected immediately following collection of the primary sample.
- Completely fill the laboratory-provided HDPE groundwater sample container.
- Replace and re-seal the lid on the groundwater sample containers, then complete the sample container label as described above.

## 3.4 Field Blanks

Field personnel shall submit of one field blank per day of sampling. Field blanks shall consist of DI water containerized in an HDPE sample container filled at the laboratory prior to beginning the field program. Field blank sample containers shall be opened during the collection of a sample and the laboratory-supplied DI water contained therein shall be poured directly into a laboratory-supplied HDPE sample container, then resealed. Field blank container lids shall remain in the hand of field personnel until replaced on the sample container. Sample container labels shall be completed as described above.

## 3.5 Trip Blanks

Field personnel shall submit one laboratory-supplied trip blank per day of sampling. Trip blanks shall consist of PFAS-free water containerized in an HDPE sample container filled at the laboratory prior to the beginning of the field program. Field personnel shall place one trip blank container in the sample cooler at the beginning of the day and the trip blank shall remain in the cooler for the duration of sampling activities conducted on that day. Trip blank containers shall be submitted to the laboratory with the daily field sample shipment.

## 3.6 Analytical QA/QC

Internal laboratory QA/QC shall consist of one laboratory blank and one matrix spike / matrix spike duplicate (MS/MSD) for every 20 primary field samples collected for analysis. Field personnel shall collected MS/MSDs immediately after collection of the primary field samples as described above for field duplicates.

As part of the internal QA/QC, relative percent difference (RPD) shall be calculated between samples and corresponding field or laboratory duplicates. The laboratory quality assurance portion of the laboratory certificates shall be reviewed to verify that all calculations/recoveries were within acceptable limits as established by the laboratory method.

## 3.7 Sample Shipping

QA/QC samples shall be maintained at a temperature between 0 and 4 °C during shipping. Only new, fresh ice may be used in sample coolers. Field personnel shall not use reusable chemical or gel ice packs, as these may contain PFAS. Samples shall be shipped via courier service with priority overnight delivery. Tracking numbers for all shipments shall be provided once they have been sent out so to ensure their timely delivery.

## ATTACHMENT B

## LOW-FLOW GROUNDWATER PURGE/SAMPLE FIELD INFORMATION FORM

## ATTACHMENT B

## LOW-FLOW GROUNDWATER PURGE/SAMPLE FIELD INFORMATION FORM

Site _____

Location: _____

Project Number: _____ Meter/Type/Serial #: _____

**MONITORING WELL ID:** _____ Meter Calibrated @: _____

Depth to Water Prior to Purging [ft-bmp]: _____ Sampling Date/Time: _____

Well Casing Diameter [in]: _____ Sampler(s): _____

Start Time (purging): _____ Sampling Device: _____

Purging Device: _____ Sampling Purge Rate: _____

Pump intake setting: _____ Sample Characteristics: _____

Well Screen Interval: _____ PID Measurement of Well Headspace (ppm): _____

As-Built Construction Well Depth [ft-bmp]: _____ Analytical Parameters: _____

Sounded Well Depth [ft-bmp]: _____ _____

Weather Conditions: _____ Fe+2 result (field measurement): _____ PPM

| Time [hh:mm] | Temperature [°C] | pH [std] | Specific Conductance Circle One [S/m] or [mS/cm] | Turbidity [ntu] | Dissolved Oxygen [mg/l] | Redox Potential Note - Indicate if (+) or (-) [mV] | Depth To Water [ft-bmp] | Volume Purged [liters] | Approximate Purge Rate [ml/min] | Observations (PID readings, sample characteristics, equipment problems, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
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**Comments:**

Signature:

**Page __ of __**

## ATTACHMENT C

## VOLUME AVERAGE GROUNDWATER PURGE/SAMPLE FIELD INFORMATION FORM

## ATTACHMENT C

# Volume Average Groundwater Purge/Sample Field Information Form

Site: _____

Location: _____

Project Number: _____

Sampling Team: _____

**Sample Point ID:** _____

Purging Device: _____

Depth to water before purging (ft-bmp) _____ Date: _____ Time: _____

Well depth (ft-bmp) _____

Casing diameter (in) _____

Casing volume (gal) _____

Volume purged (gal) _____ Time Start: _____ Time Finish: _____

Depth to water after purging (ft-bmp) _____

Remarks:

Casing Volume Calculation

| 2" | 4" | 6" | 8" |
|---|---|---|---|
| 0.163 gal/ft | 0.653 gal/ft | 1.47 gal/ft | 2.61 gal/ft |

WELL INSPECTION (Circle Y or N)

| | | | |
|---|---|---|---|
| Is well location correct on map? | Y or N | Is the well locked? | Y or N |
| Is well located in a dry area? | Y or N | Is the lock in good condition? | Y or N |
| Is well readily accessible? | Y or N | Is the well vented? | Y or N |
| Is well legibly labeled? | Y or N | Does casing have weep hole? | Y or N |
| Is well protected with posts? | Y or N | Does well have dedicated bailer? | Y or N |
| Is casing free of kinks/bends? | Y or N | Does well have dedicated pump? | Y or N |
| Is protective casing secure? | Y or N | Is equip. in good condition? | Y or N |

Remarks:

FIELD MEASUREMENTS

| | 1) | 2) | 3) | 4) | Units | Calibration Notes |
|---|---|---|---|---|---|---|
| Temp. | | | | | **ºC** | |
| pH | | | | | **std. units** | |
| Sp. Cond | | | | | **ms/cm** | |
| Turbidity | | | | | **ntu** | |
| Volume | | | | | **gallons** | |
| Other | | | | | | |

Sample Collection Notes:

Weather conditions at time of sampling:

Sample characteristics:

Sample date / time: Method of sample collection:

Sample sequence:

Signature: _____ Company: _____ Date: _____

# ATTACHMENT D

# LABORATORY QUALITY MANUALS

# Cover Page:

# Quality Assurance Manual

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