SUMMARY REPORT - SOURCE AREA INVESTIGATION OF THE FORMER W BUILDING 2 CORRIDOR AND BUILDING 58 AREAS for PART 2 of the SUPPLEMENTAL GROUNDWATER REMEDIAL INVESTIGATION Former York Naval Ordnance Plant 1425 Eden Road, Springettsbury Township York, Pennsylvania

Prepared for:

Harley-Davidson Motor Company Operations, Inc.

1425 Eden Road

York, Pennsylvania

April 2013

Prepared by:

Groundwater Sciences Corporation

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
µg/kg	micrograms per kilogram
µg/l	micrograms per liter
µmhos/cm	micro-mhos per centimeter
μV	microvolts
1,1-DCE	1,1-dichloroethene
AMSL	above mean sea level
bgs	below ground surface
Bldg 58	Building 58
cis-1,2-DCE	cis-1,2-dichlorothene
CVOC	chlorinated volatile organic compounds
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
ECD	electron capture detectors
FID	flame ionization detectors
FSP	Field Sampling Plan
fYNOP	former York Naval Ordnance Plant
GPR	Ground Penetrating Radar
GSC	Groundwater Sciences Corporation
GW RI Part 1	Supplemental Remedial Investigation Groundwater Report (Part 1)
GW RI Part 2	Part 2 of the Groundwater Remedial Investigation
H-D	Harley-Davidson Motor Company Operations, Inc.
lb.	pound
lbs.	pounds
MIP	Membrane Interface Probe

mg/L	milligrams per liter
MSCs	medium specific concentrations
NAD 83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NTU	nephelometric turbidity units
PCE	tetrachloroethene
PID	photoionization detectors
SAIC	Science Applications International Corporation
S.U.	standard units
SVOC	semi-volatile organic compounds
TCA	1,1,1-trichloroethane
TCE	trichloroethene
TestAmerica	TestAmerica of Pittsburgh, Pennsylvania
VOCs	volatile organic compounds
XSD	halogen-specific detector
WBldg2	West Building 2
YCIDA	York County Industrial Development Authority

1 INTRODUCTION

In September 2011, Groundwater Sciences Corporation (GSC) completed the report titled "Supplemental Remedial Investigation Groundwater Report (Part 1)" (GW RI Part 1) for the former York Naval Ordnance Plant (fYNOP) in York, Pennsylvania (Site). Several data gaps were identified in that report that required additional investigation prior to conducting a feasibility study for selection of a final remedy for the Site. These data gaps are being investigated as Part 2 of the Supplemental Groundwater Remedial Investigation. The current source area investigation was conducted in an effort to identify the location or locations of the source of high concentrations of chlorinated volatile organic compounds (CVOCs) in the groundwater near the Building 58 (Bldg 58) and West Building 2 (WBldg2) Corridor areas at the Site (**Figure 1**). The exact mode, mechanism, and age of releases within these areas is unknown, but are believed to have occurred following development of the site in the 1940s, and may have been introduced through spills, leakage, and/or disposal of materials and wastes associated with metal degreasing, painting, and plating operations.

The source area investigation was conducted at the fYNOP on property currently owned by the York County Industrial Development Authority (YCIDA) and Harley-Davidson Motor Company Operations, Inc. (H-D). YCIDA purchased H-D's West Campus in June 2012 which included the WBldg2 Corridor area and a portion of the Bldg 58 area. Buildings 2 and 58 have been demolished and only the building slabs remain.

2 INVESTIGATION DESCRIPTION

GSC has prepared this summary report of the source area investigation at the Bldg 58 and WBldg2 Corridor areas conducted in accordance with the Field Sampling Plan (FSP) for Part 2 of the Supplemental Groundwater Remedial Investigation (GSC, April 2012). This source area summary report will be included as an appendix to the final report describing the results of Part 2 of the Supplemental Groundwater Remedial Investigation. The objective of this investigation was to attempt to locate shallow sources of CVOCs at the former Bldg 58 and WBldg2 Corridor areas.

Concentrations of CVOCs in groundwater that are suggestive of the nearby presence of a dense non-aqueous phase liquid (DNAPL) source or sources have historically been detected near former Bldg 58 and WBldg2 Corridor at the fYNOP. However, the location or locations of an originating DNAPL source of the CVOCs has not been identified by previous investigations. One objective of Part 2 of the Groundwater Remedial Investigation (GW RI Part 2) was to focus on locating the source or sources of these elevated CVOC concentrations in groundwater. A source area would be considered significant if the mass of CVOCs was persistent and not readily depleted by leaching, or if evidence of DNAPL were found. Locating a source with a significant mass of CVOCs would provide useful information when making decisions during the Feasibility Study phase of the work for remediation.

Following is the working conceptual model for the distribution of CVOCs in this area of the Site:

- From the point of entry into the subsurface, CVOCs in the form of DNAPL would seep vertically downward through the fill and natural soil and sediment/residuum. Vapor phase CVOCs would remain in the unsaturated material (primary sourcing) or partition into the unsaturated material from the groundwater (secondary sourcing).
- 2. DNAPL may accumulate and spread laterally at the top of the phreatic surface (water table), and if sufficient accumulation occurs at the water table, DNAPL will penetrate the saturated zone. The DNAPL will travel vertically downward, potentially deflecting laterally in response to changes in soil texture and remnant structures within the sediment/residuum.

- 3. If the DNAPL encounters the top of bedrock, it may spread out and migrate laterally along the top of the bedrock surface or may travel vertically downward through fractures, solution features, or depressions along the top of bedrock. The downward slope of the bedrock surface would direct the DNAPL migration. DNAPL can be retained in the subsurface in pore spaces and as trapped globules and ganglia in soil and fractures along the migration pathway.
- 4. The DNAPL at and below the water table would dissolve in the groundwater and then migrate in the direction of groundwater flow.

The first step in locating a source of CVOCs causing impacts to the groundwater quality was to install monitoring wells that screen groundwater at or near the top of bedrock surrounding locations near Bldg 58 and locations near the WBldg2 Corridor where elevated concentrations of CVOCs have previously been detected in groundwater. The distribution and relative concentrations of CVOCs in these new shallow wells were used to locate Membrane Interface Probe (MIP) points. The results of the initial MIP profiles were used to attempt to backtrack the potential path of the CVOCs, focusing on upgradient and up the bedrock slope directions. The combination of the bedrock surface contours, the groundwater elevation contours and the concentrations and ratios of CVOCs were used to locate the second through fifth rounds of MIP points. While the purpose of this investigation was primarily to locate sources above the water table (entry points from DNAPL losses), high MIP responses deeper in the probe close to the top of bedrock and below the water table were used to attempt to find the source point by locating MIP points upgradient and or up the slope of the bedrock.

2.1 Well Installation Procedures

Shallow monitoring wells were drilled at the Bldg 58 and WBldg2 Corridor areas (**Figure 1**) using air rotary techniques. Locations for the wells were chosen based on historical groundwater analytical results and the reported or suspected past operations at the Site. Wells MW-114 and MW-113 historically contained elevated concentrations of CVOCs, and therefore, the shallow wells were located around these existing wells in an attempt to better define the direction from where the CVOC source(s) originated. Groundwater from the new shallow wells was sampled and the results of chemical analyses were used to select locations for MIP sampling to identify the CVOC sources

and help guide the placement of deeper vertical extent wells in the two areas. Four shallow bedrock wells were installed in the area of Bldg 58, and six shallow bedrock wells were installed in the WBldg2 Corridor area.

Well logs with descriptions of the drill cuttings and well construction details are provided in **Appendix A**. Descriptions of the drilling and well installation methods and procedures are provided below.

The air-rotary drilling method was used to install the monitoring wells into shallow bedrock. A nominal 8-inch diameter borehole was advanced using either a percussive down-hole hammer or a tri-cone roller bit. Drill cutting samples were collected from the surface to the total depth of the borehole. Descriptions of the drill cuttings were recorded on a standard log form by a GSC geological scientist. Drill cuttings were then containerized in roll-off containers for proper disposal by H-D. Groundwater produced during drilling were containerized into frac tanks, then treated by processing through the Site groundwater treatment system.

Each monitoring well was constructed with 2-inch inner diameter schedule 40 PVC well screens and casing. Screen sections were commercially fabricated and slotted with openings equal to 0.010 inches (10 slot) and were flush joint threaded. U-pack screen sections, with an annular space that is filled with sand, were used for intervals that could not be filter packed conventionally due to subsurface conditions such as unstable boreholes or the presence of solution cavities. Screen lengths varied between 15 and 20 feet and the wells were generally screened extending from above the water table to below the bedrock. The tops of all well casings were capped with an expandable plug.

Granular filter pack graded as Morie No. 1 sand or similar (and pea gravel where void areas were encountered) was placed in the borehole outside of the screen. The filter pack was placed to 2 to 5 feet above the top of the PVC well screen. The final depth of the filter pack was measured with a weighted tape and recorded on the logs.

Following filter pack placement, a bentonite seal was placed above the filter pack. Bentonite seal materials consist of compressed, powdered bentonite pellets or chips, generally measuring 0.25 to 0.38 inches in size. The bentonite seal was placed to a dry thickness of 2 to 5 feet, measured shortly after placement. Following placement, the bentonite seal was allowed to hydrate approximately one

hour. If the seal was above the water table, potable water was poured down the borehole several times, allowing for hydration of the seal.

The remainder of the borehole above the bentonite seal was grouted to within approximately 3 feet of the ground surface. Where subsurface conditions were unstable or there were void spaces, a bentonite slurry grout was used. Where conditions were more stable, the grout consisted of Type I or II Portland cement, with proportions of approximately 5 to 8 pounds (lbs.) dry weight of powdered bentonite per 94 lb. sack of dry cement, and a maximum of 6 to 7 gallons of water per sack of cement. The grout was combined in an aboveground rigid container and mechanically blended to produce a thick, lump free mixture. The grout was placed into the borehole through a rigid tremie pipe, initially set slightly above the bentonite seal.

Well development was performed to remove drilling debris, mud, silt, fine sand, and sediment from the well to promote the hydraulic connection between the well and surrounding formation. Well development activities did not commence until the grout had cured at least 24 hours. The wells were surged and then purged by raising and lowering a 2-inch diameter submersible pump within the screened interval. Field parameters (pH, conductivity, dissolved oxygen [DO], and temperature) were recorded before, during, and after the development process. Following well development, the monitoring wells were completed with at-grade drive-over covers which were concreted in place.

At the completion of monitoring well construction activities, each well was surveyed by a Pennsylvania-licensed surveyor for horizontal and vertical control. The elevation of the inner and outer well casings (at designated marked points on the rims) and the ground surface at each location was surveyed. The horizontal well location was established relative to North American Datum of 1983 (NAD 83) Pennsylvania State Plane South (coordinates are in feet). Vertical measurements were recorded to the nearest 0.01 foot above mean sea level (AMSL) relative to the North American Vertical Datum of 1988 (NAVD 88), and horizontal measurements were recorded to the nearest 1 foot.

2.2 Groundwater Sampling Procedures

Groundwater sampling methods followed the procedures described in the Field Sampling Plan (GSC, April 2012) and the Quality Assurance Project Plan (GSC, June 2012). The groundwater

samples were collected from each of the new monitoring wells after a period of at least ten days after well development. Water level measurements were recorded prior to purging and sampling activities at each well location using an electronic water level indicator.

Wells were purged of groundwater using modified low-flow (minimal drawdown) techniques prior to the collection of groundwater samples. A well yield matched purge sampling technique was applied to sample the groundwater monitoring wells. The well yield matched purge technique incorporates some of the aspects of low flow or micro purge sampling techniques in an attempt to acquire samples that are representative of the actual conditions within the aquifer and to collect reproducible sampling results. The collection of groundwater samples from monitoring wells using the well yield matched purge sampling technique was accomplished in four general steps:

- 1. Set the purge flow rate;
- 2. Control drawdown in the well;
- 3. Obtain stabilized water quality indicator parameters; and
- 4. Collect groundwater samples.

The monitoring wells were purged and sampled in an order so that the well having the lowest suspected contaminant concentration was sampled first, and the well having the highest suspected concentration of contamination was sampled last. Decontamination of purging and sampling equipment was performed between each well using an Alconox cleaning solution and a deionized water rinse. New disposable polyethylene tubing was used on all non-dedicated submersible, positive-displacement sampling pumps and was discarded after sampling each well. The pump intake was set at about the middle of the screened interval.

The field parameters of pH, conductivity, temperature, DO, and turbidity were monitored during purging. To the extent practical, the purge rate was adjusted as necessary to achieve stabilized water levels. Purging was considered complete when the field parameters stabilized after a minimum of three readings at 5-minute intervals according to the following criteria:

- DO: ± 0.2 milligrams per liter (mg/L)
- conductivity: ± 25 micro-mhos per centimeter (μ mhos/cm)

- temperature: ± 0.5 degrees Celsius (°C)
- pH: ± 0.1 Standard units (S.U.)
- turbidity: < 50 nephelometric turbidity units (NTU)

The collection of groundwater samples from a monitoring well began after the stabilization of field parameters. The flow-through cell for collecting the stabilization parameters was removed from the discharge tubing prior to starting the sampling activities and samples were collected directly into pre-preserved laboratory sample containers from the pump discharge tubing. Dissolved metals samples were field filtered by attaching an in-line filter to the discharge tubing and filtering directly into the preserved sample bottles. The pre-preserved sample containers were supplied by TestAmerica of Pittsburgh, Pennsylvania (TestAmerica).

The groundwater samples were placed into ice-filled coolers and shipped by courier to TestAmerica for chemical analyses in accordance with chain-of-custody procedures. Samples were analyzed for volatile organic compounds (VOCs) (SW-846 Method 8260B), semi-volatile organic compounds (SVOCs; SW-846 Method 8270C), 1,4 Dioxane (SW-846 Method 8270C SIM), dissolved and total metals (Methods SW-846 6020/7470A), total cyanide (SW-846 Method 9012A), available cyanide (SW-846 Method 1677), and total and dissolved hexavalent chromium (Standard Method 3500CrD).

Water generated from well purging activities and decontamination water from groundwater sampling activities was containerized and transferred to the on-Site groundwater treatment plant for treatment.

2.3 GPR Survey Utilization

Prior to MIP sampling in the Bldg 58 area, ground penetrating radar (GPR) was used to attempt to define the configuration of the reported former press pits. GPR is a geophysical method that uses radar pulses to produce a vertical image or profile of the subsurface. High-frequency radio waves are transmitted into the subsurface and reflected back to a detector when waves hit a buried object or boundary with different dielectric properties. The survey was performed on July 13, 2012 by Science Applications International Corporation (SAIC) to identify anomalies suspected to be

associated with former press pits. SAIC utilized a GSSI SIR3000 GPR with a 400 megahertz antenna configured in a cart mode to perform the survey. Three anomalous areas were identified by attenuated GPR signals at depth and one anomalous area was identified by a high amplitude reflection at depth. The anomalous areas are shown on **Figure 1** and the GPR survey report is included as **Appendix B**. The first four MIP points at the Bldg 58 area were positioned in locations at or adjacent to these anomalous areas.

2.4 MIP Sampling Procedures

Vironex, Inc. of Bowie, Maryland performed the MIP sampling activities between July 26 and August 15, 2012. The MIP sampling was observed and supervised by a GSC geologist. MIP is a semi-quantitative field screening device used to detect total volatile organic compounds in unconsolidated material, providing vertical profiling information for total CVOCs. MIP was used in this investigation with Geoprobe direct-push drilling equipment which pushes the MIP into the subsurface at a targeted rate of about one foot per minute. MIP sampling procedures use heat to volatilize VOCs from subsurface soils and soil porewater. The heater block operates at a regulated temperature between 100 to 120 degrees Celsius. The MIP controller unit at the ground surface has an LCD temperature readout which is monitored by the MIP operator. The volatilized VOCs pass through a hydrophobic membrane and are transferred using an inert carrier gas to detection devices located at the ground surface. Detection devices used in this study consisted of an electron capture detector (ECD), a halogen-specific detector (XSD), a photoionization detector (PID) with a 10.6 eV lamp, a flame ionization detector (FID), and a conductivity detector. Standard practices for using **MIPs** be found the direct-push technology with can at http://www.astm.org/DATABASE.CART/HISTORICAL/D7352-07.htm.

Individual chemical compounds are not identified with the MIP technology. However, the different detectors are somewhat selective or specialized and give better results for certain substances compared with the other detectors. For instance, the XSD and ECD are best for analyzing CVOCs, whereas the FID is better for detecting hydrocarbons. The PID detects a range of substances, but is not as sensitive as the other detectors. The significant difference between the XSD and the ECD is that the ECD is the more sensitive detector, especially for the more chlorinated ethenes such as tetrachloroethene (PCE) and trichloroethene (TCE), but it does not detect cis-1,2-dichlorothene (cis-1,2-DCE) or vinyl chloride, which are picked up by the XSD. Therefore, the interpretation of the

MIP data included a review of the relative response of the various detectors used in combination. For example, a concentrated PCE or TCE source area or a DNAPL source in soil may be interpreted to exist if the XSD showed a concentration of 700,000 microvolts (μ V) (the maximum detection limit for the XSD), the ECD showed a concentration of 14,000,000 μ V (the maximum detection limit for the ECD) and the PID showed a concentration of 10,000,000 μ V (the maximum detection limit for the PID) (personal communication with D. Caputo, Vironex Director of Characterization, October 29, 2012).

Locations for MIP sampling points were chosen based on 1) results of the groundwater sampling analyses from the 10 newly installed shallow monitoring wells, 2) proximity to suspected source areas based on data from previous investigations, 3) interpretations of bedrock surface topography, updated based on the shallow monitoring well installations and, 4) the GPR survey at the Bldg 58 area. Data were reviewed after each MIP point was completed so that the results from earlier MIP sampling could be used to guide the selection of later MIP sampling locations without demobilization of equipment or interruption of testing.

After MIP sampling locations were marked on the ground surface, a utility clearance was obtained from H-D personnel prior to any intrusion activities. A vacuum excavation (soft dig), extending about five feet below the concrete cover, was completed at each MIP location as an additional precaution in an effort to avoid contacting and damaging subsurface utilities. MIP equipment response tests were performed each day to verify equipment calibration prior to sampling (response test data is included in **Appendix C**). MIP sampling was conducted to the depth of Geoprobe refusal (assumed to be bedrock), ranging from approximately 21 to 37 feet below ground surface (bgs) in the Bldg 58 area and 16 to 66 feet bgs in the area of the WBldg2 Corridor.

Confirmatory samples of soil and groundwater were collected from one boring in the Bldg 58 area and from four borings in the WBldg2 Corridor and submitted to TestAmerica for VOC laboratory analyses using SW-846 Method 8260B. Confirmatory sampling was done to verify and further assess the screening-level microvolt responses of the MIP detectors and to assess the concentrations of individual chemicals in apparent MIP locations with relatively higher microvolt responses. Soil samples were retrieved from the subsurface with the Geoprobe using a dual tube sampler where a smaller rod is placed inside an outer casing and is driven through the sampling interval to collect the soil. Soil samples were obtained from the dual tube sampling device using an Encore sampler provided by TestAmerica. Confirmatory groundwater samples were collected by inserting dedicated tubing inside the outer rod and using a peristaltic pump to collect the water sample.

MIP borings were abandoned after data collection by filling the holes with granular bentonite and constructing a surface seal using materials consistent with the existing surface, such as asphalt patch in bituminous pavement areas and concrete caps in areas with concrete slabs.

3 INVESTIGATION RESULTS

The investigation of CVOC sources at Bldg 58 and WBldg2 Corridor provided data on groundwater elevations and theoretical groundwater flow patterns, soils beneath the Site, bedrock elevations, and CVOC distribution in the shallow subsurface. Investigation results are described in this section.

3.1 Groundwater Level Elevation Measurements

Depth to groundwater level measurements were recorded in the new monitoring wells on June 28 and July 2 or 6, 2012 as part of the groundwater sampling effort. Another round of groundwater level measurements was recorded at selected wells on August 6, 2012. In the new wells in the WBldg2 Corridor area, the groundwater elevations measured on August 6th ranged from 346.4 feet AMSL at well MW-130, to 347.3 feet AMSL at well MW-133, and the depth to groundwater ranged from about 15 to 21 feet bgs. In the Bldg 58 area, the groundwater elevations measured on August 6th ranged from 346.3 feet AMSL at well MW-129, to 347.7 feet AMSL at well MW-126, and the depth to groundwater ranged from 19 to 27 feet bgs. Figure 2 shows the shallow groundwater elevation contours based on the June 28th/July 2nd and August 6th water level measurement events and the water level data is provided in Table 1. Groundwater flow in the Bldg 58 and WBldg2 Corridor areas historically has been interpreted to flow toward the west as depicted on Figure 2 showing the June/July 2012 groundwater elevation contours. A groundwater trough at the Bldg 58 area was observed during the June/July 2012 water level measuring events which is consistent with a slight groundwater contour deflection observed during previous groundwater level measuring events (i.e. Figure 3.4-1 in the Supplemental Remedial Investigation Groundwater Report (Part 1), September 2011). The trough extending beneath the Bldg 58 area is interpreted to occur as a result of the pumping influence by groundwater extraction well CW-8.

The pump was temporarily removed from extraction well CW-8 on August 3, 2012 in preparation for drilling of nearby wells MW-137X (abandoned) and MW-137A. Contours shown for August 6, 2012 reflect conditions when groundwater extraction at well CW-8 was not in operation. As indicated by the August 2012 groundwater elevation contours (**Figure 2**), the trough is not pronounced and groundwater is interpreted to flow toward the south-southwest from the Bldg 58 area and southern part of Bldg 2 when CW-8 is not pumping.

3.2 Soils

The four primary soil classifications that historically have been mapped at the Site are Duffield, Glenelg, Elk and Chester (SAIC, December 2009). Overburden materials encountered during this investigation were predominantly silts and clays. Coarser grained sediments were encountered above the bedrock in well MW-132. Soils were observed from drilling cuttings and during MIP sampling using the electrical conductivity probe. Higher electrical conductivity values of 10 to 1,000 milli-Siemans per meter indicate fine-grained material such as clays, and values of 3 to 20 milli-Siemans per meter indicate less fine material such as silts. Many of the MIP borings showed finer grained clays immediately above the bedrock. As shown on the MIP logs in **Appendix D**, MIP detector responses appear to be independent of the conductivity values/soil types.

3.3 Bedrock Surface Elevation Contours

DNAPL compounds have specific gravities greater than water and would tend to sink through the water column if a release occurred. The DNAPL would have the potential to flow downward along the bedrock surface slope toward depression areas in the bedrock surface. Therefore, determining the bedrock surface elevation and interpreting the configuration of the overburden-bedrock interface were an important part of this investigation. MIP points were positioned up-slope of areas showing higher concentrations of CVOCs to attempt to back-track the path that DNAPL could have followed to where a release could have occurred.

Bedrock elevation contours were developed using available bedrock elevations from previously completed borings and wells. As MIP points were completed, information regarding the depth to bedrock from the MIP points was added to the available data, and the bedrock surface was recontoured using the new data. The contours are provided on **Figure 3**, and were developed using the Kriging method and Golden Software, Inc.'s Surfer 11 program. In general, bedrock elevation in the suspected source areas slopes toward the east, but the bedrock surface is irregular, with depressions and "pinnacles and cutters" as is typical of many carbonate rock formations. Described in the GW RI Part 1 Section 3.2.3.4 and shown on the report's corresponding Figure 3.2-11, a broad irregularly shaped bedrock surface depression exists west of the geologic contact between the carbonate bedrock and the quartitic sandstone and phyllite. The depression has a general north to south orientation, curving to the west at its northern extent, as the geologic contact curves to the

west. Depths to bedrock inferred at each MIP point provide more data suggesting an irregular bedrock surface.

Distinct bedrock depression areas are shown on **Figure 3.** Bedrock surface depressions within the WBldg2 Corridor area are located in the center of the northern Building 2 pad which is west (downslope) of a suspected VOC source area, and at the northern WBldg2 Corridor area. Newly installed wells MW-132 and MW-135, located within the depression, contained a 10- to 20-foot gravel layer above the top of bedrock. The deepest bedrock surface appears to be at the Bldg 58 area, centered at existing well MW-87 and roughly coinciding with the groundwater level elevation surface trough described above in Section 2.1.

3.4 Groundwater Chemistry Results

Groundwater was sampled from the ten shallow bedrock wells on July 2, 5 and 6, 2012 and submitted to TestAmerica for laboratory analysis of VOCs, SVOCs, total and dissolved metals, total and dissolved hexavalent chromium, total and free cyanide, and 1,4-Dioxane, as outlined in Addendum #1 to the FSP for Part 2 of the Supplemental Groundwater Remedial Investigation, dated June 2012. Analytical results are summarized in **Table 2**. TCE, PCE, cis-1,2-DCE), 1,1dichloroethene (1,1-DCE), and 1,4-dioxane were the chemicals detected most frequently and at the highest concentrations. Figure 3 provides pie diagrams showing relative concentrations of CVOCs and lists detected concentrations of TCE and PCE beside each well. The TCE and PCE concentrations posted for existing wells (well designations with numbers less than 126) includes analytical results for samples collected between 2007 and 2009 while the postings for new monitoring wells MW-126 through MW-140A are based on analyses of groundwater samples collected in July 2012. This groundwater chemistry data, in combination with the bedrock surface topography and the groundwater gradient, were used to design the MIP investigation program. Groundwater chemistry results for each suspected source area are described in the following sections.

3.4.1 Bldg 58 Area

Groundwater from the four newly installed shallow bedrock monitoring wells was sampled on July 6, 2012. SVOCs, total or dissolved metals, total or free cyanide, and total or dissolved hexavalent

chromium were not detected in any of the groundwater samples from the Bldg 58 area exceeding applicable Medium Specific Concentrations (MSCs). Concentrations of 1,4-Dioxane were detected in MW-127 (24 micrograms per liter [μ g/l]) and MW-128 (8.8 μ g/l) exceeding the Pennsylvania MSC for residential used aquifers of 6.4 μ g/l.

CVOCs were not detected above applicable MSCs in the samples from MW-126 located between former Buildings 52 and 59, north of the groundwater trough described above in Sections 2.1 and 2.2. The CVOCs PCE, TCE, cis-1,2-DCE, and 1,1-DCE were detected in groundwater from MW-127, MW-128, and MW-129 exceeding MSCs. Of these three wells, the lowest concentrations of each of the above-listed CVOCs were detected in the groundwater sample collected from well MW-129, located just northeast of the groundwater trough, where the bedrock is relatively deep at 25 feet bgs.

The highest concentrations of CVOCs were detected in the groundwater sample collected from well MW-127, located in the southern portion of the groundwater trough at the Bldg 58 area. Detections were as follows and were similar to historical concentrations and ratios of chlorinated compounds detected at nearby well MW-113:

- PCE: 33 µg/l (estimated concentration)
- TCE: 1,200 µg/l
- Cis-1,2-DCE: 590 µg/l
- 1,1-DCE: 30 µg/l (estimated concentration)

3.4.2 WBldg2 Corridor

Groundwater from newly installed shallow bedrock wells MW-130 and MW-135 (two wells) was sampled on July 2, 2012 and groundwater from MW-131 through MW-134 (four wells) was sampled on July 5, 2012. As in the Bldg 58 area, SVOCs, total or dissolved metals, total or free cyanide, and total and dissolved hexavalent chromium were not detected above applicable MSCs in any samples collected from these six WBldg2 Corridor area wells. 1,4-Dioxane was detected above the MSC of 6.4 μ g/l in five of the six wells, ranging in concentration from 14 μ g/l at MW-130 to 60 μ g/l at MW-132.

CVOCs are the predominant chemical compounds detected in groundwater at the Site. TCE was detected above the MSC of 5 μ g/l in all six of the new wells in the WBldg2 Corridor area. Its concentration ranged from 27 μ g/l at MW-133 to 4,000 μ g/l at MW-131 and the highest concentrations were detected, in increasing order, at MW-130, MW-132, and MW-131. Well MW-133 contained the lowest CVOC concentrations in any of these wells, with TCE being the only CVOC detected at a concentration that exceeded the MSC.

PCE was detected above the MSC of 5 μ g/l in wells MW-130, MW-134, and MW-135 ranging from 25 μ g/l (estimated) at MW-130 to 420 μ g/l at MW-135. Each of these wells is located west of the Building 2 pad.

Cis-1,2-DCE concentrations above the MSC of 70 μ g/l were detected at a range of 270 μ g/l at MW-134 to 3,600 μ g/l at MW-132. 1,1-DCE was detected above the MSC of 7 μ g/l ranging from estimated concentrations of 9 μ g/l at MW-134 to 160 μ g/l at MW-132. 1,1-dichloroethane (1,1-DCA) was detected above the MSC of 31 μ g/l in well MW-132 at an estimated concentration of 92 μ g/l. Cis-1,2-DCE, 1,1-DCE, and 1,1-DCA were not primary chemicals used at the facility, but are transformation (daughter) products of PCE, TCE, and 1,1,1-trichloroethane (TCA). TCA was not detected in any of the groundwater samples collected from the newly installed shallow bedrock wells.

3.5 MIP Sampling Results

A total of 54 MIP borings were completed in the suspected source areas, with 19 MIP points located in the Bldg 58 area and 35 MIP points in the WBldg2 Corridor. MIP locations were selected in five rounds with the first round based on proximity to suspected sources and based on the groundwater chemistry and gradient results from the new shallow wells. The subsequent MIP locations were selected using the real time MIP screening data and depth to bedrock information obtained from the earlier MIPs. Vertical profiling data and 2-D and 3-D interpreted imaging were provided by Vironex, Inc. and are included as **Appendix D**. It should be noted that the upper five feet of the soil profile were disturbed during vacuum excavation and were not used for determining potential sources of CVOCs.

Confirmatory soil samples were collected from one boring at the Bldg 58 area and from four borings at the WBldg2 Corridor (**Figure 3**). Three shallow groundwater samples were also obtained during the MIP confirmation sampling to compare with the MIP total VOC concentrations. **Table 3** summarizes the laboratory results for total VOC concentrations and MIP responses (concentrations) for the ECD and XSD at adjacent MIP sampling points. As observed from **Table 3**, low or undetected concentrations of VOCs in the laboratory samples correlate with no significant responses being detected at the MIP points, and the higher laboratory detections correlate with higher detections at the MIP points. One exception to the correlation was observed in the groundwater sample taken at 22 feet bgs at HD-WB2COR-SB-03-22-0 in the WBldg2 Corridor. This groundwater sample contained 964 μ g/l of total VOCs, but the corresponding MIP result did not show elevated VOC concentrations.

3.5.1 Bldg 58 Area

Of the 19 MIP points in the Bldg 58 area, only Bdg58-MP-013 and -014 exhibited detections by the XSD detector (see the MIP response logs and cross sectional views in **Appendix D**. The minimal responses in these two points look very similar in both MIP points where low concentrations were detected at 16 feet bgs by the XSD and FID in both borings. Furthermore, there were no detections by the ECD which may indicate that CVOCs were not present or that only the less chlorinated CVOCs, such as cis-1,2-DCE, were present. FID responses could be the result of combustibles such as methane.

The confirmatory groundwater sample, designated BDG58-SB-001, collected from a depth of between 30 and 31 feet bgs at the Bldg 58 area, contained 4.5 μ g/l of TCE (**Tables 4** and **5**), which is less than the MSC of 5 μ g/l. TCE was the only CVOC detected. CVOCs were not detected in the confirmatory soil sample.

3.5.2 WBldg2 Corridor

Figure 4 shows horizontal MIP results from the ECD at depths bgs of 5, 8, 10, 15, 20, 25, and 30 feet where cooler colors (i.e. blues and greens) represent low responses/concentrations from the ECD and warmer colors (i.e. orange and reds) represent higher responses. ECD responses shown in red represent CVOC concentrations of about 14,000,000 μ V, but do not necessarily indicate the

presence of DNAPL or a source area unless the responses of the other detectors confirm the detections as described in Sections 1.4 and 3. Results are reported in this section predominantly for the ECD because it is the most sensitive detector for CVOCs, and whenever cis-1,2-DCE historically has been detected, it is accompanied by TCE or PCE which would be detected by the ECD.

The highest shallow detections (8- and 10- foot depths) occurred at MIP point WB2COR-MP-027, located in the north-central Building 2 pad; however, there were only moderate responses by the XSD and PID detectors. At about 15 feet bgs, the concentration in MP-027 decreased while the concentration increased in the adjacent MIP point, WB2COR-MP-013, located closer to the bedrock surface depression.

Also at about 10 to 15 feet bgs, the concentration responses were elevated at WB2COR-MP-003, located in the central portion of the Bldg 2 pad and west of an area where TCE and PCE were previously detected in the soil. At about 20 feet bgs (just below the water table) the highest concentrations occurred at WB2COR-MP-002, located west of the former location of waste water sumps containing acid and alkaline wastes, chrome rinse wastes, cyanide wastes, and municipal water and a cutting oil tank. These sumps, located along the east wall of former Building 2, and the surrounding soil were excavated in October 2000 by SAIC, but excavation of soil beneath Building 2 was not performed. The elevated ECD responses were confirmed by the responses of the XSD and PID. MIP point WB2COR-MP-025 located adjacent to the former waste sump locations had a moderate detection shown in orange.

In the soil immediately above the bedrock, the highest concentrations of CVOCs were detected in WB2COR-MP-001 where the ECD was at the maximum detection limit of 14,000,000 μ V from 23 feet bgs to refusal at 30 feet bgs. This MIP point was also located adjacent to the former waste water sumps and cutting oil tank. Elevated CVOC concentrations in this interval were confirmed by an elevated XSD response at 24 feet bgs and an elevated PID response at 26 feet bgs (refer to the MIP boring logs in **Appendix B**).

Cross sections A-A', B-B' and D-D' shown on **Figures 5 through 8** further illustrate the MIP detector responses in the subsurface. There is very minimal detection above 10 feet bgs in the MIPs. Detections below 10 feet bgs and above the water table are distinct in two areas – at the

north-central part of Bldg 2 near WB2COR-MP-013 and -MP-027, and immediately west of the former waste water sumps/cutting oil tank area near WB2COR-MP-002 and WB2COR-MP-003. Detections below the water table are generally highest where the bedrock surface is deepest at WB2COR-MP-004 west of the waste water sump area.

Laboratory results of the MIP confirmation sampling are listed in **Tables 4** and **5**. The soil sample results confirm the MIP data and show that the highest CVOC concentrations (TCE) occur at or above the water table near MIP points WB2COR-MP-013 and -MP-027 in the north central Bldg 2 area and below the water table near the bedrock surface near WB2COR-MP-002 located west of the waste water sump area. The TCE concentrations in soil at these borings range from 230 to 400 micrograms per kilogram (μ g/kg) which are below the Soil to Groundwater MSC for TCE of 500 μ g/kg.

MIP confirmatory groundwater samples from HD-WB2COR-SB-001-27/28-0 and HD-WB2COR-SB-001-27/28-0 contained TCE, PCE, cis-1,2-DCE, and 1,1-DCE exceeding applicable groundwater MSCs. Most notable is the TCE concentration of 1,900 μ g/l detected at HD-WB2COR-SB-001-27/28-0 which is the highest detection of a compound in the confirmatory samples. CVOC concentrations in groundwater equal to or exceeding 1% of the solubility of a particular compound is often used as an indication of a DNAPL source. One percent of the solubility of TCE is 14,000 μ g/l. Therefore, even the highest detected concentration does not indicate that this sample contains DNAPL or is a primary source of CVOCs.

As shown by the pie diagrams on **Figure 3**, the individual chemicals detected in the confirmatory soil and groundwater samples are the same chemicals as historically have been detected in nearby groundwater samples; however, cis-1,2-DCE was detected at proportionally higher concentrations in the MIP confirmatory groundwater samples than in historical samples. Cis-1,2-DCE is a transformation product produced during the breakdown of TCE.

4 INTERPRETATION AND CONCLUSIONS

Results of each activity associated with the source area investigation were used to draw conclusions about the existence and locations of shallow sources of contamination in the Bldg 58 and the WBldg2 Corridor areas and are described in the following subsections. Data from the upper five feet of sampling were considered unreliable for source area interpretation because utility preclearing included the vacuum excavation and removal of soil at each boring to a depth of approximately five feet. Following utility inspection, the soil was placed back into the hole for later access by the MIP investigation crew. MIP sampling from five feet and below was considered to be from undisturbed sediments and was considered to be useable data.

4.1 Bldg 58 Area

The drilling of the four new shallow bedrock wells and installation of the MIP points provide evidence that a bedrock depression exists beneath an area northwest of the Bldg 58 pad. Groundwater level measurements indicate that the pumping influence at CW-8 has directed shallow groundwater flow in an elongated trough between former buildings 58 and 59, roughly coinciding with the location of the bedrock depression. Historical groundwater samples contain elevated CVOC concentrations from the wells located within the area of the bedrock depression and the groundwater trough and the laboratory results from new shallow bedrock well MW-127, located on the southern slope of the bedrock depression / groundwater trough, are similar to the historical detections. Individual chemical concentrations are elevated in these wells, but the concentrations are not at or approaching 1% of the solubility values of the compounds, indicating a DNAPL source is not proximal to these wells. Groundwater from the new shallow wells installed to the east, north, and northwest of the trough contain lower concentrations of the CVOCs. Higher concentrations in groundwater in the trough and on the south side of the trough.

The ratios of TCE to the other chemicals is similar in wells MW-126, -127, -128, -113, -138A, -87, and -57, suggesting a common source. It is interesting to note that the concentration of cis-1,2-DCE (200 μ g/l) in MW-129 is proportionally higher than the other chemicals when compared to other wells in the area (see the pie diagrams on **Figure 3**).

Based on the slope of the top of bedrock and the relative concentrations of TCE in the wells surrounding this area, a case could be made for a single source originating point to the southeast of MW-113, in the northeast quadrant of the Bldg58 slab. Another possibility would be two or more source originating points immediately over the trough between Bldg 58, Bldg 59 and Bldg 66. These theories guided the placement of some of the MIP points.

MIP points did not detect a shallow source of CVOCs. Five MIP points and one confirmatory soil sample were located in positions surrounding well MW-127 because that was the shallow well with the highest TCE concentration and a similar ratio of CVOCs to the wells in the trough (excluding the low concentrations of TCA in the trough wells). None of the MIP points had significant responses that would indicate the presence of elevated CVOCs. CVOCs were undetected in the MIP confirmatory soil sample, and TCE ($4.5 \mu g/l$) was detected below the MSC in the MIP groundwater confirmatory sample, BLDG58-SB-001, located at the northeastern part of the Bldg 58 pad.

A shallow area of high concentrations that would indicate the source area of CVOCs in groundwater in wells MW-80, MW-87, and MW-113, was not located by the MIP sampling. The location of a point where the source material entered the subsurface was not identified by the MIP points that profiled the overburden, particularly the soil/bedrock interface in this area of the Site.

4.2 WBldg2 Corridor Area

Apparent shallow groundwater flow patterns (based on groundwater elevation contours) and distribution of individual chemicals across the WBldg2 Corridor area suggest that there are, or have been, three discrete sources of CVOCs in this area of the Site, including: west of Bldg 2; the north central portion of the Bldg 2 pad; and east of Bldg 2, near the former waste water sumps.

4.2.1 West of Bldg 2

Detection of PCE in the groundwater in the area west of Bldg 2 suggests that sometime in the past, a release occurred nearby. Pie diagrams on **Figure 3** show that PCE was only detected west of the Building 2 pad, but not detected beneath the Building 2 pad area, either in the new shallow wells or in the confirmatory MIP sample. PCE concentrations were higher in groundwater samples from the northern part of the WBldg2 Corridor (MW-27, MW-114, MW-140A) indicating that a release

occurred west or northwest of the Building 2 pad area, or within the northwestern corner of the former Building, certainly west of MW-131. MIP points WB2COR-MP-10, -MP-12, -MP-29, and - MP-034 were located in this area, but were unsuccessful in detecting a concentrated zone of CVOCs.

4.2.2 North Central Portion of the Bldg 2 Pad

The highest TCE concentrations from the new shallow bedrock wells were detected at MW-131 and MW-132 in the north central portion of the Building 2 pad. Therefore, MIP sampling locations were concentrated near these wells to attempt to locate the source. MIP point WB2COR-MP-027 contained the most elevated concentrations in the shallow soil which could indicate that a release of CVOCs may have occurred nearby. However, only moderate responses exhibited by the XSD and PID suggest that the area of -MP- 027 is not a source itself. Confirmatory soil samples collected in WB2COR-SB-002, which was located approximately two feet to the southeast, contained up to 400 µg/kg of TCE at a depth of 17 feet, but this is below the PADEP Soil to Groundwater MSC of 500 µg/kg, and therefore does not represent a significant source. Nine MIP points were placed within a radius of 110 feet surrounding MP-027/SB-002, but MIP responses in the unsaturated zone were lower than at WB2COR-MP-027, suggesting that the source of the high concentrations of CVOCs is not currently present in this area of the Site.

4.2.3 East of Bldg 2 Near Former Waste Water Sumps

MIP points were placed west of the area of the former waste water sumps and cutting oil tank through the Bldg 2 slab. There were elevated detection responses in several of the MIP points adjacent to the sump/tank, but the highest detections were below the water table (below 20 feet bgs), mostly near the bedrock surface. The MIP confirmatory groundwater sample in this area contained 1,900 μ g/l of TCE and the corresponding soil sample contained 230 μ g/kg of TCE. Although these are elevated concentrations, the groundwater detection is not suggestive of DNAPL or a significant source, and the soil detection is less that the PADEP Soil to Groundwater MSC.

Previous soil samples collected by SAIC (Supplemental Remedial Investigations Soils Report, SAIC, December 2009) slightly west of the former sumps / tank contained CVOC concentrations greater than or equal to the MSCs. One MIP point (WB2COR-MP-025) was located in the area

where SAIC collected samples. Bedrock was shallow at the MIP point (17 feet) and the moderate ECD concentration response of 10,000,000 μ V did not suggest the presence of high concentrations of CVOCs in this MIP location. Therefore, this investigation was not able to pinpoint a specific DNAPL source area in the area where the sumps/tank had been excavated.

5 RECOMMENDATIONS

Data acquired during the source area investigations at the WBldg2 Corridor and Bldg 58 areas indicate that DNAPL sources were not identified in the shallow subsurface or below the water table. The investigation demonstrated that the methodology would have the ability to identify such a source area, but an area of elevated concentrations in the unsaturated zone either does not exist, or is of limited size. No further investigations are recommended at this time at the Bldg 58 area, west of Building 2, or in the northern portion of the Building 2 pad. CVOCs in the shallow groundwater in these areas are being captured by the groundwater treatment system and CVOC concentrations detected in soil samples in these areas were below the MSCs.

The MIP sampling did not provide data that enabled a source to be pinpointed at the sump/tank area east of Building 2 pad. The historic detection of CVOC concentrations in soil samples collected prior to January 2007 (SAIC, December 2009) at or above MSCs in this area, and the lack of confirmation during this study indicates that the area of CVOCs at concentrations greater than the MSCs is very limited. Thus, no additional investigation is warranted in this area. As long as the building slab remains in place, risks from soil contact in this area are mitigated.

6 REFERENCES

- SAIC, December 2009, Supplemental Remedial Investigations Soil Report Former York Naval Ordnance Plant.
- GSC, September 2011. Supplemental Remedial Investigation Groundwater Report (Part 1) Former York Ordnance Plant.
- GSC, April 2012. Field Sampling Plan for Part 2 of the Supplemental Groundwater Investigation.
- GSC, June 2012. Quality Assurance Project Plan Former York Naval Ordnance Plant.

Table 1Groundwater Elevation DataSource Area InvestigationFormer York Naval Ordnance Plant - York, PA

		Reference		
		Elevation	DTW to	Water Level
Well ID	Date	(ft. AMSL)	Groundwater	(ft. AMSL)
CW-8	8/6/2012	362.70	17.00	345.70
CW-15	7/2/2012	361.48	18.22	343.26
CW-15	8/6/2012	361.48	19.16	342.32
CW-15A	7/2/2012	361.40	25.49	335.91
CW-15A	8/6/2012	361.40	31.02	330.38
CW-16	8/6/2012	364.60	18.24	346.36
CW-18	8/6/2012	364.72	22.04	342.68
MW-27	6/28/2012	361.29	17.48	343.81
MW-27	7/2/2012	361.29	17.50	343.79
MW-27	8/6/2012	361.29	15.03	346.26
MW-28	8/6/2012	362.91	17.11	345.80
MW-32D	8/6/2012	362.57	17.09	345.48
MW-32S	8/6/2012	362.44	16.64	345.80
MW-34D	8/6/2012	361.00	15.41	345.59
MW-34S	8/6/2012	361.00	15.33	345.67
MW-35D	7/2/2012	360.60	18.49	342.11
MW-35D	8/6/2012	360.60	14.84	345.76
MW-35S	7/2/2012	2012 360.49 18.0		342.42
MW-35S	8/6/2012	360.49	14.72	345.77
MW-43D	8/6/2012	380.08	32.66	347.42
MW-43S	8/6/2012	379.76	32.41	347.35
MW-45	7/2/2012	359.91	17.49	342.42
MW-45	8/6/2012	359.91	14.30	345.61
MW-46	7/2/2012	359.19	17.33	341.86
MW-46	8/6/2012	359.19	13.79	345.40
MW-47	7/2/2012	360.57	19.09	341.48
MW-47	8/6/2012	360.57	16.77	343.80
MW-49D	7/2/2012	361.44	17.76	343.68
MW-49S	7/2/2012	361.45	17.84	343.61
MW-54	7/2/2012	365.26	23.16	342.10
MW-54	8/6/2012	365.26	18.12	347.14
MW-55	7/2/2012	365.22	23.03	342.19
MW-55	8/6/2012	365.22	16.25	348.97
MW-80	7/6/2012	370.29	25.60	344.69
MW-80	8/6/2012	370.29	24.02	346.27
MW-81D	6/28/2012	359.89	16.71	343.18
MW-81D	7/2/2012	359.89	16.73	343.16
MW-81S	6/28/2012	360.12	17.61	342.51
MW-81S	7/2/2012	360.12	17.44	342.68
MW-83	6/28/2012	363.69	25.32	338.37AN
MW-83	7/2/2012	363.69	9.15	354.54
MW-83	8/6/2012	363.69	9.89	353.80

Table 1Groundwater Elevation DataSource Area InvestigationFormer York Naval Ordnance Plant - York, PA

		Reference		,
		Elevation	DTW to	Water Level
Well ID	Date	(ft. AMSL)	Groundwater	(ft. AMSL)
MW-87	6/28/2012	370.64	25.87	344.77
MW-87	7/6/2012	370.64	25.86	344.78
MW-87	8/6/2012	370.64	23.55	347.09
MW-94	7/2/2012	365.03	9.77	355.26
MW-113	6/28/2012	371.02	26.11	344.91
MW-113	7/6/2012	371.02	25.90	345.12
MW-113	8/6/2012	371.02	23.66	347.36
MW-114	6/28/2012	360.71	17.40	343.31
MW-114	7/2/2012	360.71	17.52	343.19
MW-114	8/6/2012	360.71	15.04	345.67
MW-116	8/6/2012	364.59	12.23	352.36
MW-117	8/6/2012	365.19	10.20	354.99
MW-126	6/28/2012	371.42	25.71	345.71
MW-126	7/6/2012	371.42	27.14	344.28
MW-126	8/6/2012	371.42	23.71	347.71
MW-127	6/28/2012	371.55	26.33	345.22
MW-127	7/6/2012	371.55	26.85	344.70
MW-127	8/6/2012	371.55 24.42		347.13
MW-128	6/28/2012	370.58	25.54	345.04
MW-128	7/6/2012	370.58	25.88	344.70
MW-128	8/6/2012	370.58	23.59	346.99
MW-129	6/28/2012	365.41	19.89	345.52
MW-129	7/6/2012	365.41	20.87	344.54
MW-129	8/6/2012	365.41	19.12	346.29
MW-130	6/28/2012	362.15	19.61	342.54
MW-130	7/2/2012	362.15	19.52	342.63
MW-130	8/6/2012	362.15	15.79	346.36
MW-131	6/28/2012	365.35	21.61	343.74
MW-131	7/2/2012	365.35	21.56	343.79
MW-131	8/6/2012	365.35	19.04	346.31
MW-132	6/28/2012	365.30	21.29	344.01
MW-132	7/2/2012	365.30	21.26	344.04
MW-132	8/6/2012	365.30	18.42	346.88
MW-133	6/28/2012	365.31	21.23	344.08
MW-133	7/2/2012	365.31	21.22	344.09
MW-133	8/6/2012	365.31	17.99	347.32
MW-134	6/28/2012	361.21	17.60	343.61
MW-134	7/2/2012	361.21	17.59	343.62
MW-134	8/6/2012	361.21	15.02	346.19
MW-135	6/28/2012	361.57	17.93	343.64
MW-135	7/2/2012	361.57	17.97	343.60
MW-135	8/6/2012	361.57	15.41	346.16

Location/ID	MSC	MSC	Federal	EPA RSL	MW-126	MW-127	MW-128	MW-128 Dup	MW-129	MW-130	MW-131	MW-132	MW-133
Sample Date	Used Aquifer R	Used Aquifer NR	MCL	Tap Water	7/6/2012	7/6/2012	7/6/2012	7/6/2012	7/6/2012	7/2/2012	7/5/2012	7/5/2012	7/5/2012
Parameter	(ug/L)	(ug/L)	(ug/L)	(ug/L)									
1,4-Dioxane		•	•	•	•		•			•	•	•	
1,4-Dioxane	6.4	32		0.67	1.9 U	24	8.8		5.3	13	14	60	0.95 J
Cyanide, Free		•	•		•					•		•	
Cyanide, Free	200	200	200	730	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Cyanide, Total		•	•		•					•		•	
Cyanide, Total	200	200		730	1.6 J	10 U	10 U	10 U	10 U	1.9 J	1.8 J	10 U	10 U
METAL		•	•		•					•		•	
Antimony	6	6	6	15	0.45 J	0.16 J	0.072 J	0.056 J	0.14 J	0.12 J B	0.38 J B	0.44 J B	0.24 J B
Arsenic	10	10	10	0.045	0.39 J ^	0.72 J ^	0.43 J ^	1 U	2.4 ^	1 U	1 U	1 U	1 U
Barium	2000	2000	2000	7300	40	14	20	20	68	80	53	31	55
Beryllium	4	4	4	73	0.045 J	0.048 J	1 U	1 U	0.071 J	1 U	0.058 J	0.05 J	1 U
Cadmium	5	5	5		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	5	5	5	18	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chromium	100	100	100		1.1 J	1.5 J	1.2 J	1.4 J	2	6.8	1.9 J	1.6 J	2.4
Copper	1000	1000	1300	1500	1.2 J	1.1 J	0.92 J	0.84 J	1.3 J	0.98 J	1.9 J	1.4 J	1.5 J
Hexavalent Chromium	100	100		0.043	4.6 J	3.3 J	10 U	10 U	4.6 J	3.93 J	4.57 J	5.8 J	3.9 J
Lead	5	5	15		0.054 J	0.1 J	0.1 J	1.8	0.69 J	0.13 J B	0.3 J	0.055 J	0.13 J
Mercury	2	2	2	0.57	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	100	100		730	0.54 J	0.33 J	1 U	1 U	1.6	0.53 J	2.3	0.71 J	0.86 J
Selenium	50	50	50	180	1.1 J B	1.5 J B	1.5 J B	1.3 J B	2.2 J B	5 U	5 U	5 U	5 U
Silver	100	100		180	1 U	1 U	1 U	1 U	1 U	1 U	0.048 J	0.037 J	1 U
Thallium	2	2	2		0.39 J	0.075 J	0.068 J	0.049 J	0.067 J	0.053 J B	0.32 J B	0.33 J B	0.12 J B
Vanadium	260	720		2.6	0.12 J	1 U	1 U	1 U	0.4 J	9.1 B	1 U	1 U	0.27 J
Zinc	2000	2000		11000	5.3	4.7 J	5.8	3.7 J	5.3	1.6 J	3.7 J B	5.8 B	5.4 B
METAL (Dissolved)													
Antimony	6	6	6	15	0.58 J B	0.23 J B	0.14 J B	0.073 J B	0.14 J B	2 U	0.38 J B	0.38 J B	0.19 J B
Arsenic	10	10	10	0.045	0.62 J B ^	0.55 J B ^	0.51 J B ^	0.64 J B ^	1.7 B ^	1 U	1 U	1 U	1 U
Barium	2000	2000	2000	7300	41	13	19	20	65	82	49	28	51
Beryllium	4	4	4	73	0.039 J	1 U	0.041 J	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	5	5	5	18	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	5	5	5		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chromium	100	100	100		1 J	1.2 J	1.4 J	1.1 J	0.89 J	1.9 J	1.5 J	1.4 J	2
Copper	1000	1000	1300	1500	1.1 J	0.77 J	0.86 J	0.74 J	0.69 J	2.1 B	1.9 J	1.3 J	1.5 J
Hexavalent Chromium	100	100		0.043	10 U	10 U	10 U	10 U	10 U	10 U	3.3 J	10 U	3.29 J
Lead	5	5	15		0.12 J	0.025 J	0.047 J	0.028 J	0.021 J	0.019 J B	0.16 J B	0.083 J B	0.097 J B
Mercury	2	2	2	0.57	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	100	100		730	0.59 J	1 U	1 U	1 U	0.87 J	0.46 J	1.7	0.75 J	0.81 J
Selenium	50	50	50	180	3.2 J B	2.9 J B	5 U	2.7 J B	0.65 J B	5 U	5 U	5 U	5 U
Silver	100	100		180	1 U	1 U	1 U	1 U	1 U	1 U	0.038 J	1 U	1 U
Thallium	2	2	2		0.5 J	0.082 J	0.067 J	0.045 J	0.06 J	0.029 J	0.35 J	0.31 J	0.12 J
Vanadium	260	720		2.6	0.35 J	1 U	1 U	1 U	1 U	1 U	1 U	0.41 J	0.59 J
Zinc	2000	2000		11000	3.1 J	4.9 J	3.5 J	1.8 J	5.2	3.8 J B	3.7 J	4.6 J	5.6

Location/ID	MSC	MSC	Federal	EPA RSL	MW-126	MW-127	MW-128	MW-128 Dup	MW-129	MW-130	MW-131	MW-132	MW-133
Sample Date	Used Aquifer R	Used Aquifer NR	MCL	Tap Water	7/6/2012	7/6/2012	7/6/2012	7/6/2012	7/6/2012	7/2/2012	7/5/2012	7/5/2012	7/5/2012
Parameter	(ug/L)	(ug/L)	(ug/L)	(ug/L)									
Semi Volatile Organic Compound		•											
1,2,4-Trichlorobenzene	70	70	70	2.3	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
1,2-Dichlorobenzene	600	600	600	370	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
1,3-Dichlorobenzene	600	600			9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
1,4-Dichlorobenzene	75	75	75	0.43	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
2,4,5-Trichlorophenol	3700	10000		3700	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
2,4,6-Trichlorophenol	37	100		6.1	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
2,4-Dichlorophenol	20	20		110	1.9 U	1.9 U	1.9 U		1.9 U				
2,4-Dimethylphenol	730	2000		730	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
2,4-Dinitrophenol	73	200		73	48 U	48 U	48 U		48 U	49 U	48 U	48 U	49 U
2,4-Dinitrotoluene	2.1	8.4		0.22	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
2,6-Dinitrotoluene	37	100		37	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
2-Chloronaphthalene	2900	8200		2900	1.9 U	1.9 U	1.9 U		1.9 U				
2-Chlorophenol	40	40		180	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
2-Methylnaphthalene	150	410		150	1.9 U	1.9 U	1.9 U		1.9 U				
2-Methylphenol	1800	5100		1800	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
2-Nitroaniline	110	310		370	48 U	48 U	48 U		48 U	49 U	48 U	48 U	49 U
2-Nitrophenol	290	820			9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
3,3'-Dichlorobenzidine	1.5	5.8		0.15	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
3/4-Methylphenol				180	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
3-Nitroaniline	11	31			48 U	48 U	48 U		48 U	49 U	48 U	48 U	49 U
4,6-Dinitro-2-Methylphenol	3.7	10		2.9	48 U	48 U	48 U		48 U	49 U	48 U	48 U	49 U
4-Bromophenyl phenyl ether					9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
4-Chloro-3-Methyl-Phenol	180	510		3700	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
4-Chloroaniline	3.3	13		0.34	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
4-Chlorodiphenyl Ether					9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
4-Nitroaniline	33	130		3.4	48 U	48 U	48 U		48 U	49 U	48 U	48 U	49 U
4-Nitrophenol	60	60			48 U	48 U	48 U		48 U	49 U	48 U	48 U	49 U
Acenaphthene	2200	3800		2200	1.9 U	1.9 U	1.9 U		1.9 U				
Acenaphthylene	2200	6100		2200	1.9 U	1.9 U	1.9 U		1.9 U				
Anthracene	66	66		11000	1.9 U	1.9 U	1.9 U		1.9 U				
Benzo (A) Anthracene	0.29	3.6	0.2	0.029	1.9 U	1.9 U	1.9 U		1.9 U				
Benzo (a) Pyrene	0.2	0.2	0.2	0.0029	1.9 U	1.9 U	1.9 U		1.9 U				
Benzo (b) Fluoranthene	0.29	1.2		0.029	1.9 U	1.90	1.9 U		1.9 U				
Benzo (g,h,i) Perylene	0.26	0.26			1.90	1.90	1.90		1.90	1.90	1.90	1.90	1.90
Benzo (K) Fluoranthene	0.55	0.55		0.29	1.90	1.90	1.90		1.90	1.90	1.90	1.90	1.90
Bis(2-Chloroetnoxy) Methane	110	310		110	9.60	9.6 0	9.6 0		9.6 0	9.70	9.6 0	9.6 0	9.70
Bis(2-Chloroethyl) Ether	0.15	0.76		0.012	1.90	1.90	1.90		1.90	1.90	1.90	1.90	1.90
Dis(2-Chloroisopropyi) Ether	300	300	6	0.32	1.9 U	1.90	1.90		1.9 0	1.90	1.90	1.9 0	1.90
Bis(2-Ethylnexyl) Phthalate	5	6	6	4.8	19.0	19.0	19.0		19.0	19.0	19.0	19.0	190
Carbazolo	350	1400		35	9.60	9.60	9.60		9.6 0	9.70	9.6 U	9.6 U	9.70
Christian	33	130		2.0	1.90	1.90	1.90		1.90	1.90	1.90	1.90	1.90
Dibonzo (2 b) Anthracono	1.9	1.9		2.9	1.90	1.90	1.90		1.90	1.90	1.90	1.90	1.90
Dibenzofuran	0.029	0.30		0.0029	1.90	1.90	1.90		1.90	1.90	1.90	1.90	1.90
Disthylphthalata	20000	2000		37	9.00	9.00	9.00		9.00	9.70	9.00	9.00	9.70
Dietriyipiitiiaiate	29000	82000		29000	9.00	9.00	9.00		9.00	9.70	9.00	9.00	9.70

Location/ID	MSC	MSC	Federal	EPA RSL	MW-126	MW-127	MW-128	MW-128 Dup	MW-129	MW-130	MW-131	MW-132	MW-133
Sample Date	Used Aquifer R	Used Aquifer NR	MCL	Tap Water	7/6/2012	7/6/2012	7/6/2012	7/6/2012	7/6/2012	7/2/2012	7/5/2012	7/5/2012	7/5/2012
Parameter	(ug/L)	(ug/L)	(ug/L)	(ug/L)									
Dimethylphthalate					9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
Di-n-Butylphthalate	3700	10000		3700	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
Di-n-octylphthalate	1500	3000			9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
Fluoranthene	260	260		1500	1.9 U	1.9 U	1.9 U		1.9 U				
Fluorene	1500	1900		1500	1.9 U	1.9 U	1.9 U		1.9 U				
Hexachlorobenzene	1	1	1	0.042	1.9 U	1.9 U	1.9 U		1.9 U				
Hexachlorobutadiene	8.5	33		0.86	1.9 U	1.9 U	1.9 U		1.9 U				
Hexachlorocyclopentadiene	50	50	50	220	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
Hexachloroethane	1	1		4.8	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
Indeno (1,2,3-cd) Pyrene	0.29	3.6		0.029	1.9 U	1.9 U	1.9 U		1.9 U				
Isophorone	100	100		71	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
Naphthalene	100	100		0.14	1.9 U	1.9 U	1.9 U		1.9 U				
Nitrobenzene	73	200		0.12	19 U	19 U	19 U		19 U				
N-Nitrosodi-N-Propylamine	0.094	0.37		0.0096	1.9 U	1.9 U	1.9 U		1.9 U				
N-Nitrosodiphenylamine	130	530		14	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
Pentachlorophenol	1	1	1	0.17	9.6 U	9.6 U	9.6 U		9.6 U	9.7 U	9.6 U	9.6 U	9.7 U
Phenanthrene	1100	1100			1.9 U	1.9 U	1.9 U		1.9 U				
Phenol	2000	2000		11000	1.9 U	1.9 U	1.9 U		1.9 U				
Pyrene	130	130		1100	1.9 U	1.9 U	1.9 U		1.9 U				

Location/ID	MSC	MSC	Federal	EPA RSL	MW-126	MW-127	MW-128	MW-128 Dup	MW-129	MW-130	MW-131	MW-132	MW-133
Sample Date	Used Aquifer R	Used Aquifer NR	MCL	Tap Water	7/6/2012	7/6/2012	7/6/2012	7/6/2012	7/6/2012	7/2/2012	7/5/2012	7/5/2012	7/5/2012
Parameter	(ug/L)	(ug/L)	(ug/L)	(ug/L)	.,.,	.,.,	.,.,=	.,.,	.,.,	.,_,	.,.,	.,.,	.,.,
TOTAL VOC	(-0/-/	(-8/-/	(-8/-/	(*8/ -/				1					
					7.3	1870	669	730	296.8	2120	5200	7812	39.82
Volatile Organic Compound													
1,1,1,2-Tetrachloroethane	70	70		0.52	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
1,1,1-Trichloroethane	200	200	200	9100	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
1,1,2,2-Tetrachloroethane	0.84	4.3		0.067	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
1,1,2-Trichloroethane	5	5	5	0.24	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
1,1-Dichloroethane	31	160		2.4	1 U	50 U	25 U	25 U	10 U	100 U	250 U	92 J	0.27 J
1,1-Dichloroethene	7	7	7	340	1 U	30 J	14 J	12 J	5.7 J	41 J	250 U	160 J	1.2
1,2-Dibromoethane	0.05	0.05	0.05	0.0065	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
1,2-Dichloroethane	5	5	5	0.15	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
1,2-Dichloropropane	5	5	5	0.39	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
1,4-Dioxane	6.4	32		0.67	200 U	10000 U	5000 U	5000 U	2000 U	20000 U	50000 U	50000 U	200 U
2-Butanone	4000	4000		7100	5 U	250 U	130 U	130 U	50 U	500 U	1300 U	1300 U	5 U
2-Hexanone	11	44		47	5 U	250 U	130 U	130 U	50 U	500 U	1300 U	1300 U	5 U
4-Methyl-2-Pentanone	2900	8200		2000	5 U	250 U	130 U	130 U	50 U	500 U	1300 U	1300 U	5 U
Acetone	33000	92000		22000	5 U	250 U	130 U	130 U	50 U	500 U	1300 U	1300 U	5 U
Acrylonitrile	0.72	3.7		0.045	20 U	1000 U	500 U	500 U	200 U	2000 U	5000 U	5000 U	20 U
Benzene	5	5	5	0.41	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Bromochloromethane	90	90			1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Bromodichloromethane	80	80		0.12	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Bromoform	80	80		8.5	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Bromomethane	10	10		8.7	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Carbon Disulfide	1500	6200		1000	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Carbon Tetrachloride	5	5	5	0.44	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Chlorobenzene	100	100	100	91	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Chlorodibromomethane	80	80		0.15	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Chloroethane	230	900		21000	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Chloroform	80	80		0.19	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	0.2 J
Chloromethane	30	30		190	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
cis-1,2-Dichloroethene	70	70	70	73	2.6	590	210	240	200	690	1100	3600	11
cis-1,3-Dichloropropene	6.6	26		0.43	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Ethylbenzene	700	700	700	1.5	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Methyl tert-butyl ether	20	20		12	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Methylene chloride	5	5		4.8	1 U	17 J B	14 J B	13 J B	5.1 J B	64 J B	100 J B	160 J B	1 U
Styrene	100	100	100	1600	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Tetrachloroethene	5	5	5	0.11	0.2 J	33 J	11 J	15 J	10 U	25 J	250 U	250 U	0.15 J
Toluene	1000	1000	1000	2300	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
trans-1,2-Dichloroethene	100	100	100	110	1 U	50 U	25 U	25 U	19	100 U	250 U	250 U	1 U
trans-1,3-Dichloropropene	6.6	26		0.43	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Trichloroethene	5	5	5	2	4.5	1200	420	450	67	1300	4000	3800	27
Vinyl Chloride	2	2	2	0.016	1 U	50 U	25 U	25 U	10 U	100 U	250 U	250 U	1 U
Xylenes (Total)	10000	10000	10000	200	3 U	150 U	75 U	75 U	30 U	300 U	750 U	750 U	3 U

Location/ID	MSC	MSC	Federal	EPA RSL	MW-134	MW-135
Sample Date	Used Aquifer R	Used Aquifer NR	MCL	Tap Water	7/5/2012	7/2/2012
Parameter	(ug/L)	(ug/L)	(ug/L)	(ug/L)		
1,4-Dioxane		•		•	•	
1,4-Dioxane	6.4	32		0.67	57	10
Cyanide, Free						
Cyanide, Free	200	200	200	730	2 U	2 U
Cyanide, Total						
Cyanide, Total	200	200		730	10	10 U
METAL						
Antimony	6	6	6	15	0.24 J B	0.063 J B
Arsenic	10	10	10	0.045	1 U	0.52 J B
Barium	2000	2000	2000	7300	56	66
Beryllium	4	4	4	73	1 U	1 U
Cadmium	5	5	5		1 U	1 U
Cadmium	5	5	5	18	1 U	1 U
Chromium	100	100	100		1.5 J	6.5
Copper	1000	1000	1300	1500	1.2 J	1.2 J
Hexavalent Chromium	100	100		0.043	5.2 J	12
Lead	5	5	15		0.064 J	0.041 J B
Mercury	2	2	2	0.57	0.2 U	0.2 U
Nickel	100	100		730	1	6.6
Selenium	50	50	50	180	5 U	5 U
Silver	100	100		180	1 U	0.04 J
Thallium	2	2	2		0.11 J B	0.04 J B
Vanadium	260	720		2.6	1 U	9 B
Zinc	2000	2000		11000	2.5 J B	1.6 J
METAL (Dissolved)						
Antimony	6	6	6	15	0.15 J B	2 U
Arsenic	10	10	10	0.045	1 U	1 U
Barium	2000	2000	2000	7300	55	71
Beryllium	4	4	4	73	1 U	1 U
Cadmium	5	5	5	18	1 U	1 U
Cadmium	5	5	5		1 U	1 U
Chromium	100	100	100		2.2	2
Copper	1000	1000	1300	1500	1.5 J	2.5 B
Hexavalent Chromium	100	100		0.043	5.8 J	10 U
Lead	5	5	15		0.047 J B	0.034 J B
Mercury	2	2	2	0.57	0.2 U	0.2 U
Nickel	100	100		730	0.92 J	8
Selenium	50	50	50	180	5 U	5 U
Silver	100	100		180	1 U	0.054 J
Thallium	2	2	2		0.088 J	0.037 J
Vanadium	260	720		2.6	0.45 J	1 U
Zinc	2000	2000		11000	4 J	6.2 B

Location/ID	MSC	MSC	Federal	EPA RSL	MW-134	MW-135
Sample Date	Used Aquifer R	Used Aquifer NR	MCL	Tap Water	7/5/2012	7/2/2012
Parameter	(ug/L)	(ug/L)	(ug/L)	(ug/L)		
Semi Volatile Organic Compound						
1,2,4-Trichlorobenzene	70	70	70	2.3	9.6 U	9.6 U
1,2-Dichlorobenzene	600	600	600	370	9.6 U	9.6 U
1,3-Dichlorobenzene	600	600			9.6 U	9.6 U
1,4-Dichlorobenzene	75	75	75	0.43	9.6 U	9.6 U
2,4,5-Trichlorophenol	3700	10000		3700	9.6 U	9.6 U
2,4,6-Trichlorophenol	37	100		6.1	9.6 U	9.6 U
2,4-Dichlorophenol	20	20		110	1.9 U	1.9 U
2,4-Dimethylphenol	730	2000		730	9.6 U	9.6 U
2,4-Dinitrophenol	73	200		73	48 U	48 U
2,4-Dinitrotoluene	2.1	8.4		0.22	9.6 U	9.6 U
2,6-Dinitrotoluene	37	100		37	9.6 U	9.6 U
2-Chloronaphthalene	2900	8200		2900	1.9 U	1.9 U
2-Chlorophenol	40	40		180	9.6 U	9.6 U
2-Methylnaphthalene	150	410		150	1.9 U	1.9 U
2-Methylphenol	1800	5100		1800	9.6 U	9.6 U
2-Nitroaniline	110	310		370	48 U	48 U
2-Nitrophenol	290	820			9.6 U	9.6 U
3,3'-Dichlorobenzidine	1.5	5.8		0.15	9.6 U	9.6 U
3/4-Methylphenol				180	9.6 U	9.6 U
3-Nitroaniline	11	31			48 U	48 U
4,6-Dinitro-2-Methylphenol	3.7	10		2.9	48 U	48 U
4-Bromophenyl phenyl ether					9.6 U	9.6 U
4-Chloro-3-Methyl-Phenol	180	510		3700	9.6 U	9.6 U
4-Chloroaniline	3.3	13		0.34	9.6 U	9.6 U
4-Chlorodiphenyl Ether					9.6 U	9.6 U
4-Nitroaniline	33	130		3.4	48 U	48 U
4-Nitrophenol	60	60			48 U	48 U
Acenaphthene	2200	3800		2200	1.9 U	1.9 U
Acenaphthylene	2200	6100		2200	1.9 U	1.9 U
Anthracene	66	66		11000	1.9 U	1.9 U
Benzo (A) Anthracene	0.29	3.6	0.2	0.029	1.9 U	1.9 U
Benzo (a) Pyrene	0.2	0.2	0.2	0.0029	1.9 U	1.9 U
Benzo (b) Fluoranthene	0.29	1.2		0.029	1.9 U	1.9 U
Benzo (g,h,i) Perylene	0.26	0.26			1.9 U	1.9 U
Benzo (k) Fluoranthene	0.55	0.55		0.29	1.9 U	1.9 U
Bis(2-Chloroethoxy) Methane	110	310		110	9.6 U	9.6 U
Bis(2-Chloroethyl) Ether	0.15	0.76		0.012	1.9 U	1.9 U
Bis(2-Chloroisopropyl) Ether	300	300		0.32	1.9 U	1.9 U
Bis(2-Ethylhexyl) Phthalate	6	6	6	4.8	19 U	19 U
Butylbenzylphthalate	350	1400		35	9.6 U	9.6 U
Carbazole	33	130			1.9 U	1.9 U
Chrysene	1.9	1.9		2.9	1.9 U	1.9 U
Dibenzo (a,h) Anthracene	0.029	0.36		0.0029	1.9 U	1.9 U
Dibenzofuran	37	100		37	9.6 U	9.6 U
Diethylphthalate	29000	82000		29000	9.6 U	9.6 U

Location/ID	MSC	MSC	Federal	EPA RSL	MW-134	MW-135
Sample Date	Used Aquifer R	Used Aquifer NR	MCL	Tap Water	7/5/2012	7/2/2012
Parameter	(ug/L)	(ug/L)	(ug/L)	(ug/L)		
Dimethylphthalate					9.6 U	9.6 U
Di-n-Butylphthalate	3700	10000		3700	9.6 U	9.6 U
Di-n-octylphthalate	1500	3000			9.6 U	9.6 U
Fluoranthene	260	260		1500	1.9 U	1.9 U
Fluorene	1500	1900		1500	1.9 U	1.9 U
Hexachlorobenzene	1	1	1	0.042	1.9 U	1.9 U
Hexachlorobutadiene	8.5	33		0.86	1.9 U	1.9 U
Hexachlorocyclopentadiene	50	50	50	220	9.6 U	9.6 U
Hexachloroethane	1	1		4.8	9.6 U	9.6 U
Indeno (1,2,3-cd) Pyrene	0.29	3.6		0.029	1.9 U	1.9 U
Isophorone	100	100		71	9.6 U	9.6 U
Naphthalene	100	100		0.14	1.9 U	1.9 U
Nitrobenzene	73	200		0.12	19 U	19 U
N-Nitrosodi-N-Propylamine	0.094	0.37		0.0096	1.9 U	1.9 U
N-Nitrosodiphenylamine	130	530		14	9.6 U	9.6 U
Pentachlorophenol	1	1	1	0.17	9.6 U	9.6 U
Phenanthrene	1100	1100			1.9 U	1.9 U
Phenol	2000	2000		11000	1.9 U	1.9 U
Pyrene	130	130		1100	1.9 U	1.9 U

Location/ID	MSC	MSC	Federal	EPA RSL	MW-134	MW-135
Sample Date	Used Aquifer R	Used Aquifer NR	MCL	Tap Water	7/5/2012	7/2/2012
Parameter	(ug/L)	(ug/L)	(ug/L)	(ug/L)		
TOTAL VOC			•	•		
					956	1613.4
Volatile Organic Compound						
1,1,1,2-Tetrachloroethane	70	70		0.52	25 U	40 U
1,1,1-Trichloroethane	200	200	200	9100	25 U	40 U
1,1,2,2-Tetrachloroethane	0.84	4.3		0.067	25 U	40 U
1,1,2-Trichloroethane	5	5	5	0.24	25 U	40 U
1,1-Dichloroethane	31	160		2.4	25 U	9.4 J
1,1-Dichloroethene	7	7	7	340	9 J	17 J
1,2-Dibromoethane	0.05	0.05	0.05	0.0065	25 U	40 U
1,2-Dichloroethane	5	5	5	0.15	25 U	40 U
1,2-Dichloropropane	5	5	5	0.39	25 U	40 U
1,4-Dioxane	6.4	32		0.67	5000 U	8000 U
2-Butanone	4000	4000		7100	130 U	200 U
2-Hexanone	11	44		47	130 U	200 U
4-Methyl-2-Pentanone	2900	8200		2000	130 U	200 U
Acetone	33000	92000		22000	130 U	200 U
Acrylonitrile	0.72	3.7		0.045	500 U	800 U
Benzene	5	5	5	0.41	25 U	40 U
Bromochloromethane	90	90			25 U	40 U
Bromodichloromethane	80	80		0.12	25 U	40 U
Bromoform	80	80		8.5	25 U	40 U
Bromomethane	10	10		8.7	25 U	40 U
Carbon Disulfide	1500	6200		1000	25 U	40 U
Carbon Tetrachloride	5	5	5	0.44	25 U	40 U
Chlorobenzene	100	100	100	91	25 U	40 U
Chlorodibromomethane	80	80		0.15	25 U	40 U
Chloroethane	230	900		21000	25 U	40 U
Chloroform	80	80		0.19	25 U	40 U
Chloromethane	30	30		190	25 U	40 U
cis-1,2-Dichloroethene	70	70	70	73	270	730
cis-1,3-Dichloropropene	6.6	26		0.43	25 U	40 U
Ethylbenzene	700	700	700	1.5	25 U	40 U
Methyl tert-butyl ether	20	20		12	25 U	40 U
Methylene chloride	5	5		4.8	16 J B	27 J B
Styrene	100	100	100	1600	25 U	40 U
Tetrachloroethene	5	5	5	0.11	41	420
Toluene	1000	1000	1000	2300	25 U	40 U
trans-1,2-Dichloroethene	100	100	100	110	25 U	40 U
trans-1,3-Dichloropropene	6.6	26		0.43	25 U	40 U
Trichloroethene	5	5	5	2	620	410
Vinyl Chloride	2	2	2	0.016	25 U	40 U
Xylenes (Total)	10000	10000	10000	200	75 U	120 U

MSC = Medium Specific Concentration R = Residential NR = Non-Residential MCL = Maximum Contaminant Level RSL = Regional Screening Level Concentrations are expressed in micrograms per liter (ug/l)

TABLE 3 MIP Confirmatory Sample Correlation Source Area Investigation Former York Naval Ordnance Plant - York, PA

			Total VOC	Corresponding	MIP Response	MIP Response
Sample ID	Sample Depth (ft)	Matrix	Conc. (ug/l or ug/kg)	MIP Point	Conc. (uV) - XSD	Conc. (uV) - ECD
HD-BDG58-SB-01-10/11-0	10-11	Soil	ND	MP-003	NSR	NSR
HD-BDG58-SB-01-30/31-0	30-31	GW	13	MP-003	NSR	NSR
HD-BDG58-SB-01-30/31-0	30-31	Soil	ND	MP-003	NSR	NSR
HD-WB2COR-SB-01-27/28-0	27-28	Soil	246	MP-001	440,000	15,500,000
HD-WB2COR-SB-01-27/28-0	27-28	GW	2,060	MP-001	440,000	15,500,000
HD-WB2COR-SB-02-11/12-0	11-12	Soil	382	MP-027	290,000	14,000,000
HD-WB2COR-SB-02-16/17-0	16-17	Soil	403	MP-027	290,000	14,000,000
HD-WB2COR-SB-03-9/10-0	9-10	Soil	ND	MP-020	NSR	14,000,000
HD-WB2COR-SB-03-22-0	22	GW	964*	MP-020	NSR	NSR
HD-WB2COR-SB-04-20.5/20.5-0	20.5	Soil	ND	MP-019	NSR	NSR

Notes:

* Contains 7.2 ug/l of PCE (the only sample where PCE was detected); elevated VOC concentrations detected at adjacent well MW-130.

uV - microvolts

ug/l - micrograms per liter

ug/kg - micrograms per kilogram

XSD - halogen-specific detector

ECD - electron capture detector; most sensitive detector, but it does not pick up cis-1,2-DCE or vinyl chloride

ND - Not Detected

NSR - No Significant Response

Groundwater samples are highlighted in blue.

Samples were collected August 15 and 16, 2012.

TABLE 4 Groundwater Data Summary - 2012 - MIP Confirmation Sampling Source Area Investigation Former York Naval Ordnance Plant - York, PA

Location/ID Depth (ft.) Sample Date	MSC	MSC	Federal	EPA RSL	BDG58-SB-001 30 - 31 8/16/2012	Trip Blank	Trip Blank	WB2COR-SB-001 27 - 28 8/15/2012	WB2COR-SB-003 22 8/15/2012
Parameter	(ug/L)	(ug/L)	(ug/L)	(ug/L)	0, 10, 1011	0, 10, 1011	0, 10, 1011	0, 10, 1011	0, 10, 1011
TOTAL VOC	(*8/=/	(~8/ -/	(*8/=/	(~8/ -/					·J
					53.52	0.71	0.89	2078	971.4
Volatile Organic Compound									
1,1,1,2-Tetrachloroethane	70	70		0.52	1 U	1 U	1 U	50 U	25 U
1,1,1-Trichloroethane	200	200	200	9100	1 U	1 U	1 U	50 U	25 U
1,1,2,2-Tetrachloroethane	0.84	4.3		0.067	1 U	1 U	1 U	50 U	25 U
1,1,2-Trichloroethane	5	5	5	0.24	1 U	1 U	1 U	50 U	25 U
1,1-Dichloroethane	31	160		2.4	1 U	1 U	1 U	50 U	10 J
1,1-Dichloroethene	7	7	7	340	1 U	1 U	1 U	40 J	22 J
1,2-Dibromoethane	0.05	0.05	0.05	0.0065	1 U	1 U	1 U	50 U	25 U
1,2-Dichloroethane	5	5	5	0.15	1 U	1 U	1 U	50 U	25 U
1,2-Dichloropropane	5	5	5	0.39	1 U	1 U	1 U	50 U	25 U
1,4-Dioxane	6.4	32		0.67	200 U	200 U	200 U	10000 U	5000 U
2-Butanone	4000	4000		7100	5.5	5 U	5 U	250 U	130 U
2-Hexanone	11	44		47	0.48 J	5 U	5 U	250 U	130 U
4-Methyl-2-Pentanone	2900	8200		2000	0.94 J	5 U	5 U	250 U	130 U
Acetone	33000	92000		22000	41	5 U	5 U	250 U	130 U
Acrylonitrile	0.72	3.7		0.045	20 U	20 U	20 U	1000 U	500 U
Benzene	5	5	5	0.41	1 U	1 U	1 U	50 U	25 U
Bromochloromethane	90	90		0.40	10	10	10	50 U	25 U
Bromodichloromethane	80	80		0.12	10	10	10	50 0	25 0
Bromotorm	80	80		8.5	10	10	10	50 0	25.0
Bromometnane	10	10		8./	10	10	10	50 0	25 0
Carbon Disulfide	1500	6200	-	1000	1.1	10	10	50 0	25.0
	5	5	5	0.44	10	10	10	50 0	25 0
Chlorodibromomothano	80	100	100	91	10	10	10	50 U	25.0
Chloroothana	220	900		21000	10	10	10	50 U	25.0
Chloroform	80	80		0.19	10	111	10	50 U	25.0
Chloromethane	30	30		190	10	111	10	50 U	25.0
cis-1 2-Dichloroethene	70	70	70	73	10	10	10	120	340
cis-1,3-Dichloropropene	6.6	26	70	0.43	10	10	10	50 U	25 U
Ethylbenzene	700	700	700	15	10	10	10	50 U	25 0
Methyl tert-butyl ether	20	20		12	10	10	10	50 U	25 U
Methylene chloride	5	5		4.8	1 U	0.71 J	0.89 J B	18 J	7.5 J
Styrene	100	100	100	1600	1 U	1 U	1 U	50 U	25 U
Tetrachloroethene	5	5	5	0.11	1 U	1 U	1 U	50 U	7.2 J
Toluene	1000	1000	1000	2300	1 U	1 U	1 U	50 U	25 U
trans-1,2-Dichloroethene	100	100	100	110	1 U	1 U	1 U	50 U	4.7 J
trans-1,3-Dichloropropene	6.6	26		0.43	1 U	1 U	1 U	50 U	25 U
Trichloroethene	5	5	5	2	4.5	1 U	1 U	1900	580
Vinyl Chloride	2	2	2	0.016	1 U	1 U	1 U	50 U	25 U
Xylenes (Total)	10000	10000	10000	200	3 U	3 U	3 U	150 U	75 U

TABLE 4 - Additional Notes Groundwater Data Summary Source Area Investigation Former York Naval Ordnance Plant – York, PA

MSC = Medium Specific Concentration R = Residential NR = Non-Residential MCL = Maximum Contaminant Level RSL = Regional Screening Level Concentrations are expressed in micrograms per liter (ug/l)

TABLE 5 Soils Data Summary - MIP Soil Confirmation Sampling Source Area Investigation Former York Naval Ordnance Plant - York, PA

Location/ID	MSC	MSC	MSC	EPA RSL	BDG58-SB-001	BDG58-SB-001	WB2COR-SB-001	WB2COR-SB-002	WB2COR-SB-002	WB2COR-SB-003	WB2COR-SB-004
Depth (ft.)	Soil to GW	Direct Contact	Direct Contact	Industrial	10	30 - 31	27 - 28	11 - 12	16 - 17	9 - 10	20.5 - 20.5
Sample Date	Used Aquifer	0 - 2 ft	2 - 15 ft	Soil	8/16/2012	8/16/2012	8/15/2012	8/16/2012	8/16/2012	8/15/2012	8/15/2012
Parameter	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)							
Volatile Organic Compound							•				
1,1,1,2-Tetrachloroethane	18	300	340	9.3	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
1,1,1-Trichloroethane	20	10000	10000	38000	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
1,1,2,2-Tetrachloroethane	0.43	38	44	2.8	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
1,1,2-Trichloroethane	0.5	140	160	5.3	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
1,1-Dichloroethane	16	1400	1600	17	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
1,1-Dichloroethene	0.7	10000	10000	1100	0.0066 U	0.0062 U	0.004 J	0.0082 U	0.0092 U	0.018 U	0.01 U
1,2-Dibromoethane	0.005	3.7	4.3	0.17	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
1,2-Dichloroethane	0.5	86	98	2.2	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
1,2-Dichloropropane	0.5	220	260	4.5	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
1,4-Dioxane	3.2	290	330	17	1.3 U	1.2 U	2.8 U	1.6 U	1.8 U	3.6 U	2.1 U
2-Butanone	400	10000	10000	200000	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
2-Hexanone	4.4	400	460	1400	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
4-Methyl-2-Pentanone	820	10000	10000	53000	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Acetone	9200			630000	0.026 U	0.025 U	0.057 U	0.033 U	0.037 U	0.073 U	0.042 U
Acrylonitrile	0.37			1.2	0.13 U	0.12 U	0.28 U	0.16 U	0.18 U	0.36 U	0.21 U
Benzene	0.5			5.4	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Bromochloromethane	9	10000	10000		0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Bromodichloromethane	8	60	69	1.4	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Bromoform	8	2000	2300	220	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Bromomethane	1	400	460	32	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Carbon Disulfide	620	10000	10000	3700	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Carbon Tetrachloride	0.5	150	170	3	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Chlorobenzene	10	4000	4600	1400	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Chlorodibromomethane	8	82	95	3.3	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Chloroethane	90	10000	10000	61000	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Chloroform	8	97	110	1.5	0.0066 U	0.0062 U	0.014 U	0.009	0.0062 J	0.018 U	0.01 U
Chloromethane	3	1200	1400	500	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
cis-1,2-Dichloroethene	7	10000	10000	2000	0.0066 U	0.0062 U	0.012 J	0.0017 J	0.0033 J	0.018 U	0.01 U
cis-1,3-Dichloropropene	2.6	560	640	8.1	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Ethylbenzene	70	10000	10000	27	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Methyl tert-butyl ether	2	8600	9900	220	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Methylene chloride	0.5	4700	5400	53	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Styrene	24	10000	10000	36000	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Tetrachloroethene	0.5	1500	4400	2.6	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Toluene	100	10000	10000	45000	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
trans-1,2-Dichloroethene	10	4800	5500	690	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
trans-1,3-Dichloropropene	2.6	560	640	8.1	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Trichloroethene	0.5	1300	1500	14	0.0066 U	0.0062 U	0.23	0.38	0.4	0.018 U	0.01 U
Vinyl Chloride	0.2	110	580	1.7	0.0066 U	0.0062 U	0.014 U	0.0082 U	0.0092 U	0.018 U	0.01 U
Xylenes (Total)	1000	8000	9100	2700	0.02 U	0.019 U	0.042 U	0.025 U	0.027 U	0.055 U	0.031 U

TABLE 5 - Additional Notes Groundwater Data Summary Source Area Investigation Former York Naval Ordnance Plant – York, PA

MSC = Medium Specific Concentration R = Residential NR = Non-Residential MCL = Maximum Contaminant Level RSL = Regional Screening Level Concentrations are expressed in milligrams per kilogram (mg/kg)







Q:\10000\10012\Projects\2012 Source Area Report\Final\FIG_3_Source_area_20121119.mxd

Q:\10000\10012\Projects\2012 Source Area Report\Final\FIG_4_MIP_ECD_20121119.mxd

Appendix A

WELL LOGS

*Appendix A is in portable document format (PDF) on the compact disc (CD) in the front pocket of this binder.

Appendix B GPR SURVEY REPORT (SAIC 2012)

*Appendix B is in portable document format (PDF) on the compact disc (CD) in the front pocket of this binder.

Appendix C

MIP RESPONSE TEST DATA – VIRONEX

*Appendix C is in portable document format (PDF) on the compact disc (CD) in the front pocket of this binder.

Appendix D MIP SAMPLING DATA – VIRONEX

*Appendix D is in portable document format (PDF) on the compact disc (CD) in the front pocket of this binder.