PROJECT INVESTIGATION REPORT
FOR THE
NOCKAMIXON TCE SITE
NOCKAMIXON TOWNSHIP
BUCKS COUNTY, PENNSYLVANIA

PADEP Requisition Number GTAC5-1 ·222

Leidos Project 301576. TM.020115

Prepared for:

Pen ısylva ıia Department of Environ ıental Protection
Southeast Regional Office
2 East Main Street
Norristown, PA 19401

March 2014

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1.0 INTRODUCTION AND BACKGROUND

1.1 Project Introduction

The Pennsylvania Department of Environmental Protection (PADEP) Bureau of Environmental Cleanup and Brownfields (ECB) Hazardous Sites Cleanup Act (HSCA) Division requested that Leidos Engineering, LLC (Leidos), formerly SAIC, assist with a site investigation to determine the origin of chlorinated organic compounds, primarily trichloroethylene (TCE), in groundwater in private potable water wells in Nockamixon Township, Pennsylvania, under the General Technical Assistance Contract (GTAC) SAP #4000013588 and requisition number GTAC5-1-222. The PADEP requested assistance by Leidos in a letter dated December 10, 2009. A general Site Location Map is provided as **Figure 1**.

Chlorinated organic impacts to groundwater are present at numerous properties along and in close proximity to Easton Road (Route 611), Durham Road (Route 412), and Mountainview Drive (Route 563) in Nockamixon Township (Site Area). Affected properties consist of businesses and residential properties along Easton and Durham Roads and scattered residential properties along Tower Road, Mountainview Drive, Cord Way, Brennan Road, Brennan Drive, and Park Drive West. **Figure 2** depicts the Site Area, parcel boundaries, and associated land use/zoning. A public water supply system does not exist in the Site Area.

1.2 Project Background

Chlorinated organic impacts, primarily TCE, were initially detected in the late 1980s during routine monitoring of the water supply at Przyuski's Family Restaurant (now MOO restaurant) at 4010 Durham Road by the Bucks County Health Department (BCHD). Subsequent sampling of private wells in the area by BCHD in 2002 identified the presence of TCE in numerous wells at concentrations as high as 27 micrograms per liter (µg/L). PADEP resumed the private well sampling in October 2009 and identified TCE at levels as high as 47 µg/L and exceeding the United States Environmental Protection Agency (USEPA) Drinking Water Maximum Contaminant Levels (MCLs) at the following six residential properties:

- Stanzione – 133 Tower Road
- Watson – 135 Tower Road

- Grieger – 149 Tower Road
- Loubris – 4051 Durham Road
- Baumhauer – 8329 Easton Road
- Sado – 282 Park Drive West

A Baseline Water Quality Monitoring study was conducted in the area by Princeton Hydro, LLC in the fall of 2009 for the Lower Delaware River Wild and Scenic Management Committee in advance of regional Marcellus Shale gas exploration. This study also identified TCE impacts to groundwater in the vicinity of the Site Area.

The PADEP reported that known environmental sites in the area include the Revere Chemical Superfund Site, the former Bickel Landfill, Cabot Metals, the Fleck Site, and the Nockamixon Township Route 563 Drum Site. In addition, a gas station previously existed at the intersection of Durham Road and Mountainview Drive along with a vacant car dealership property present at the intersection of Easton Road and Durham Road. **Figure 2** depicts the locations of these properties.

1.3 Project Work Scope Evolution

To initiate the scope of work, Leidos attended a project scoping meeting on January 8, 2010, at PADEP's offices in Norristown, Pennsylvania, to review available information and determine the project objectives. Following the scoping meeting, Leidos prepared a work plan and pricing to perform the initial phase of the work (Work Plan – Nockamixon TCE Site). The final work plan was submitted to the PADEP on March 16, 2010. The work scope tasks included relieving the PADEP of providing bottled water to the six affected residents identified above in **Section 1.2**, obtaining and reviewing historical information for properties in the area, conducting regulatory file reviews on known environmental sites in the area, completing a well search using the Pennsylvania Department of Conservation and Natural Resources (DCNR) Pennsylvania Groundwater Information System (PaGWIS) in an effort to obtain well construction and geologic/hydrogeologic details, accompanying PADEP personnel during the April 2010 private well sampling event to accurately locate the private wells using a sub-meter Global Positioning System (GPS), assembling private well chemistry results, and preparing a project report documenting all work completed. Leidos prepared a Draft Preliminary

Investigation Report in July 2010 that documented the findings of the initial work scope. The report was never finalized and has been incorporated into this Project Investigation Report.

A second project scoping meeting between the PADEP and Leidos project personnel occurred on April 5, 2011, to discuss the installation of bedrock groundwater monitoring wells and other project work scope items. The PADEP requested the installation of as many as eight bedrock monitoring well pairs to further investigate suspected sources (Nockamixon Township Route 563 Drum Site, Revere Chemical Waste Site, Quarry Equipment Maintenance Facility) and/or fill in data gaps. Additional work scope items included obtaining geologic structure and hydrogeologic data from other investigations at nearby properties, the preparation of pricing to install carbon filter systems (as many as 20) at residential properties, and the preparation of contaminant distribution figures for a public meeting to be held in May 2011. Leidos submitted a Phase 2 Work Scope (Change Order 3 Work Scope) to address these additional work scope items on May 17, 2011.

Leidos began providing bottled water to the six affected residents identified above in **Section 1.2** in February 2010. Thirteen additional residences were added to the water delivery schedule from May 2010 through June 2011 due to elevated detections of TCE in samples collected from potable wells at those locations. The delivery of bottled water was discontinued upon installation of carbon filter systems at the properties throughout the second half of 2011 and early 2012. TCE had also been identified at a concentration exceeding the MCL in the potable well water at St John the Baptist Catholic School on Durham Road. A carbon filtration system was already in place at the school; however, a carbon filter change-out was needed and provided on behalf of the PADEP.

A third project meeting between Leidos and PADEP project personnel occurred on January 18, 2012. The meeting was requested by the PADEP to discuss and reevaluate the strategy for installation of bedrock monitoring wells, which had not yet occurred. By this time, confirmed impacts to residential wells had expanded to the north and included additional properties along Mountainview Drive, Brennan Drive, Brennan Road, and Park Drive West. In lieu of well pairs, the PADEP requested the installation of deeper bedrock monitoring wells at 10 different locations to investigate multiple fracture zones representative of the fractures encountered by typical potable water wells in the area. The locations of the originally proposed wells were also reevaluated with respect to impacted potable wells and suspected source areas,

and new well locations were selected during the meeting. Borehole geophysics and straddle packer sampling of target zones within the monitoring wells was requested by the PADEP. Additionally, the PADEP requested that Leidos process the Environmental Covenants associated with the residential carbon filter systems with the Bucks County Recorder of Deeds. Revisions to the May 20, 2011 Phase 2 Work Plan were submitted to the PADEP on March 6, 2012.

The ten bedrock monitoring wells (MW-1 through MW-10) were installed in May 2012. Leidos then performed the borehole geophysics and straddle packer sampling on the wells in June and July 2012. The PADEP then requested the installation of nested well screens within the monitoring wells based on the results of the boring and geophysics logs and the straddle packer work. Leidos then prepared a Nested Well Screen Installation and Groundwater Sampling Work Plan that was submitted on November 12, 2012. The work plan proposed the methods and construction details for the installation of the nested well screens within the new monitoring wells, the performance of a professional survey update for the new well screen elevations, and two rounds of groundwater sampling at the monitoring wells.

Nested well screens were installed in selected wells as proposed in late 2012 and early 2013. Complications occurred during the installation of the screens at wells MW-1, MW-4, and MW-10. MW-4 was cleaned out and the screens were properly reinstalled. A new shallow bedrock well (MW-1S) was drilled adjacent to MW-1 to resolve the upper screen issue at that location. The issue within the shallow screen at MW-10 was not directly resolved but instead, another bedrock well (MW-11) was installed at a different location as requested by the PADEP.

The PADEP requested the installation of one additional bedrock monitoring well (MW-12) at a location farther to the north along Park Drive West. A Supplemental Phase 3 Work Plan was prepared by Leidos and submitted to the PADEP on April 30, 2013, for the completion of this work and related activities including borehole geophysics and straddle packer sampling at MW-12. Well installation and borehole geophysics work was completed in May 2013. Straddle packer sampling was conducted in June 2013 and nested well screens were installed in August 2013. Leidos conducted groundwater monitoring activities at the monitoring wells in January and September 2013. The PADEP sampled the wells again using passive diffusion bags in December 2013.

2.0 SITE SETTING

2.1 Setting and Land Use

The Site Area is located approximately 13 miles north of Doylestown along the Easton Road (Route 611), Durham Road (Route 412), and Mountainview Drive (Route 563) corridors in Ottsville, Nockamixon Township, Pennsylvania. Nockamixon State Park is located beyond the Site Area to the west. An aerial photograph depicting the Site Area and surrounding land is provided as **Figure 2**.

Land use along Easton and Durham Roads within the Site Area is primarily for commercial, residential, and community purposes. Commercial properties include a shopping center, contractor businesses, a vacant auto dealership, an active used car business, medical and veterinary offices, a day care, two restaurants, a creamery, and other commercial properties and offices. Residential use properties are also present along portions of Easton Road, Durham Road, Mountainview Drive, and Brennan Drive, and Park Drive West at the northern portions of the Site Area. Lands within the Site Area farther to the west are used almost exclusively for agricultural purposes with a smaller component of sporadic residential use properties adjacent to roadways. A church and school are also present along Durham Road within the central portion of the Site Area.

2.2 Topography, Surface Water, and Climate

The ground surface elevation across the majority of the Site Area is approximately 500 feet above mean sea level (MSL) according to United States Geological Survey (USGS) 1983 Digital Raster Graphic for the area. Western portions of the Site Area slope to the southwest toward Haycock Creek. The general topography in the region is characterized by lands sloping to the southeast (see **Figure 1**).

The nearest surface water bodies are Haycock Creek located immediately southwest of the Site Area and Rapp Creek and one of its unnamed tributaries located within 1,500 feet to the southeast, northeast, and east. Haycock Creek becomes Lake Nockamixon and discharges to Tohickon Creek. Rapp Creek flows into Tinicum Creek, and both the Tohickon and Tinicum

Creeks flow to the Delaware River. All businesses, farms, and residences within the Site Area obtain water from potable and/or irrigation supply wells.

The lands beyond the Site Area are or have been used for various purposes including quarrying, commercial, residential, and agricultural use, or are unused, wooded or vegetated lands.

2.3 Reported Geology and Hydrogeology

Soil at the Site Area consists of six or more soil types, the most predominant including the Croton silt loam and Amwell silt loam. Croton silt loam is classified as poorly drained soil originating from sandstone and shale. Amwell silt loam is defined as somewhat poorly drained soil originating from igneous, metamorphic, and sedimentary rock (United States Department of Agriculture [USDA] Web Soil Survey, May 20, 2010).

The bedrock underlying surface soil at the Site Area is mapped as Triassic or Jurassic aged Brunswick Formation consisting of reddish-brown shale, siltstone, and mudstone containing a few green and brown shale interbeds (Geologic Map of Pennsylvania, 1980). **Figure 3** depicts the local geology. The Brunswick Formation is part of the larger Newark Supergroup present within the Newark and Gettysburg Basins which is composed of several thousand meters of nonmarine (fluvial and lacustrine) sedimentary rocks and intrusive diabase flows (Smoot, 1999). The Brunswick Formation overlies the Lockatong Formation that is present nearby as shallow bedrock to the east and northeast of the Site Area where uplifting has occurred and the Brunswick Formation has been eroded away. The Lockatong Formation is characterized by dark gray to black, thick bedded argillite (mudstone, lithified mud) containing a few zones of thin bedded black shale. Depending on location, the Lockatong Formation may have thin layers of limestone and calcareous shale (Geologic Map of Pennsylvania, 1980 and Smoot, 1999). Diabase dikes and flows are prevalent within the Basin and occur relatively nearby to the northeast and west of the Site Area. Regional bedding strike is northeast-southwest, while bedding dip is to the north, northwest at low angles.

The local geology is expected to be dominated by the base of the Brunswick Formation characterized by red or dark gray argillite transitioning into the Lockatong Formation, the contact being arbitrarily placed where red mudstones predominate over gray (Smoot, 1999). This is

supported by aerial views of the Hanson Quarry on Tower Road that reveal gray to dark gray bedrock from near grade to a depth of what appears to be 100 or more feet below grade (fbg). Information presented in the Remedial Action Completion Report (RACR) for Donohue's Gulf, formerly located at the intersection of Durham Road and Mountainview Drive, indicates shallow, weathered bedrock consisting of blue-gray siltstone and limestone to be present below four fbg (see **Section 3.5**).

Greenman, in *Ground Water Resources of Bucks County, Pennsylvania*, reports "the lower beds of the Brunswick occur in sinuous bands which alternate with bands of the Lockatong. The Brunswick Formation is a sequence of monotonously similar, irregularly bedded soft red argillaceous shales locally interbedded with fine-grained red sandstone. The lower beds of the Brunswick in the zones of transition with the Lockatong include a considerable thickness of thick-bedded hard red argillite and occasional beds of tough gray shale. The argillite grades upward into typical soft red shale, and near the top of the formation there are rare recurrences of the more resistant Lockatong-type rocks. In general, the Brunswick conformably overlies the Lockatong, but the lower beds of the Brunswick extensively interfinger with an appreciable thickness of beds of the Lockatong."

The geologic structure of the Brunswick and Lockatong Formations in nearby Montgomery and Berks Counties is characterized by beds dipping gently to the north and northwest at an average angle of 20 degrees (Longwell, 1965). Joint systems are reportedly well developed in many beds of the Brunswick Formation. Reported joint sets are present striking N 30 E, N 45 W, and N 75 E, independent of the strike and dip of the beds. All joint sets are nearly vertical and the average distance between joints in most sets is six inches (Longwell, 1965). The movement of groundwater in fractured bedrock of the Gettysburg-Newark Lowland generally moves through and is stored in networks of narrow secondary openings, such as bedding planes and joints. Groundwater flow is reportedly complex, anisotropic, and heterogeneous. Horizontal permeability is much greater than vertical permeability and is greatest parallel to strike and lowest perpendicular to strike of the bedding planes (Low, 2002).

Greenman reports "The Brunswick contains water under both water table and semi-artesian conditions in the weathered zone of the formation, which may extend to a depth of 600 feet or more. A water table aquifer of low permeability, comprising the highly weathered zone of the formation, occurs to depth of about 250 feet; and one or more rather permeable artesian

aquifers, consisting of beds of partly altered rock rarely more than 20 feet thick, occur to depths of about 600 feet. In both types of aquifers, the saturated voids are believed to be vertical joint fractures enlarged by solution. The water table aquifer contains many more fractures than the semi-artesian aquifers, but the near-surface rocks have been so thoroughly decomposed that many cracks are filled with clay residual from the weathering of shale. Most wells in the Brunswick tap both the water table and artesian aquifers, and their yields are derived in part from both sources." Additional information provided by Greenman for 52 Brunswick Formation wells indicates that yields range between 2 and 260 gallons per minute (gpm), the average being 40 gpm.

Greenman reports that the capacity of the Lockatong Formation to transmit water is low, occurring by fracture and solution porosity where it has been faulted and jointed and exposed to the forces of weathering. Additional information provided by Greenman for 43 wells tapping the Lockatong indicates that yields range from 2 to 25 gpm and average 10 gpm.

Median values of hydraulic conductivity and transmissivity for the Brunswick Formation from analysis of single-well aquifer tests are 1.3 feet per day (ft/day) and 350 square feet per day (ft^2/day), respectively, while median values of hydraulic conductivity and transmissivity for the Lockatong Formation from analysis of single-well aquifer tests are 0.78 ft/day and 81 ft^2/day, respectively (Low, 2002).

The published geologic and hydrologic information presented above suggests private water wells within and nearby the Site Area are most likely drawing groundwater from multiple aquifers within the Brunswick and Lockatong Formations, under both water table and semi-artesian conditions. Groundwater storage and movement is primarily by secondary openings including bedding planes and joints and tends to be anisotropic and heterogeneous. Horizontal permeability is much greater than vertical permeability and is greatest parallel to strike or in the orientation of most major joint systems (northeast to southwest).

3.0 HISTORICAL INFORMATION

A land use evaluation consisting of obtaining and reviewing historical aerial photographs, topographic maps, an environmental database radius report, and city directory abstract search was conducted for the Site Area and surrounding land. The historical materials were obtained from Environmental Data Resources, Inc. (EDR) of Milford, Connecticut. EDR reported that no historical Sanborn® fire insurance maps are available for the area. Additional aerial photographs were obtained from the Pennsylvania Geological Survey Penn Pilot Photo Center. Review of available files for environmental sites within and nearby the Site Area was also conducted at PADEP offices.

3.1 Historical Aerial Photographs

Historical aerial photographs were obtained for the Site Area and surrounding lands to evaluate historical land use in the area. The aerial photographs were available for years 1938, 1950, 1955, 1964, 1971, 1978, 1981, 1988, 1992, and 2005 at scales ranging between one inch equals 500 feet and one inch equals 1,000 feet. Additional aerial photographs were obtained for years 1938, 1958, and 1972 at a scale of one inch equals 1,000 feet from Penn Pilot Photo Center (source: USDA/Farm Service Industry). Copies of the aerial photographs are provided in **Appendix A**.

The early aerial photographs (1938, 1950, 1955, 1958, and 1964) depict the Site Area primarily as cultivated, agricultural land with farm buildings or unused, wooded land. Some residential properties are also visible along the major roadways. A building similar in size to the one that currently exists at the intersection of Durham Road and Mountainview Drive (formerly Donohue's Gulf, now OwowCow Creamery and an insurance agency) is present on the 1950 photograph. What is now St John the Baptist Catholic School along Durham Road appears sometime between 1958 and 1964. The car dealership building at the intersection of Easton and Durham Roads is present for the first time on the 1971 photograph. Activities at the Revere Chemical Waste Site and the Bickel Landfill are clearly visible on the 1972 photograph.

The aerial photographs indicate the area identified as the Nockamixon Township Route 563 Drum Site along Brennan Road and Brennan Drive is agricultural in use from 1938 until sometime between 1964 and 1971 at which time cultivation of the property has ceased and the

fields begin to become overgrown. Initial ground disturbances are visible at westerly portions of that area on the 1964 photograph. The ground disturbances have significantly increased to the north and east by the time of the 1971 photograph. Prior to this time, Brennan Road and Brennan Drive were connected as one road connecting Durham Road and Mountainview Drive with a sharp 90 degree bend at its interior along field boundaries. The bend in the road has changed to be more arced or rounded on the 1971 photograph and an access drive entering the interior portions of the site is clearly visible. Many visibly disturbed surface areas are visible along the access drive at the central portions of the site. A large disturbed area at the northwestern portion of the site is visible on the 1978 photograph and the previously disturbed areas are no longer visible. The resolution of the 1981 aerial photograph is poor; however there does seem to be a new area of disturbance at the site along the northern property boundary near the access drive entrance from Brennan Drive. Subsequent photographs depict increasing vegetation along Brennan Drive and it appears the bend connecting Brennan Road and Brennan Drive becomes overgrown and unused by 2005. A driveway to the residential property now identified as 77 Brennan Road and related residential structures are clearly visible on the 2005 photograph. This driveway was once part of the access drive to internal portions of the site discussed above.

The Mountainview Plaza shopping strip mall is visible on Mountainview Drive just west of the intersection with Durham Road in 1988. The plaza was destroyed by fire in March 2008 and remains vacant, except for a small shed used to sell and rent canoes. Other notable changes visible on the aerial photographs include the construction of the St John the Baptist Church next to the school on Durham Road sometime between 1992 and 2005 and the development of the Harrow Station Shopping Center along Easton Road in 2005 (previously cultivated agricultural fields).

The commercial land across Easton Road from the Harrow Station Shopping Center, now occupied by commercial businesses and Harrow Homes, was originally agricultural land occupied by farm-type structures and fields. The transformation of these properties to commercial use appears to have occurred in the 1980s.

3.2 Historical Topographic Maps

Topographic maps were obtained for the Riegelsville and Bedminster Quadrangles for all available map years including 1942, 1946, 1956, 1957, 1968, 1973, 1983, 1990, 1992, and 1997. Copies of the historic topographic maps are provided in **Appendix A**.

Historic topographic maps dated 1942 and 1946 for Riegelsville and Bedminster, respectively, indicate the Site Area is primarily used for agricultural and, to a lesser extent, residential purposes at all areas within and adjacent to the Site Area. There are no indications of significant commercial or industrial operations in the area. Structures are present at three corners (north, east, and south) of the intersection of Easton Road, Tower Road, and Quarry Road. Structures are also present at the intersection of Easton and Durham Roads and Durham Road and Mountainview Drive.

The next set of maps (1956/1957) does not illustrate any significant changes other than the addition of numerous small structures assumed to be houses or agricultural-related structures along Easton and Durham Roads. Three structures are now present at the east corner of the intersection of Easton and Quarry Roads, of which one new structure is elongated similar to a barn.

The 1968 maps again only show the addition of small structures assumed to be house- and agricultural-related structures along the main roads. St John the Baptist Catholic School is now present on Durham Road and the Revere Chemical site is present for the first time and consists of a series of round features of various sizes interpreted to be the lagoons (as many as nine) and a building.

The 1973 maps show no significant change from the 1968 maps. A lone 1983 map of the Bedminster Quadrangle does not present any noticeable changes. The 1990/1992 and 1997 sets of maps also do not present any new information.

3.3 Environmental Database Report

A radius report of state and federal database sites was obtained for the Site Area and surrounding lands. Over 80 different federal, state, and local databases were searched for sites

that could be potential sources of chlorinated organic compounds to the groundwater aquifer in the area. A half mile was added to the database search request resulting in databases being searched for sites a distance of 1.5 miles from the center of the Site Area. The individual databases and associated search distances are listed in the radius report. Additional physical setting information including topography, shallow soil data, and nearby water and gas wells is also included with the report. A copy of the radius report is provided in **Appendix A**.

Twelve different sites are identified within the specified search distances. Individual sites or database listing at a particular location are identified by number. Multiple sites or database listings at a single location are identified by a letter followed by a number specific to the database listing. Sites identified as "FINDS" (Facility Index System/Facility Registry System) are not included in the discussions. The FINDS database contains multiple USEPA databases used for indexing sites.

1 – Nockamixon TWP RTE 563 Site

This site is identified in the CERCLIS (Comprehensive Environmental Response, Compensation, and Liability Information System) database located at the center of the Site Area. The report describes the site as a former drum storage area less than one acre in size. The report also indicates two other storage areas were observed near the former storage area and that the Pennsylvania Department of Environmental Resources (PADER) conducted drum removal in 1980. A site inspection was conducted in March 1990 which resulted in a "No further Remedial Action planned" status for the site.

NPL – Revere Chemical Co.

This site is identified in National Priority List (NPL), CERCLIS, US ENG Controls (Engineering Controls Sites List), US INST Controls (Sites with Institutional Controls), CONSENT (Superfund Consent Decrees), and ROD (Records of Decisions) databases. This site is located approximately 0.5 to 1.0 mile to the east of the Site Area. The report indicates this site is currently on the Final NPL and was once operated as a metals reclamation facility where waste streams including chromic acid, copper sulfate, sulfuric acid, and ammonia were stored in numerous unlined earthen lagoons. Spray fields were used to dispose of liquids generated during the reclamation processes. The facility was forced to close in 1969. Subsequent investigation work identified the presence of metals and chlorinated organic compounds in shallow groundwater. Reportedly, deep groundwater was not impacted by operations at this

facility. Additional information regarding the Revere Chemical Waste Site is presented below in **Section 3.5**.

2 – OwowCow Creamery

This site is identified in the FINDS database and is not further discussed.

A3/A4 – St. John the Baptist Catholic School

This site is identified in the ICIS (Integrated Compliance Tracking System) database used to track USEPA Enforcement and Compliance information. The listing in the ICIS database is related to Toxic Substances Control Act (TSCA) asbestos activity.

5 – Country Drive In

This site is only identified in the FINDS database and is not discussed further.

6 – Suburban Ford, Inc.

The former Suburban Ford property at the intersection of Easton Road and Durham Road is within the Site Area and is identified in the RCRA-CESQG (Resource Conservation and Recovery Act-Conditionally Exempt Small Quantity Generator), FINDS, and Manifest databases. The site was registered as a CESQG of wastes including D001, D002, and F002 (includes both perchloroethylene [tetrachloroethene or PCE] and TCE). No violations are reported. The Manifest listing is related to a 1996 manifest associated with waste D039 – PCE.

B7 – Depaul Ford

The former Depaul Ford facility was located at the same property as Suburban Ford and is also identified in the RCRA-NonGen (Resource Conservation and Recovery Act-Non Generators), FINDS, and Manifest databases. The facility was a RCRA-Large Quantity Generator (LQG) from 1988 to 1996 and generated waste streams D001 (ignitable hazardous wastes), F002 (spent halogenated solvents including PCE and TCE), and F003 (spent non-halogenated solvents). No violations are reported. Manifest information provided in the report is associated with disposal of F003 wastes in 1988, 1989, and 1990.

B8 – Donohue's Gulf

The former Donohue's Gulf gas station site is located within the Site Area at the intersection of Mountainview Drive and Durham Road. This site is identified in the LUST (Leaking

Underground Storage Tank Site) database. The report indicates a release date of 1997 and current status of "Cleanup Completed." This site is the current location of a single-story building occupied by the OwowCow Creamery business and a vacant suite. The LUST case is related to the release of gasoline from the underground storage tank (UST) system formerly located at the site and removed in 1997. Monitoring and remedial activities were conducted for methyl tertiary-butyl ether (MTBE) from 1998 through 2007. Additional information regarding this site is provided below in **Section 3.5**.

9 – Harrow Station, LLC

This site is only identified in the FINDS database and is not discussed further. This site is the current location of the Harrow Station Shopping Center recently developed in 2005. The site was previously cultivated, agricultural land.

10 – AT&T Harrow

This site is located within the Site Area along Tower Road and is identified in the LUST database. This site is the location of a communications tower and associated equipment building. The report indicates the release of petroleum from a UST in 1989 and a current status of "Cleanup Completed." Additional information regarding the release is provided below in **Section 3.5**.

11 – K&J Autoworks

This site is located near the southeastern boundary of the Site Area and identified in the RCRA-SQG (Resource Conservation and Recovery Act-Small Quantity Generator) and FINDS databases. This site is the current location of Swamp's Auto Body automotive repair facility. The report indicates the generation and handling of small quantities of waste stream D001 (ignitable hazardous wastes). No violations found.

12 – Better Materials Ottsville Quarry

This site is located near the southeast boundary of the Site Area on Quarry Road and is the location of historical surface mining operations for stone products. The site is identified in the RCRA-CESQG and FINDS databases. The report indicates this facility has been a RCRA-CESQG since 2002. No other information is provided. Additional information obtained during review of PADEP files is provided below in **Section 3.5**.

3.4 City Directory Abstract Search

An abstract search of the Cole Criss-Cross Directory for available city directory data was conducted for years 1972, 1975, 1980, 1985, 1989, 1994, 2001, and 2007. A copy of the City Directory Abstract is provided in **Appendix A**. Leidos requested the following addresses be researched:

- 4018 Durham Road – currently Big Backyard preschool and Rakowsky Family Dentistry,
- 4105 Durham Road – currently OwowCow Creamery facility, formerly Donohue's Gulf,
- 8214 Easton Road – currently Swamp's Auto Body, formerly K&J Autoworks,
- 8244 Easton Road – currently Specialty Woods facility,
- 8260 Easton Road – former gas station at Easton and Tower Roads,
- 8305 Easton Road – currently Harrow Professional Center building (spa, realtor, Harrow Homes) and Harrow Homes storage yard,
- 8330 Easton Road – current location of Harrow Station Shopping Center,
- 8340 Easton Road – current real estate office,
- 8364 Easton Road – currently vacant commercial property, formerly Suburban Ford and Depaul Ford,
- 8410 Easton Road – currently vacant property, formerly Off The Wall Custom Cycle Harley-Davidson parts and outdoor home center,
- 2503 Mountainview Drive – currently Parkside Orchid Nursery and possibly a former machine shop, and
- 2540 Mountainview Drive – currently Nature's Way Canoe and Kayak, formerly Mountainview Plaza strip mall.

Listing information was not identified in directories for years 1972 through 1989 at any of the requested addresses. Listing information was identified for some locations in 1994 and 2001 and at all locations for 2007. The listing information is provided on pages 4 and 5 of the City Directory Abstract.

The only notable finding is that the Specialty Woods facility property located at 8244 Easton Road is identified as the Candlewic Company (candle making equipment and supplies) in 2001.

3.5 Regulatory File Review Information

Regulatory file reviews were conducted for known environmental sites within and nearby the Site Area. Leidos requested the review of PADEP files for sites including the following:

- Bickel Landfill,
- Fleck Site (Tower Road),
- Nockamixon Township Route 563 Drum Site,
- Suburban Ford/Depaul Ford (8364 Easton Road),
- Donohue's Gulf (4105 Durham Road),
- AT&T Harrow (92 Tower Road),
- K&J Autoworks/Swamp's Auto Body (8214 Easton Road),
- Parkside Orchid Nursery/Machine Shop (2503 Mountainview Drive),
- Better Materials Ottsville Quarry/Hanson Quarry (262 Quarry Road), and
- Cabot Metals/Cabot Performance Materials (Beaver Run Road).

Review of available files was conducted at PADEP offices in Norristown, Pennsylvania, on May 5, 2010, and June 8, 2010. Files for the Revere Chemical Waste Site were available for review online at the USEPA Region 3 website. Copies of selected file information are provided in **Appendix B**. The September 2011 Revere Chemical Superfund Site Five-Year Review Report is provided in **Appendix C**.

Bickel Landfill

Limited file information for the former Bickel Landfill site was available for review. File information contained a WRS Infrastructure and Environment, Inc. (WRS) June 2005 Work Plan to the PADEP to complete repair work related to undercutting of landfill materials by a stream. The work plan indicates the landfill was a pre-regulation landfill closed in the mid-1960s. Additional file information included WRS invoices to the PADEP dated 2005 through 2007 for work associated with repair of the landfill cap. No information regarding the quantities or types of wastes disposed at this site, or information related to investigation or characterization of the groundwater beneath the site was available in the PADEP files.

Fleck Site

File information for the Fleck site included various 2007 well permit application documents by Arbor Operating, LLC (Arbor Resources) to drill a gas production well at property owned by Frank Fleck located at 4415 Durham Road. The property is located directly adjacent and to the east of Durham Road near the intersection with Church Road. The files also contained a June 2007 Comprehensive Wetland Delineation Report prepared by Mellon Biological Services for Arbor Resources.

Nockamixon Township Route 563 Drum Site

File information provided by the PADEP for the Nockamixon Township Route 563 Drum Site included 1981 BCHD residential potable water well sample information and 1989/1990 site assessment and inspection reports by NUS Corporation Superfund Division (NUS) on behalf of the USEPA Hazardous Site Control Division. The NUS reports included a March 1989 Preliminary Assessment of the Nockamixon Township Route 563 site, a May 1989 Site Visit Summary Report for the Nockamixon Township Route 563 site, and a March 1990 Site Inspection of the Nockamixon Township Route 563 site. Copies of the file information are provided in **Appendix B**.

BCHD conducted sampling of residential wells in the area surrounding what was identified as the Nockamixon Township Route 563 site in 1981 as a response to an adjacent landowner (55 Brennan Road) complaint that high amounts of TCE had been detected in his well. The results of the home well sampling demonstrated that TCE contamination was detected in 11 home wells, 4 having TCE concentrations between 110 and 150 parts per billion (ppb). BCHD also collected one soil sample from an area within the site identified as a former drum storage area. TCE, PCE, and 1,1,1-trichloroethane (1,1,1-TCA) were detected at concentrations as high as 260 ppb in the soil sample. Several remaining drums, some leaking, were reported by BCHD to be present onsite. BCHD also reported paint-like substances and oil stains at the site and noted that the former drum storage area (approximately 20 feet in diameter) was devoid of vegetation. The BCHD documentation is included as Appendix A of the NUS Preliminary Assessment report discussed below.

The NUS March 22, 1989, Preliminary Assessment report for the Nockamixon Township Route 563 site documents preliminary assessment efforts associated with the subject site including review of historical information, research of geologic and hydrogeologic information for the area,

interviews, and a site visit. Ms. Roxanne Schulburger-Miller was identified as the owner of the site and was present during the NUS site visit on November 1, 1988 (also attended by the USEPA and the PADER). The area of focus during the preliminary assessment is a 1-acre area of land within a larger 10-acre wooded parcel formerly used for the storage of approximately 50 drums, many of which had reportedly leaked. The area of focus was located directly north and west of the bend in Brennan Road, adjacent to the 55 Brennan Road (Hall) property (see Figures 2.1, 2.2, and 2.3 of the Preliminary Assessment report). The previous owner of the property, William Schulburger, reportedly used the property for disposing of septic wastes and created a dump site for garbage at the site in the 1970s. An old foundation and stone walls of a building, still present today at the 55 Brennan Road property, serves as a nearby point of reference for the former drum storage area (located 175 yards to the east of the reported location of the former drum storage area). The report indicates removal of the drums occurred in early 1980 under supervision of the PADER. However, no file information documenting the removal activities could be found by NUS.

The NUS May 17, 1989, Site Visit Summary Report for Nockamixon Township Route 563 site documents site inspections conducted on April 12 and May 2, 1989, at the subject site. The actual scope of the site visits is poorly summarized in the report and unclear. It is indicated that Ms. Heidi Gawron (another daughter of William Schulburger) is the owner of the area of focus and that Ms. Roxanne Miller, Ms. Rosalice Uhl, and Mr. Larry Hall are adjacent property owners who were present during the inspections.

From figures provided in the report (Figures 1 and 2), it appears that the area of focus is the entrance to the 77 Brennan Road property (currently owned by Mr. John Coia) where some drums had previously been observed at the time of the November 1988 site visit. The report indicates that the drums had been recently removed and that stained soils and stressed vegetation were observed at the area of focus. Scrap metal and tires were also scattered around the area. Four shallow soil samples were collected at the area and five nearby home water wells were sampled. One or more chlorinated organic compounds were detected in three of the home well samples at concentrations as high as 160 ppb (TCE). Three of the four soil samples contained three chlorinated organic compounds (TCE, PCE, and 1,1,1-TCA) at levels as high as 44,000 ppb. The same soil samples also contained several semi-volatile organic compounds (SVOC) (pyrene and chrysene) and one soil sample contained polychlorinated biphenyls (PCBs) at a concentration of 5,200 ppb.

Leidos installed a monitoring well, MW-1, on April 30, 2012, in the same location as described in the NUS May 17, 1989, Site Visit Summary Report discussed above. Photoionization detector (PID) readings quickly escalated at 4 to 5 fbg to 340 ppm. A soil sample was collected from that interval and submitted to the PADEP Bureau of Laboratories (BOL) in Harrisburg, Pennsylvania, for analysis of volatile organic compounds (VOCs) by USEPA Method 8260C. The chlorinated organic compounds TCE, PCE, and 1,1,1-TCA were detected in the soil sample collected from MW-1. TCE was detected at a concentration of 5,140 ppb; PCE was detected at a concentration of 55,600 ppb; and 1,1,1-TCA was detected at a concentration of 2,340 ppb. Seven VOCs were also detected in the soil sample collected from MW-1, at levels as high as 3,360 ppb. Please see **Section 5.2** for further discussion regarding the soil sample collected from MW-1.

The NUS March 14, 1990 Site Inspection Report for Nockamixon Township Route 563 site re-documents the April 12 and May 2, 1989 site inspections at the former drum storage area at the Heidi Gawron (77 Brennan Road) property, and the soil and home well sampling activities that were also conducted. The report seems to confuse the reported BCHD information for the "former drum storage area" previously identified at the Roxanne Miller property farther to the west in the Preliminary Assessment with this other drum storage area at the Heidi Gowran property.

Leidos believes that what was referred to as the Nockamixon Township Route 563 site during the time of the NUS work was actually several different sites along Brennan Road that were at one time all part of a larger site used for the storage and/or disposal of mixed wastes by Mr. William Schulburger. Ground surface disturbances at these and other areas of the subject site are clearly visible on the 1971, 1978, and 1981 aerial photographs, discussed above in **Section 3.1**.

Suburban Ford/Depaul Ford

No PADEP file information was available for Suburban Ford, Depaul Ford, or 8364 Easton Road.

Donohue's Gulf

PADEP files for the Donohue's Gulf gas station that previously existed at the intersection of Durham Road and Mountainview Drive included various correspondence and documents

related to the closure of the UST system at that site and subsequent remedial activities and monitoring. The UST system was closed in August 1997 and included the removal of two 8,000-gallon steel gasoline USTs and associated equipment. Impacted soils were also removed and soil samples indicated adequate soil removal had been completed. A water sample of groundwater infiltrating into the excavation contained benzene and MTBE at levels above the applicable criteria. File information did not indicate whether automotive repair operations were conducted at the property or whether any other USTs had existed at the property (i.e., waste oil UST).

Subsequent investigation and remedial activities ensued and included the installation of monitoring wells and operation of a groundwater remediation system (pump and treat) beginning in August 1998 to address the impacts of a MTBE plume extending to the southeast and east. Quarterly monitoring was implemented. Nearby potable water wells were also sampled to determine if deeper groundwater was impacted with gasoline-related constituents. Supply well carbon treatment systems were installed at six nearby residences to address MTBE impacts. The groundwater remediation system was operated until November 2001. Individual temporary treatment systems were installed at 10 Brennan Road and 2526 Mountainview Drive to address persistent MTBE concentrations. The temporary treatment systems consisted of carbon vessels and additional plumbing that allowed continuous pumping of the wells and permitted discharge to the storm sewer. The site received closure and release of liability on September 17, 2007.

Concurrent with the MTBE investigation at offsite potable water wells, the presence of TCE, PCE, 1,1,1-TCA, and cis-1,2-dichloroethene (cis-1,2-DCE) were identified in wells at 2454 Mountainview Drive, 2526 Mountainview Drive, 2506 Mountainview Drive, and 10 Brennan Road at concentrations as high as 160 µg/L. It should be noted that these compounds were not detected in potable wells further to the east of the Donohue's Gulf site or at other adjacent properties suggesting a source in close proximity to the above residences, possibly the Nockamixon Township Route 563 Drum Site located 1,500 feet to the west along Brennan Road. What appeared to be a machine shop of some type was also observed during site reconnaissance activities to be located in close proximity to the affected properties at the location of the Parkside Orchid Nursery at 2503 Mountainview Drive.

AT&T Harrow

No PADEP file information was available for the AT&T Harrow communications tower property located at 92 Tower Road.

K&J Autoworks/Swamp's Auto Body

No PADEP file information was available for the K&J Autoworks, Swamp's Autobody, or 8214 Easton Road property.

Parkside Orchid Nursery/Machine Shop

No PADEP file information was available for the Parkside Orchid Nursery or 2503 Mountainview Drive property.

Better Materials Ottsville Quarry/Hanson Quarry

PADEP file information for Hanson Aggregates, Better Materials Ottsville Quarry, and Bucks County Crushed Stone included residual waste General Permit correspondence and renewal information related to the reuse of hot-mix asphalt plant baghouse fines and scrubber pond precipitates as soil additives or soil conditioners. This facility would be expected to maintain National Pollutant Discharge Elimination System (NPDES) permits associated with quarry dewatering operations however, no permit information was present in the provided files.

Cabot Metals/Cabot Performance Materials

Information in the PADEP files for Cabot Super Metals Corp, Cabot Performance Materials Corp, Cabot Berylco, Inc., and Penn Rare Metals Division of Kawecki Berylco Industries, Inc. included the following:

- relatively recent documents (2002-2004) related to the characterization of remaining onsite slag materials and PADEP approval to reuse the materials in specific industrial and commercial applications,
- NPDES permit discharge reports and correspondence (1994-2002),
- PADEP inspection reports (1987-2002),
- UST registration information related to a 1,000-gallon anhydrous ammonia UST installed in 1983, a 5,000-gallon sulfuric acid UST installed in 1978 and removed in 2001, a 10,000-gallon fuel oil UST installed in 1980, and a 500-gallon gasoline UST installed in 1968, and

- 1973 NPDES permit application for discharge of treated process waters to Rapp Creek and a 1981 NPDES permit transfer application to Cabot Berylco, Inc.

The file information indicates the facility manufactured columbium base master alloys by aluminothermic reduction of oxide and manufacture of cesium, rubidium, germanium metals and compounds by chemical leach reaction of ores. The most recent activities conducted at the plant included metal refining processes for the production of cesium, germanium, rubidium, tellurium, and niobium. The facility was active from 1973 through 2002 when the plant was shut down. The site is currently vacant and most equipment and buildings have been removed. No additional information regarding recent site characterization work was available in the provided files.

Online USEPA Region 3 information for the Cabot Performance Materials site indicates RCRA Corrective Action activities at the facility are being conducted under the direction of USEPA Region 3 with assistance from the State. The USEPA fact sheet also indicates no institutional controls are needed at this time. Leidos contacted Mr. Walter Payne, Project Manager and ECP Licensed Professional Geologist Manager of PADEP, to inquire about the current characterization status at the plant. Mr. Payne was unable to provide definitive information, but did indicate chlorinated organic compounds were not a contaminant of concern at the Cabot site.

Revere Chemical Waste Site

The complete Administrative Record for the Revere Chemical Waste Site (Superfund) is available online at the USEPA Region 3 website: (http://www.epa.gov/reg3hwmd/super/sites/PAD051395499/index.htm#Contacts). The Five Year Review Report prepared for the site in September 2011 was the third Five Year Review Report conducted. It indicates the site operated as a metals reclamation facility from 1963 to 1969 causing the release of VOCs to groundwater, the release of metals and organic contamination to soil, and the migration of metal contamination to two onsite tributaries to Rapp Creek. The 1993 ROD for Operable Unit One (OU1) addressed the remaining contaminated soil, solid wastes, and debris onsite and included long-term groundwater monitoring with institutional controls (capping a large portion of the site). The 1996 ROD for Operable Unit Two (OU2) addressed groundwater and the mercury contaminated stream sediments and required no further action for groundwater and stream corridor monitoring. OU1 construction was completed in 1998. Additional information regarding

site history, chronology of events, and remedial measures are provided in sections II, III, and IV of the Five Year Review Report in **Appendix C**.

The report indicates the groundwater monitoring program is designed to determine whether contamination in the shallow aquifer is migrating to the deep aquifer. Deep groundwater samples are analyzed for TCE, 1,2,4-trichlorobenzene, 1,2,3-trichlorobenzene, and bis(2-ethylhexyl)phthalate because they were historically detected in shallow groundwater. Only very low levels of 1,2,3-trichlorobenzene and bis(2-ethylhexyl)phthalate have been detected in several deep well samples since 1998. In the past four reports, 2005 through 2009, a full scan for VOCs was run on the groundwater samples, and the results indicated non-detect for all compounds. The report concludes "the data support the hypothesis of the conceptual site model that the natural barriers (low permeability geologic formation) as well as the remedy chosen for OU1 will prevent the migration of contaminants into the deeper aquifer. The report indicates ongoing maintenance and monitoring programs will continue to be implemented.

3.6 Additional Sites of Interest

Reconnaissance activities were conducted following the scoping meeting on January 8, 2010, and April 16, 2010, to investigate historical information findings and identify additional sites of interest. The Parkside Orchid Nursery and what appeared to be a machine shop located at 2503 Mountainview Drive is considered to be an additional site of interest based on the detections of chlorinated organic compounds as recently as 2007 (TCE up to 180 µg/L) in nearby private water wells during the site investigation and remedial work associated with the Donohue's Gulf gas station property. TCE and chlorinated organic compounds were not detected in private water wells closer to the Donohue's Gulf property, but were detected in the private water wells farther to the southwest at 2454 Mountainview Drive, 2526 Mountainview Drive, 2506 Mountainview Drive, and 10 Brennan Road. PCE, 1,1-dichloroethene (1,1-DCE), 1,1,1-TCA, and cis-1,2-DCE were also consistently detected in the private well samples.

A large metal frame building located on land to the northwest of the Hanson Quarry appears to be used for large quarry machinery maintenance activities. The exact nature of operations currently and formerly conducted at this property are unknown, but are suspected to involve maintenance and repair work on heavy machinery. Also present at this property are old out-of-service quarry dump trucks and large aboveground storage tanks (ASTs) and dispensers

for refueling machinery. Historical aerial photographs indicate this property has been active since at least 1972 along with quarrying operations.

4.0 PRELIMINARY INVESTIGATION WORK

The following sections provide available information on potable water wells within the Site Area and surrounding areas, the results of the Baseline Water Quality Monitoring study conducted by Princeton Hydro in the fall of 2009 for the Lower Delaware River Wild and Scenic Management Committee, PADEP home/potable well sampling results, and PADEP bottled water delivery and home water treatment system installation.

4.1 PaGWIS Water Well Information

A search of the DCNR Pennsylvania Geological Survey PaGWIS was conducted to identify the number and nature of registered water wells within three miles of the center of the Site Area. Well record data in PaGWIS come from various sources (USGS, PADEP, Susquehanna River Basin Commission [SRBC], Pennsylvania Department of Agriculture), but the vast majority is from well records submitted to the Pennsylvania Geological Survey by water well drillers. The results of the search are provided in **Appendix D** and include a table of the individual wells and related details and a map that depicts the well locations and type. The large majority of the wells are domestic/agricultural in nature and used for obtaining potable water for consumption and household purposes.

4.2 Princeton Hydro 2009 Baseline Water Quality Monitoring Study

A Baseline Water Quality Monitoring study was conducted in the area by Princeton Hydro, LLC in the fall of 2009 for the Lower Delaware River Wild and Scenic Management Committee in advance of regional Marcellus Shale natural gas exploration. The study encompassed the 300-square mile Lower Delaware River, Wild and Scenic designated attributes spanning across Bucks, Lehigh, and Northampton Counties and included the collection of 22 surface water samples from streams and 10 groundwater samples from private, potable water wells. The study identified two permitted gas well drilling sites—the Cabot and Fleck sites, both located within the Rapp Creek watershed in Bucks County and in proximity to the Site Area (see **Figure 3**). The Cabot site is the location of the former Cabot Super Metals facility on Beaver Run Road, also previously known as Cabot Performance Materials and Penn Rare Metals that produced columbium base master alloys, cesium, rubidium, germanium, tellurium, and niobium compounds. The Fleck site referred to in the Princeton Hydro Study is a gas production well

pad site located at 4415 Durham Road on agricultural-use property owned by Frank Fleck. The property is located directly adjacent and to the east of Durham Road (Route 412) near the intersection with Church Road.

All 10 groundwater samples were collected on August 13, 2009, from potable water wells in the vicinity of the Cabot and Fleck sites. The general locations of the samples are depicted on Figure 4 of the Princeton Hydro report. Only one sample, GW-10 Park Drive West, falls within the Site Area. Well samples were analyzed for various wet chemistry parameters, ions, metals, detergents, and VOCs (by USEPA Method 8260). TCE was only detected in two well water samples, GW-10 Park Drive West and GW-2 Beaver Run Road, at concentrations of 7.99 µg/L and 1.54 µg/L, respectively. The well water at Park Drive West also contained cis-1,2-DCE and chloroform at concentrations below 1.0 µg/L. A copy of the Baseline Water Quality Monitoring study is provided in **Appendix E**.

4.3 PADEP Potable Well Sampling Locations

Potable well samples have been collected at 68 different locations during the course of the project. Twenty-two locations were originally located in the field using a high quality GPS (Trimble GPS Pathfinder Pro XRS) by Leidos at the time of the April 2010 potable well sampling efforts. Subsequent potable well locations were mapped by Leidos during site reconnaissance activities in January 2013. A map depicting the potable well locations is provided as **Figure 4**.

4.4 PADEP Potable Well Sampling Results

Potable well sampling was conducted at multiple residences and businesses at the Site Area by the BCHD in May and June 2002 after the discovery of chlorinated organic compounds in the water supply at Przyuski's Family Restaurant (now MOO restaurant) on Durham Road.

The PADEP resumed sampling in October 2009 and began providing bottled water to residents with well water containing dissolved TCE and/or related compounds above the MCLs. The PADEP conducted a second round of sampling in April 2010. The PADEP conducted 15 additional sampling events, to include additional residences, between November 2010 and July 2013. Sample results for selected chlorinated organic compounds for sampling events

between 2002 and 2013 are provided in **Table 1**. Well sample analytical data sheets are retained by the PADEP.

The well sampling efforts between 2002 and 2013 have identified the presence of TCE in 44 different private water wells at concentrations as high as 411 µg/L. PCE has been detected in 32 home wells at concentrations as high as 24.3 µg/L. 1,1-DCE was detected in 27 home wells and cis-1,2-DCE was detected in 33 home wells at concentrations as high as 14.7 µg/L and 105 µg/L, respectively. Other chlorinated organic compounds including 1,1,1-TCA, 1,1,2-trichloroethane (1,1,2-TCA), and 1,2-dichloroethane (1,2-DCA) have also been detected in home well water samples, but at concentrations below the applicable MCLs.

TCE has been detected above the MCL of 5 µg/L in home well samples collected at 28 different residences between 2002 and 2013. To date, the highest concentration of TCE has been detected in well water at 44 Brennan Road at a concentration of 411 µg/L. **Figure 5** depicts the historical TCE concentrations at the private well locations by range of TCE detection. The figure illustrates that the highest TCE concentrations in home well water (those >100 µg/L) have been detected in close proximity to what has historically been identified the Nockamixon Township Route 563 Drum Site. TCE concentrations exceeding the MCL (up to 99 µg/L) have been identified in home wells as far as 4,000 feet to the southeast of that site.

PCE has been detected above the MCL of 5 µg/L in home well samples collected at nine different residences between 2002 and 2013. To date, the highest concentration of PCE has been detected in well water at 44 Brennan Road at a concentration of 24.3 µg/L. **Figure 6** depicts the historical PCE concentrations at the private well locations by range of PCE detection. The highest PCE concentrations in home well water have occurred immediately to the east and southeast of the Nockamixon Township Route 563 Drum Site. PCE concentrations exceeding the MCL in home wells have occurred as far as 3,000 feet to the southeast of that site.

1,1-DCE has been detected above the MCL of 7 µg/L in home well samples collected at four different residences between 2002 and 2013. To date, the highest concentration of 1,1-DCE has been detected in well water at 44 Brennan Road at a concentration of 14.7 µg/L.

Cis-1,2-DCE has been detected above the MCL of 7 µg/L in home well samples collected at two different residences between 2002 and 2013. To date, the highest concentration of cis-1,2-DCE has been detected in well water at 44 Brennan Road at a concentration of 105 µg/L.

4.5 Bottled Water Delivery

Leidos arranged bottled water deliveries to residential properties with contaminant concentration levels in exceedance of the MCLs. Leidos initially began providing bottled water to six affected residents on February 17, 2010 (see **Section 1.2**). Additional deliveries were added as the PADEP increased the scope of the home well sampling program and more affected locations were identified. In all, the following 19 locations received bottled water between February 2010 and February 2012:

- 30, 44, 55, 77, and 84 Brennan Road
- 24, 133, 135, 140, and 149 Tower Road
- 4028 and 4051 Durham Road
- 8329, 8374, 8378, and 8382 Easton Road
- 282 and 287 Park Drive; and
- 2465 Mountainview Drive.

Bottled water deliveries ceased at each location shortly after the PADEP installed carbon filter treatment systems at the properties (see **Section 4.6**). The last bottled water delivery occurred in February 2012.

4.6 Home Water Treatment System Installation

The PADEP installed carbon filter systems at 27 properties between July 2011 and November 2013. Leidos subcontracted S&G Water Conditioning, Inc. to evaluate and install the carbon treatment systems for the properties with concentrations that exceeded MCLs for constituents discussed above in **Section 4.5**. The treatment systems were installed at the following locations:

- 10, 30, 44, 55, 65, 77, and 84 Brennan Road
- 24, 117, 133, 140, and 149 Tower Road

- 4028, 4050, 4051, and 4071 Durham Road
- 8329, 8374, 8378, and 8382 Easton Road
- 287, 294, and 324 Park Drive West
- 2442, 2465 and 2506 Mountainview Drive and
- 9 Cord Way.

Environmental Covenants were executed pursuant to the Pennsylvania Uniform Environmental Covenants Act for the above properties and filed with the Bucks County Recorder of Deeds.

The PADEP did not install carbon filter systems at the following residences that had exceedances of contaminants in their potable well water:

- 135 Tower Road – Shares the same well and water system as 133 Tower Road where a system was installed.
- 282 Park Drive West – The owner of this property refused the installation of a filter system or the placement of an Environmental Covenant at the property. The Department issued an Administrative Order pursuant to Sections 512(a) and 1102 of the Pennsylvania Hazardous Sites Cleanup Act (HSCA) for the placement of an Environmental Covenant on the property deed. The Environmental Covenant was recorded by the Bucks County Recorder of Deeds on February 13, 2013.

5.0 MONITORING WELL NETWORK INSTALLATION

5.1 Monitoring Well Installation

Ten bedrock monitoring wells (MW-1 through MW-10) were installed at the Site in May 2012. Three additional bedrock wells (MW-1S, MW-11, and MW-12) were installed at the Site in May 2013. MW-1S was installed as a replacement well to resolve issues that occurred during the installation of the upper nested well screen at MW-1 (further discussed below in **Section 5.6**). The monitoring well locations are presented on **Figure 7**. Access agreements with the property owners were obtained by the PADEP prior to installation of the wells. Gravel access driveways were installed at well sites MW-3, MW-4, MW-11, and MW-12 to improve access conditions at those soft ground properties.

Well installation and development was completed by Rabb Well Drilling, Inc. (Raab) of Perkasie, Pennsylvania. An Ingersoll Rand T-4 air rotary drill rig was used by Raab to complete the drilling activities. Split-spoon sampling was conducted from the ground surface to refusal to characterize the overburden at each well location. If soil intervals above the water table exhibited elevated PID readings for organic vapors or visible staining, soil samples were retained for laboratory analysis. A 10-inch-diameter air hammer was used to drill the borehole for the installation of a 6-inch steel casing to 40 fbg at each well. Once the steel outer casing was installed, a Portland cement and bentonite grout mix was pumped around the outer annulus of the steel casing and allowed to cure overnight before continuing drilling. A 6-inch air hammer was then used to complete drilling of each well to depths of 250 to 300 fbg. Upon completion, the wells were developed using pressurized air from the rig to lift and flush loose sediment from the borehole. Monitoring wells were finished in stick-up fashion at the request of the PADEP and were secured with a hinged locking well cap. Additional monitoring well installation details including lithology, well yield, and PID readings are provided on the individual monitoring well boring logs provided in **Appendix F**.

Water generated during drilling and development as well as drill cuttings, were captured at the wellhead within a lined containment structure constructed by the driller. Well/production water was then pumped into portable plastic storage totes or directly pumped into a waiting 3,000 gallon vacuum truck and transported to a nearby, secured investigation-derived waste (IDW) staging area where the water was offloaded into a larger storage vessel. Drill cuttings

were drummed and transported to the staging area. The well water and cuttings were ultimately disposed offsite at a permitted disposal facility. The details associated with the IDW management and disposal activities are further discussed in **Section 5.7**.

At MW-11, a highly fractured and unstable zone was encountered from 105 to 110 fbg. Upon initial attempts to complete the borehole geophysics logging summarized below in **Section 5.4**, it was discovered that the unstable zone had partially collapsed resulting in a blockage of the borehole. The PADEP remobilized the driller on June 4, 2013, to further develop and flush the well, focusing on the highly fractured zone. Subsequent borehole video work indicated the fracture zone was still unstable and continued to partially collapse, although the majority of the borehole remained open and nested well screen installation work documented below in **Section 5.6** was able to be completed.

5.2 Well Boring Interpretation

A Leidos geologist logged lithology, olfactory observations, color, fracture locations, the presence of water during drilling, and any other notable observations during the drilling of the monitoring wells. The individual well boring logs are provided in **Appendix F**. A description of the geology encountered at each well location is provided below. Geologic cross-sections were prepared and are provided in **Appendix G**. Well construction details including depth, casing depth, coordinates, and elevations are provided in **Table 2**.

The geology encountered during the drilling of the well borings was found to be in agreement with what is reported for the area (see **Section 2.3**), specifically the base of the Brunswick Formation. Reportedly, the base of the Brunswick Formation is characterized by red or dark gray argillite transitioning into the Lockatong Formation, the contact being arbitrarily placed where red mudstones predominate over gray (Smoot, 1999). Greenman, in *Ground Water Resources of Bucks County, Pennsylvania*, reports “the lower beds of the Brunswick occur in sinuous bands which alternate with bands of the Lockatong. The lower beds of the Brunswick in the zones of transition with the Lockatong include a considerable thickness of thick-bedded hard red argillite and occasional beds of tough gray shale. In general, the Brunswick conformably overlies the Lockatong, but the lower beds of the Brunswick extensively interfinger with an appreciable thickness of beds of the Lockatong.” The well bore cuttings have been preserved and evaluated by Leidos geologists. The dominant bedrock material in all borings has been

identified as argillite, a lithified mud or mudstone, similar to shale but not possessing fissile layering. Bedding within the argillite is difficult to distinguish other than differences in color. The transition from Brunswick sediments to Lockatong sediments is insignificant, but appears to occur between 100 and 150 fbg in well bores farthest east (MW-5, MW-7, MW-8) with increasing depth to the west and north (direction of bedding dip). The interpreted transition in MW-12 is roughly 280 fbg.

MW-1/1S

MW-1 and MW-1S are located approximately 30 feet apart. The overburden materials at MW-1/1S consisted of highly organic, reddish brown, silt. During drilling at MW-1, a strong chemical odor was noted in the shallow overburden and a maximum PID response of 345 parts per million (ppm) was recorded at 4 fbg. This well is located in or in close proximity to one of the former drum storage areas identified in the NUS reports for the Nockamixon Township Route 563 site discussed above in **Section 3.5**. A soil sample was collected from four to five fbg where elevated PID readings were detected. The soil sample results are presented in **Table 3**. The chlorinated organic compounds TCE, PCE, and 1,1,1-TCA were detected in the sample at concentrations of 5.14 milligram per kilogram (mg/kg), 55.6 mg/kg, and 2.34 mg/kg, respectively. The TCE and PCE results exceed the PADEP medium-specific concentration (MSC) soil to groundwater numeric values as identified in **Table 3**. Seven other VOCs including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, cis-1,2-DCE, ethylbenzene, isopropylbenzene, n-propylbenzene, and total xylenes were also detected in the soil sample collected from MW-1, at levels below the applicable MSCs.

The overburden was underlain by a highly weathered argillite to a depth of 10 fbg where the argillite becomes highly fractured. Argillite of varying colors was encountered to the depth of well boring completion (300 fbg). Fractures and joints had visible deposits of pyrite and calcite. MW-1 was completed to a depth of 300 fbg. A total of four fracture zones at depths of 35, 60, 85, and 120 fbg were encountered during drilling. Water was first encountered at 120 fbg with a blown yield of one gpm. The final blown yield of the well was 3.5 gpm at a total depth of 300 fbg. MW-1S was completed to a depth of 145 fbg. A total of three fracture zones at depths of 26, 55, and 85 fbg were encountered during drilling. Water was first encountered at 26 fbg with a blown yield of one gpm. The blown yield increased to 7 gpm at 130 fbg and to between 15 and 20 gpm by 145 fbg.

MW-2

The overburden material at MW-2 consisted of 10 feet of brown sand with some silt. PID scanning indicated little to no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (250 fbg). Fractures and joints had visible deposits of pyrite and calcite and staining due to iron deposits was noted. A total of four fracture zones at depths of 125, 140, 146, and 170 fbg were encountered during drilling. Water was first encountered at 125 fbg with a blown yield of one gpm. The blown yield significantly increased to 40 gpm once drilling advanced through the fractures at 140 and 146 fbg. The final blown yield of the well was 50 to 60 gpm at a total depth of 250 fbg.

MW-3

The overburden material at MW-3 consisted of five feet of reddish yellow clay with some sand. PID scanning indicated little to no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (250 fbg). Fractures and joints had visible deposits of pyrite and calcite. A total of two fracture zones at depths of 75 and 176 fbg were encountered during drilling. Water was first encountered at 160 fbg with a blown yield of 10 gpm. The final blown yield of the well was 10 to 12 gpm at a total depth of 250 fbg.

MW-4

The overburden material at MW-4 consisted of five feet of brown clay with some silt. PID scanning indicated little to no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (300 fbg). Fractures and joints had visible deposits of pyrite and calcite. No discernible fractures were encountered during drilling. Water was first encountered at 200 fbg with a blown yield of one gpm. The final blown yield of the well was one gpm at a total depth of 300 fbg.

MW-5

The overburden material at MW-5 consisted of four feet of reddish brown clay with some silt. PID scanning indicated little to no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (300 fbg). Fractures and joints had

visible deposits of pyrite and calcite. Fractures were encountered at 100 and 190 fbg, however "soft zones" were encountered as well. Water was first encountered at 125 fbg with a blown yield of one half gpm. The final blown yield of the well was one half gpm at a total depth of 300 fbg.

MW-6

The overburden material at MW-6 consisted of six feet of yellow clay with some sand. PID scanning indicated little to no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (300 fbg). Fractures and joints had visible deposits of pyrite and calcite. A fracture was encountered at 85 fbg. Water was not encountered during drilling until the well was completed to 300 fbg. The final blown yield of the well was approximately one gpm.

MW-7

The overburden material at MW-7 consisted of three and a half feet of clay with some silt. PID scanning indicated little to no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (300 fbg). Fractures and joints had visible deposits of pyrite and calcite. Fractures were encountered at 163 and 284 fbg, however "soft zones" were also encountered. Water was first encountered during drilling at 160 fbg. The final blown yield of the well was approximately 10 to 12 gpm.

MW-8

The overburden material at MW-8 consisted of two feet of clay with some silt. PID scanning indicated little to no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (300 fbg). Fractures and joints had visible deposits of pyrite and calcite. Fractures were encountered at 101, 106, 225, and 280 fbg, however many "soft zones" were also encountered. Water was encountered during drilling at 130 fbg (0.5 gpm) and again at 250 fbg (increased to one gpm). The final blown yield of the well was approximately one gpm.

MW-9

The overburden material at MW-9 consisted of five feet of clay with some silt. PID scanning indicated little to no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (250 fbg). Fractures and joints had visible deposits of pyrite and calcite. Fractures were encountered at 95 and 183 fbg, however "soft zones" were also encountered. Water was first encountered during drilling at 95 fbg with a yield of two gpm. The final blown yield of the well was approximately six gpm.

MW-10

The overburden material at MW-10 consisted of one foot of clay with some silt. PID scanning indicated little to no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (300 fbg). Fractures and joints had visible deposits of pyrite and calcite. Fractures were encountered at 114, 140, and 290 fbg. Water was first encountered during drilling at 140 fbg with a yield of one gpm. The final blown yield of the well was approximately three gpm.

MW-11

The overburden material at MW-11 consisted of six feet of clay with some silt. PID scanning indicated no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (250 fbg). Fractures and joints had visible deposits of pyrite and calcite. Fractures were encountered at 15, 25, 33, 55, 110 to 115, 175, and 195 fbg. The fracture at 110 to 115 fbg was interpreted to be a significant and unstable fracture zone characterized by gravel and small cobble-sized cuttings (up to six inches in diameter) that were highly weathered/oxidized (iron staining). "Soft zones" were also encountered during drilling. Water was first encountered within the fracture zone at 110 to 115 fbg with a yield of 15 gpm. The yield increased to 35 gpm by 185 fbg. The final blown yield of the well was approximately 35 gpm. The highly fractured zone from 110 to 115 fbg collapsed between the time the borehole was drilled and borehole geophysics was attempted. The borehole had to subsequently be redeveloped and cleaned out with emphasis on the fracture zone before the fracture zone attained some stability (remained open).

MW-12

The overburden material at MW-12 consisted of six feet of clay with some silt. PID scanning indicated no detectable VOCs within the shallow overburden. The overburden was underlain by a thin layer of weathered argillite underlain by competent argillite with variations in color to the depth of well boring completion (300 fbg). Fractures and joints had visible deposits of pyrite and calcite. Fractures were encountered at 30, 65, 168, 195, 225, and 255 fbg, however many "soft zones" were encountered as well. Water was first encountered during drilling at 146 fbg with a yield of one half gpm. Significant yield increases occurred at 200 fbg (up to 10 gpm), 240 fbg (up to 25 gpm), and 265 fbg (up to 30 gpm). The final blown yield of the well was approximately 30 gpm.

5.3 Site Survey

Surveying of the monitoring wells and nearby planimetric features was conducted by Geotec, Inc., a Pennsylvania licensed professional surveyor, of Hollidaysburg, Pennsylvania. The electronic survey data was imported and manipulated using a geographic information system to accurately project the new monitoring well locations on project maps and figures (e.g. **Figure 7**). The survey also included elevation/vertical data for each monitoring well that is presented in **Table 2** and used to calculate accurate groundwater elevations.

5.4 Borehole Geophysics Completion

THG Geophysics, Ltd. (THG) completed electric logging of the initial 10 well borings (MW-1 through MW-10) at the Site from May 30 to June 3, 2012. A series of down-hole logs were collected including temperature, fluid conductivity, caliper, natural gamma, spontaneous potential, resistivity (short, normal, and single point), acoustic televiewer, and heat pulse. Due to the nature of each well, the surveys were tailored to maximize available data from each individual well. A copy of the complete geophysics report and individual down-hole logs are provided in **Appendix H**.

Earth Data Northeast, Inc. (EDN) performed geophysical logging at well borings MW-11 and MW-12 on May 20 and 21, 2013, and June 6, 2013. Down-hole logs were collected using video, temperature, fluid conductivity, caliper, spontaneous potential, resistivity (short, normal, and single point), natural gamma, acoustic televiewer, and heat pulse. Unstable borehole

conditions in MW-11 prevented the acoustic televiewer and heat pulse flowmeter surveys from being completed. A copy of the EDN report and individual logs are provided in **Appendix H**.

5.5 Straddle Packer Groundwater Sampling

Straddle packer groundwater sampling of the monitoring wells was conducted following the borehole geophysics logging. The straddle packer groundwater sampling work was conducted to obtain chemical and hydrogeologic data from targeted fracture zones within the individual well borings and to aid in the design of nested well screens.

5.5.1 Methodology

Leidos provided and operated the equipment for the performance of the straddle packer sampling work. A dual packer system with 10-foot spacing between the two packers was utilized to isolate as many as five targeted fracture zones within each well. The packer system was connected and lowered into the wells with two-inch galvanized steel piping (20-foot lengths). The packer system was installed to the lowest target fracture zone first and raised to successively shallower target fracture zones. The packer system utilized three pressure transducers to monitor fluid pressures above, within, and below the center packer zone to ensure an effective seal had been achieved with the packers once inflated. The packers were inflated with inert nitrogen gas. Once the packer system was placed at the designated interval and inflated, Leidos technicians lowered a stainless steel, two-inch-diameter Grundfos submersible pump down the inside of the galvanized piping and into the central packer zone. The central packer zone and piping was then purged of stagnant water (minimum of two volumes) and the fluid pressures were monitored to ensure evacuation of the target fracture zone is occurring rather than leakage past the packer and borehole wall into the central packer zone.

During pumping, well purge water was monitored with a water quality meter by Leidos technicians for several water quality parameters. The parameters were recorded and evaluated every five minutes until stabilization occurred. Parameters included: turbidity (10% for values greater than 1 NTU), DO (10%), specific conductance (3%), temperature (3%), pH (± 0.1 unit). The pumping rate was monitored at the discharge using a flow meter. Once stabilization occurred, water samples were collected from the sample pump discharge tubing by PADEP

personnel. Fluid pressures were also monitored during the purging and sampling process to ensure the target fracture zone was adequately isolated.

Once sampling was completed at the first and lowest target depth of a well, the pump was removed from the piping, the packers were deflated, and the packer system was raised to the next shallower target interval and the sampling process was repeated. The pump and tubing were not decontaminated between successive target fracture zones in the same well, but were decontaminated between well locations. Purging activities at each target fracture zone within a well adequately removed any residual contaminants from the previous zone. Purge water was pumped through a 30-gallon granular activated carbon (GAC) vessel containing new, virgin carbon and discharged to the ground surface at the well location. Purge water at MW-1, MW-2, MW-3, and MW-4 was expected to contain higher concentrations of chlorinated organic compounds and therefore treated through a 30-gallon GAC vessel and then stored onsite in poly totes and sampled to ensure adequate removal of the contaminants.

5.5.2 2012 Straddle Packer Work

On June 18, 2012, Leidos met with the PADEP to select straddle packer sampling intervals within the 10 monitoring wells (MW-1 through MW-10) initially installed at the Site Area in 2012. During the meeting, Leidos and PADEP representatives reviewed monitoring well installation/drilling logs and borehole geophysics logs for each well and identified zones with water-bearing characteristics to be targeted during the straddle packer sampling work. The work scope developed during that meeting is documented in the Leidos June 19, 2012, *Monitoring Well Straddle Packer Sampling Work Scope* provided in **Appendix I**.

The straddle packer sampling work was performed by Leidos at the 10 wells during the period of June 25 through July 10, 2012.

5.5.3 2013 Straddle Packer Work

Following the installation of monitoring wells MW-11 and MW-12 and subsequent borehole geophysics work in 2013, Leidos reviewed the geologic/hydrogeologic information for each well and prepared the *MW-11 & MW-12 Straddle Packer Sampling Work Scope,* submitted to the PADEP on June 21, 2013. A copy of that document is provided in **Appendix I**. Straddle

packer sampling work was not recommended or conducted at MW-11 due to unstable conditions within a fracture zone at 105 to 110 fbg within the borehole.

The straddle packer sampling work at MW-12 was performed by Leidos on June 25 and 26, 2013.

5.5.4 Straddle Packer Sampling Results

Groundwater samples were collected from MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, and MW-12. Copies of the groundwater sampling forms completed in the field at the time of the sampling work are provided in **Appendix I**. Samples were collected from the planned intervals within each well if the interval was able to sustain a sufficient yield indicating formation water was actually entering the straddle packer system. VOC sample results are presented in **Table 4**. General water quality parameters are provided in **Table 5**. Once collected, samples were handled by the PADEP and submitted to the PADEP BOL in Harrisburg, Pennsylvania, for analysis.

PCE was detected in samples from three wells at concentrations above the applicable MSC of 5 µg/L. TCE was detected in samples from seven wells at concentrations above the applicable MSC of 5 µg/L. 1,1-DCE was detected in samples from six wells at concentrations above the applicable MSC of 7 µg/L. Cis-1,2-DCE was detected in samples from six wells at concentrations above the applicable MSC of 7 µg/L. The highest concentrations of PCE, TCE, 1,1-DCE, and cis-1,2-DCE were all detected in the 140 to 160 foot interval of MW-2 at concentrations of 217 µg/L, 3,180 µg/L, 112 µg/L, and 612 µg/L, respectively.

Listed below is a summary of target contaminants in each well with concentrations that exceeded the applicable MSCs:

- **MW-1**: TCE (41.4 µg/L at 115-145 fbg, 20.7 µg/L at 170-200 fbg, and 648 µg/L at 210-240 fbg); cis-1,2-DCE (220 µg/L at 210-240 fbg)
- **MW-2**: PCE (217 µg/L at 140-160 fbg and 106 µg/L at 180-200 fbg); TCE (3,180 µg/L at 140-160 fbg and 1,660 µg/L at 180-200 fbg); 1,1-DCE (112 µg/L at140-160 fbg and 57.8 µg/L at 180-200 fbg); cis-1,2-DCE (612 µg/L at 140-160 fbg and 321 µg/L at 180-200 fbg)

- **MW-3**: PCE (12.2 µg/L at 100-120 fbg and 11.3 µg/L at 175-195 fbg); TCE (214 µg/L at 100-120 fbg and 244 µg/L at 175-195 fbg); 1,1-DCE (7.9 µg/L at 100-120 fbg and 9.4 µg/L at 175-195 fbg)
- **MW-4**: PCE (25 µg/L down to 95 fbg, 18.4 µg/L at 100-130 fbg, and 15.5 µg/L at 190-220 fbg); TCE (796 µg/L down to 95 fbg, 658 µg/L at 100-130 fbg, and 582 µg/L at 190-220 fbg); 1,1-DCE (12.3 µg/L down to 95 fbg, 11.4 µg/L at 100-130 fbg, and 11.9 µg/L at 190-220 fbg); cis-1,2-DCE (117 µg/L down to 95 fbg, 105 µg/L at 100-130 fbg, and 110 µg/L at 190-220 fbg)
- **MW-7**: TCE (15 µg/L at 270-300 fbg)
- **MW-10**: TCE (27.8 µg/L down to 155 fbg and 24.6 µg/L at 187-207 fbg)
- **MW-12**: TCE (7.1 µg/L at 0-155 fbg, 0.61 µg/L at 210-230 fbg, and 5.2 µg/L at 245-265 fbg); cis-1,2-DCE (0.89 µg/L at 0-155 fbg and 0.59 µg/L at 245-265 fbg)

5.5.5 Groundwater Ion Correlation Attempt

Straddle packer samples collected during the 2012 efforts were also analyzed for various ions (cations and anions) in an effort to identify unique water-bearing zones or signatures within or between monitoring wells. The results of the analyses are presented in **Table 6**. A summary of the results is provided in the Leidos September 27, 2012, Draft Monitoring Well Nested Well Screen Installation work scope provided in **Appendix J**. The results are also depicted on piper diagrams included with that document. In general, the ionic compositions of sampled intervals within a particular well were similar and did not indicate distinct differences in the geochemistry of the water-bearing zones or provide merit to further the study.

5.6 Nested Well Screen Installations

Leidos installed nested well screens at selected monitoring wells based upon the review of straddle packer sampling data combined with previous information including the monitoring well installation/drilling logs and the borehole geophysical logs. Leidos' recommendations for nested well screen installation in the initial 10 monitoring wells (MW-1 through MW-10) were provided in the September 27, 2013 Draft Monitoring Well Nested Well Screen Installation work scope provided in **Appendix J**. Leidos' recommendations for installing nested well screens in MW-11 and MW-12 were provided in the July 22, 2013, Draft MW-11 and MW-12 Well Screen Installation Recommendation also provided in **Appendix J**. The PADEP was in agreement with

most of the recommendations for the recommended well screen intervals. However, it was decided that nested well screens would not be installed in wells MW-5, MW-6, MW-8 and MW-9 due to low yields and/or low water levels. Well screen intervals in each well are provided in **Table 2** and depicted on the monitoring well logs provided in **Appendix F**.

5.6.1 2012 Nested Well Screen Installs

Nested well screen installation work conducted at wells MW-1, MW-2, MW-3, MW-4, MW-7, and MW-10 was performed by B. L. Myers Bros. of Glenmoore, Pennsylvania, under subcontract to Leidos beginning on December 3, 2012, and continuing through January 16, 2013.

The 2012 monitoring wells were originally constructed as six-inch-diameter open borehole wells with six-inch steel casing extending to a depth of approximately 40 fbg. Two nested wells consisting of two-inch-diameter polyvinyl chloride (PVC) screen and riser pipe were installed at each of the six monitoring wells identified above following the construction specifications provided in the Leidos November 12, 2012, Draft Nested Well Screen Installation & Groundwater Sampling Work Plan.

Construction issues were identified in wells MW-1, MW-4, and MW-10 following the installation of the well screens. At MW-1, the upper screen was found to have bentonite materials within the screened section of the well. A similar situation was also discovered within the upper screen of MW-10. MW-4 was found to have bentonite materials within the lower screen and the initial design specifications for screen intervals was not achieved or within the margin for error. As a result, the situation at MW-1 was resolved by drilling a nearby new shallow well, MW-1S. MW-4 was completely cleaned out, the removal of all bentonite materials verified by running downhole video following the cleanout work, and properly reconstructed. The situation at MW-10 was not directly resolved. The PADEP requested MW-10 not be fixed and instead requested the installation of a new well in closer proximity to the Nockamixon Township Route 563 Drum Site, what is currently MW-11.

5.6.2 2013 Nested Well Screen Installs

Nested well screen installation work conducted at wells MW-11 and MW-12 was conducted by Duane Moyer Well Drilling of Lehighton, Pennsylvania, under subcontract to Leidos on August 21 through 23, 2013.

The 2013 monitoring wells were originally constructed as six-inch-diameter open borehole wells with six-inch steel casing extending to a depth of approximately 40 fbg. Two nested wells consisting of two-inch-diameter PVC screen and riser pipe were installed in MW-11 and MW-12 following similar construction specifications followed for the 2012 screen installation work with the exception of the use of bentonite pellets within middle seal zones instead of slurry products. Additionally, a five-inch-diameter PVC pipe was initially installed within the upper 120 feet of MW-11 to prevent the collapse of the unstable section of the borehole from 105 to 110 fbg during the installation and construction of the nested well screens. The five-inch PVC pipe was removed as the upper well screen was constructed.

5.7 Management of Investigation Derived Waste

IDW in the form of drill cuttings and well production water was generated during the monitoring well installation activities in 2012 and 2013. Copies of the IDW disposal documents are provided in **Appendix K**.

During the 2012 well installation work, Lewis Environmental, Inc. (Lewis) of Royersford, Pennsylvania, was retained by Leidos to manage, transport, and dispose the IDW generated during the installation of the monitoring wells. The driller, Raab Drilling, Inc., also assisted with the movement of drums from the well sites to the IDW staging area at the Korman Commercial Property (near MW-7 adjacent to Easton Road). The staging area was secured with temporary fencing that enclosed a 21,000-gallon mobile storage tank (frac tank) for storage of well production water and the drummed well cuttings. Once the drilling work was completed, the IDW was characterized by Lewis for offsite disposal.

Approximately 11,486 gallons of IDW water was removed from the frac tank at the staging area on June19 and 21, 2012, for offsite disposal at Environmental Recovery Corporation (ERC) in Lancaster, Pennsylvania. The frac tank was then cleaned by Lewis technicians trained to enter

a confined space. Poly totes used to temporarily hold the well production water at various well sites were also cleaned by Lewis to remove fine sediment that had accumulated in the totes. Approximately 182 drums of drill cuttings were removed from the staging area by Lewis on July 9 and 10, 2012. The drums were also disposed at ERC. Upon removal of the IDW, Lewis removed the temporary fencing and restored ruts and ground disturbances at the staging area.

Lewis returned to the Site Area on August 13, 2012, to remove IDW in the form of well purge water generated during straddle packer sampling work at wells MW-1, MW-2, MW-3, and MW-4. Approximately 1,000 gallons was removed by Lewis and disposed at ERC.

During the 2013 well installation work, Lewis was again retained by Leidos to manage and dispose of IDW in the form of drill cutting and well production water. A secured property at 8410 Easton Road (location of MW-5) was used for the staging of IDW, as necessary. Well production water was captured in waiting 3,000-gallon vacuum trucks or poly totes staged at the well sites. Approximately 2,000 gallons of IDW water was disposed at ERC on May 15, 2013, 3,200 gallons on May 16, 2013, and 1,752 gallons on May 20, 2013. An additional 3,500 gallons of well production water was generated during the redevelopment work at MW-11 on June 4, 2013, and immediately transported to ERC for disposal. Approximately 53 drums of drill cuttings were removed from the staging area and disposed at ERC on June 6, 2013.

5.8 Site Restoration

Site restoration work was completed at the majority of the monitoring well locations following well installation work and the related tasks that followed in 2012 and 2013. The restoration work was completed by Ken Chwal Hydro-Seeding (KCHS) of Pipersville, Pennsylvania, and included grading, seeding, stone and topsoil placement, tree and brush removal, repairs to a culvert along Brennan Road, and maintenance of the stone access drives installed to some monitoring well sites.

6.0 MONITORING WELL SAMPLING

Leidos conducted groundwater sampling activities at the monitoring wells at properties within the Site Area in January and September 2013. The first sampling event was conducted January 14 through 23, 2013. At the time of the first sampling event, bentonite materials were discovered or known to exist in MW-1U, MW-4L, and MW-10U. As a result, wells MW-4L and MW-10U were unable to be sampled. The second sampling event was conducted September 9 through 12, 2013. All wells, with the exception of MW-1U and MW-10U, were sampled. Those well screens are no longer in use.

The PADEP also performed groundwater sampling of the monitoring wells in December 2013 using passive diffusion bags to collect the samples.

6.1 Groundwater Sampling Procedures

Groundwater sampling was conducted following the low stress/low flow methodologies specified in the Leidos May 20, 2011 Change Order 3 Work Scope – Nockamixon TCE Site. The well screen intervals and depths at which the pumps were set are provided in **Table 2**. During well purging, turbidity, temperature, specific conductance, pH, and dissolved oxygen (DO) were recorded immediately upon the beginning of purging and every three to five minutes thereafter. Copies of the groundwater sampling logs completed in the field are provided in **Appendix L**.

Purging was considered complete when three well volumes were removed and when all of the above parameters had been stabilized. Samples were then taken directly by filling the laboratory glassware from the pump discharge. After the samples were collected, labels were prepared and secured on all of the glassware and placed in a cooler on ice. The pump was then removed from the well and decontaminated. Each well was closed and secured at each sampling location.

6.2 Groundwater Sampling Results

Groundwater sample results from the January and September 2013 sampling events are provided in **Table 7**. **Figures 8** and **10** depict the sample results for each monitoring event.

Samples were submitted to the PADEP BOL in Harrisburg, Pennsylvania, for analysis of VOCs by USEPA Method 8260C.

PCE was detected in samples from seven monitoring wells with concentrations exceeding the applicable MSC of 5 µg/L. TCE was detected in samples from 13 monitoring wells with concentrations exceeding the applicable MSC of 5 µg/L. 1,1-DCE was detected in samples from six monitoring wells with concentrations exceeding the applicable MSC of 7 µg/L. Cis-1,2-DCE was detected in samples from six monitoring wells with concentrations exceeding the applicable MSC of 70 µg/L. The highest concentrations of PCE, TCE, 1,1-DCE, and cis-1,2-DCE were all detected in MW-2U at concentrations of 105 µg/L, 2,210 µg/L, 112 µg/L, and 518 µg/L, respectively, in January 2013. Tetrahydrofuran (THF) was detected in MW-4U at a concentration exceeding the applicable MSC of 25 µg/L in January 2013.

Listed below is a summary of contaminants in each well with concentrations that exceeded the applicable MSCs. A table is included below the summary of contaminants for ease of comparison.

- **MW-1U/S**: TCE (509 µg/L on January 14, 2013 and 295 µg/L on September 12, 2013), cis-1,2-DCE (186 µg/L on January 14, 2013);
- **MW-1L**: TCE (13.6 µg/L on January 14, 2013 and 11.2 µg/L on September 9, 2013);
- **MW-2U**: PCE (105 µg/L on January 16, 2013 and 33.1 µg/L on September 10, 2013), TCE (2,210 µg/L on January 16, 2013 and 562 µg/L on September 12, 2013), 1,1-DCE (112 µg/L on January 16, 2013 and 26.8 µg/L on September 12, 2013); cis-1,2-DCE (518 µg/L on January 16, 2013 and 114 µg/L on September 12, 2013);
- **MW-2L**: PCE (42.4 µg/L [42 µg/L for the duplicate sample] on January 16, 2013 and 15.1 µg/L on September 12, 2013), TCE (822 µg/L [875 µg/L for the duplicate sample] on January 16, 2013 and 414 µg/L on September 12, 2013), 1,1-DCE (42 µg/L [43.8 µg/L for the duplicate sample] on January 16, 2013 and 17.8 µg/L on September 12, 2013), cis-1,2-DCE (203 µg/L [204 µg/L for the duplicate sample] on January 16, 2013 and 95.2 µg/L on September 12, 2013);
- **MW-3U**: PCE (10.6 µg/L [11.2 µg/L for the duplicate sample] on January 15, 2013 and 10.6 µg/L on September 11, 2013), TCE (277 µg/L [291 µg/L for the duplicate sample] on January 15, 2013 and 266 µg/L on September 11, 2013), 1,1-DCE (12.4 µg/L [13.4 µg/L for the duplicate sample] on January 15, 2013 and 10.6 µg/L on

September 11, 2013), cis-1,2-DCE (74 µg/L [72.7 µg/L for the duplicate sample] on January 15, 2013);

- **MW-3L**: PCE (9.9 µg/L on January 15, 2013 and 19.4 µg/L on September 11, 2013), TCE (244 µg/L on January 15, 2013 and 441 µg/L on September 11, 2013), 1,1-DCE (9.8 µg/L on January 15, 2013 and 15.6 µg/L on September 11, 2013), cis-1,2-DCE (92.8 µg/L on September 11, 2013);
- **MW-4U**: PCE (19.4 µg/L on September 11, 2013), TCE (132 µg/L on January 15, 2013 and 700 µg/L on September 11, 2013), 1,1-DCE (14.2 µg/L on September 11, 2013), cis-1,2-DCE (96.1 µg/L on September 11, 2013), THF (37.7 µg/L on January 15, 2013);
- **MW-4L**: PCE (7 µg/L on September 11, 2013), TCE (306 µg/L on September 11, 2013);
- **MW-7L**: TCE (5.7 µg/L on January 14, 2013 and 7.3 µg/L on September 9, 2013);
- **MW-10L**: TCE (64.9 µg/L on January 15, 2013 and 72.6 µg/L on September 11, 2013);
- **MW-11U**: PCE (5.9 on September 12, 2013), TCE (146 µg/L on September 12, 2013), 1,1-DCE (9.2 µg/L on September 12, 2013);
- **MW-11L**: TCE (57.2 µg/L on September 12, 2013);
- **MW-12U**: TCE (7.8 µg/L on September 10, 2013).

6.3 Groundwater Elevations and Flow Direction

Shallow bedrock groundwater elevation data for January, May, and September 2013 is provided on **Figures 8, 9,** and **10**, respectively. Groundwater flow within the bedrock aquifer occurs primarily along fractures and joints and is expected to be influenced by pumping of potable water wells within the Site Area. Dewatering activities at the nearby Hanson Quarry to the east are also expected to have a significant influence on nearby water levels. Other potential influences on the potentiometric surface at the Site Area include the wastewater treatment and discharge operations that occur at the church and school along Durham Road and the Harrow Station Shopping Center along Easton Road at the intersection with Tower Road.

Shallow bedrock groundwater elevation contours were interpreted from water levels in the shallow well screens and open borehole wells. Groundwater elevations in the specified wells ranged between 363 and 452 feet above MSL at the times the three rounds of data were collected. The groundwater contour figures indicate the potentiometric surface varies significantly across the Site Area and is characterized by higher groundwater elevations at the central portion of the Site Area beneath the church and school property located at 4040 Durham

Road. Groundwater elevations decrease to the northwest, southwest, and southeast from the central portion of the Site Area (**Figures 8, 9,** and **10**). Groundwater flow to the northwest, west, and southwest toward Haycock Creek/Lake Nockamixon is expected and reported for the area. The component of flow toward the south and southeast is suspected to be related to the pumping of home and commercial wells in that direction along Routes 611 and 412, as well as the ongoing dewatering activities at the Hanson Quarry. As discussed in **Section 2.3**, groundwater storage and movement at the Site Area is primarily by secondary openings including bedding planes and joints and tends to be anisotropic and heterogeneous. Horizontal permeability is much greater than vertical permeability and is greatest parallel to strike or in the orientation of most major joint systems (northeast to southwest).

6.4 PADEP Passive Diffusion Bag Groundwater Sampling

The PADEP performed a round of groundwater sampling using passive diffusion bags to collect the samples. The bags were placed in the monitoring wells by PADEP personnel on November 25, 2013, and retrieved on December 11 and 12, 2013. Wells MW-1S, MW-1L, MW-2U, MW-2L, MW-3U, MW-3L, MW- 4U, MW-4L, MW-5, MW-6, MW-7U, MW-7L, MW-8, MW-9, MW-10L, MW-11U, MW-11L, MW-12U, and MW-12L were sampled. The samples were submitted to the PADEP BOL in Harrisburg, Pennsylvania, for analysis of VOCs by USEPA Method 8260C. Results of the passive diffusion bag samples are provided in **Table 7**.

7.0 SIGNIFICANT FINDINGS

The significant findings associated with the site investigation work conducted to date are presented below:

- The private water well sampling efforts between 2002 and 2013 have identified the presence of TCE in 44 different wells at concentrations as high as 411 µg/L. PCE has been detected in 32 wells at concentrations as high as 24.3 µg/L. 1,1-DCE was detected in 27 wells and cis-1,2-DCE was detected in 33 wells at concentrations as high as 14.7 µg/L and 105 µg/L, respectively. The highest concentrations of the identified chlorinated organic compounds occur in private wells along Brennan Road immediately to the southeast of what is identified as the Nockamixon Township Route 563 Drum Site.
- TCE and other chlorinated organic compounds were found at concentrations between 100 and 200 µg/L in private water wells along Mountainview Drive to the southwest of the intersection with Durham Road in association with Donohue's Gulf gas station LUST case investigation and remediation between 1997 and 2007. The chlorinated organic compounds were not attributed to historical operations associated with the gas station and are suspected to be the result of the drum storage/dumping at the nearby Nockamixon Township Route 563 Drum Site on Brennan Road.
- The review of PADEP files for environmental sites within or nearby the Site Area identified a septic tank waste and drum dump site present along Brennan Road between Mountainview Drive and Durham Road (known as Nockamixon Township Route 563 Drum Site). The site was reportedly used for the disposal of septic tank wastes in the 1970s and for the storage of 55 drums of unknown content at a less than one acre area of land during the 1980s. USEPA performed Preliminary Assessment and Site Inspection activities in 1989 and 1990. One or more chlorinated organic compounds were detected in three nearby home well samples at concentrations as high as 160 ppb (TCE). Three of four soil samples contained three chlorinated organic compounds (TCE, PCE, and 1,1,1-TCA) at levels as high as 44,000 ppb. The same soil samples also contained several SVOCs (pyrene and chrysene) and one soil sample contained PCBs at a concentration of 5,200 ppb. No further investigative or remedial work appears to have occurred at that site. Additionally, unusual land disturbances indicative of pits or trenching are visible at multiple locations of that property on historical aerial photographs of the 1970s.

- A soil sample was collected during the installation of MW-1 from four to five fbg where elevated PID readings were detected. The chlorinated organic compounds TCE, PCE, and 1,1,1-TCA were detected in the sample at concentrations of 5.14 milligram per kilogram (mg/kg), 55.6 mg/kg, and 2.34 mg/kg, respectively. The TCE and PCE results exceed their applicable PADEP MSC soil to groundwater numeric values.
- Groundwater samples were collected from a network of bedrock monitoring wells installed as part of the PADEP site investigation work in 2013. The highest concentrations of TCE, PCE, 1,1-DCE, and cis-1,2-DCE were all detected in MW-2U at concentrations of 2,210 µg/L, 105 µg/L, 112 µg/L, and 518 µg/L, respectively. MW-2U is located within the boundaries of the Nockamixon Township Route 563 Drum Site. Elevated concentrations of the identified compounds were also detected in groundwater samples from wells MW-1U, MW-1S, MW-2L, MW-3U, MW-3L, MW-4U, MW-4L, and MW-11U. These wells are all in close proximity to what is identified as the Nockamixon Township Route 563 Drum Site.
- Monitoring wells MW-1S, MW-2, MW-3, and MW-11 produced significant amounts of water from fractures during drilling. These wells are located in close proximity to or within the property that has been identified as the Nockamixon Township Route 563 Drum Site. Wells MW-1S, MW-2, and MW-11 began producing water between 110 and 140 fbg. Another water-bearing fracture zone is present between 160 and 175 fbg in wells MW-2, MW-3, and MW-11 (MW-1S only drilled to 145 fbg). The fractures encountered in MW-1S produced 14 to 20 gpm at the time of drilling, MW-2 produced 50 to 60 gpm, and MW-11 produced 35 gpm. These connected and highly transmissive fracture zones are suspected to extend farther to the northwest and southeast of the Nockamixon Township Route 563 Drum Site property, propagating the movement of chlorinated organic compounds in groundwater from beneath that site in those directions. The detections of chlorinated organic compounds in the private water wells (**Figures 5** and **6**) strongly support this theory.

8.0 RECOMMENDATIONS

The following recommendations are presented based upon the findings of site investigation work conducted to date and documented in this Project Investigation Report.

Leidos recommends further investigation of the Nockamixon Township Route 563 Drum Site as identified in the NUS historical reports presented in **Section 3.5** based upon the results of the home and monitoring well sampling activities. Specifically, Leidos recommends:

- The performance of a shallow subsurface geophysics survey within the boundaries of the Nockamixon Township Route 563 Drum Site to investigate the potential presence of buried wastes and subsurface abnormalities such as trenches and/or larger buried objects. **Figure 11** identifies the boundaries of the former site on a recent aerial photograph. Features such as drum storage and removal areas, paths, and landmarks are superimposed. Areas of land disturbance visible on the 1971 and 1978 aerial photographs are also superimposed. The geophysics work will be focused on the targeted areas identified on **Figure 11**. However, additional areas may also be investigated if additional waste storage or burial information is obtained from the landowner interviews.
- The performance of a test pitting and soil sampling program at potential waste burial areas based upon the locations of waste storage areas presented in the NUS reports, interviews, ground surface disturbances visible on the historical aerial photographs, and the findings of the shallow subsurface geophysics survey.
- The completion of an additional round of groundwater monitoring at all Site Area wells in late spring/early summer 2014 to further establish seasonal water level and contaminant trends.

9.0 REFERENCES

Greenman, David W., 1955. Ground Water Resources of Bucks County, Pennsylvania, Commonwealth of Pennsylvania, Bureau of Internal Affairs, Topographic and Geological Survey.

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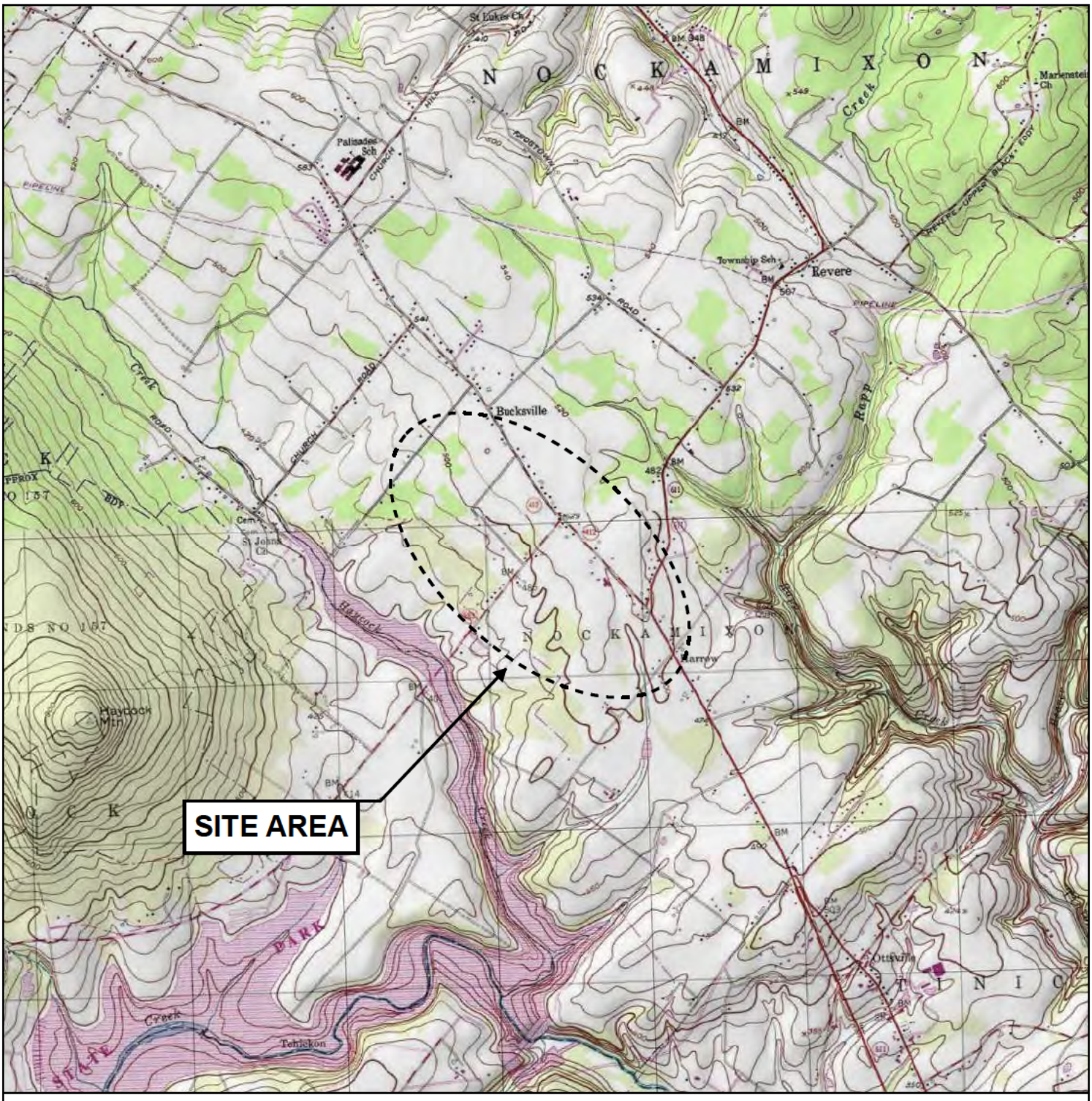
Smoot, 1999. Early Mesozoic-Sedimentary Rocks, Chapter 12A in The Geology of Pennsylvania, 1999, Pennsylvania Geological Survey and Pittsburgh Geological Society.

Socolow, Arthur A., Geologic Map of Pennsylvania – 1980, Commonwealth of Pennsylvania Department of Environmental Resources Bureau of Topographic and Geologic Survey.

United States Department of Agriculture (USDA) – Natural Resource Conservation Service (NRCS); May 20, 2010; “Web Soil Survey”; http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

FIGURES



Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

0 1,500 3,000 6,000 Feet

1 inch = 3,000 ft

GTAC-5
Nockamixon TCE Site
Nockamixon Township, PA

Site Location Map

drawn	TAY	checked	RLM	approved	RLM	figure no.
date	01/13/2014	date	01/13/2014	date	01/13/2014	1
job no. 4501020115/2070				file no. Fig 1 - Site Location		

initials	date	revision

leidos

N

G:\GTAC\Nockamixon\Projects\Fig 1 - Site Location.mxd

Cabot Metals Site

Former Gas Station(s)

RT 611 - EASTON ROAD

Brown Schoen Rd

PARK DRIVE WEST

BRENNAN DRIVE

Revere Chemical Waste Site

Nockamixon Twp. Route 563 Drum Site

563 Drum Site

BRENNAN ROAD

RT 412 - DURHAM ROAD

Harrow Station Shopping Center Harley Davidson Parts

QUARRY ROAD

Park Dr Orchid Nursery and Machine Shop

Quarry Equipment Maintenance Facility

Former Mountainview Plaza

Former Przyuski's Restaurant

Nockamixon State Park

Former Ford Dealership

Hanson Quarry

Harrow Station Shopping Center

Specialty Woods

Tabor Rd

Top Rock Trl

RT 563 - MOUNTAINVIEW DR

Tower Farm Horses

TOWER ROAD

Linden Hill Gardens

RT 611 - EASTON ROAD

Swamp's Auto Body and NAPA Auto Parts

Former Bickel Landfill Area

Buck Run Rd

Mountain View Dr

563

Fleck Farm

Communications Tower

Easton Rd

Annwand's Rd

Gravel Hill Rd

Fern Dr

Legend:

Zoning Areas

- C - Commercial
- I - Industrial
- LI - Light Industrial
- OSM - Open Space Management
- Q - Quarry
- R - Residential
- VC - Village Center
- Parcel Boundaries
- Site Area

N

Source Imagery:
USGS Ortho Aerial
c. 2005 Bedminster PA Quadrangle PA
Projection: NAD 1983, UTM Zone 18

0 600 1,200 2,400 Feet

1" = 1200 feet

GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

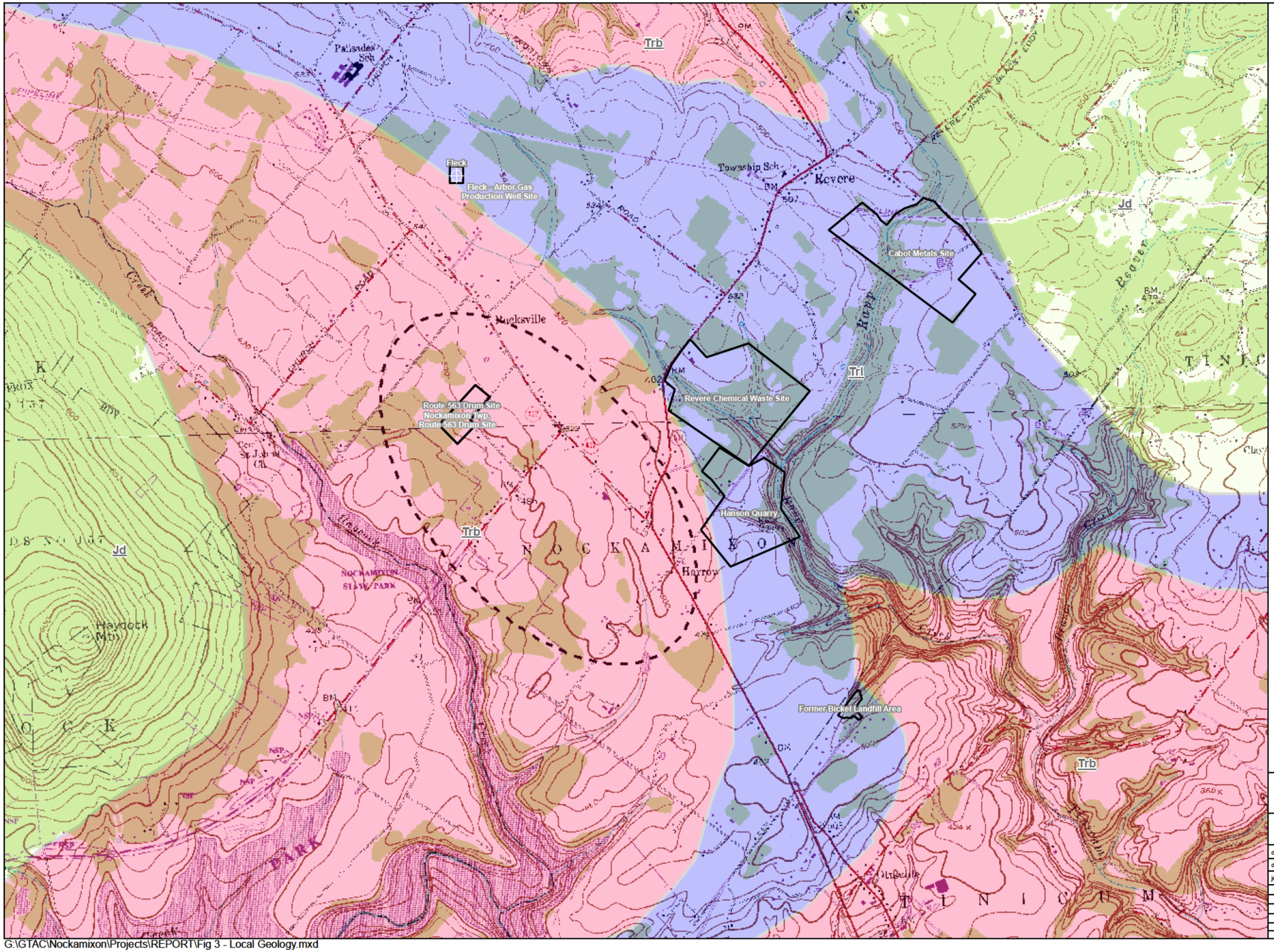
Site Area and Zoning Map

drawn	TAY	checked	LAC	approved	RLM	figure no.
date	01/13/2014	date	01/14/2014	date	01/14/2014	2
job no.	4501020115/2070			file no.	Fig 2 - Site Area and Zoning	

initials	date	revision

leidos

G:\GTAC\Nockamixon\Projects\Fig 2 - Site Area and Zoning.mxd



Legend

Site Area

PA Geology

- Diabase: Intrusive igneous rock; medium to coarse grained labradorite and pyroxenes
- Brunswick Formation: Typically reddish-brown shale, siltstone and mudstone with occasional green and brown shale interbeds. Interbedded argillites near base.
- Lockatong Formation: Dark gray to black, thick bedded argillite with occasional zones of thin bedded black shale.

N

Source Imagery:
USGS Ortho Aerial
c. 2005 Bedminster PA Quadrangle PA
Projection: NAD 1983, UTM Zone 18

0 1,000 2,000 4,000 Feet

1" = 2000 feet

GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

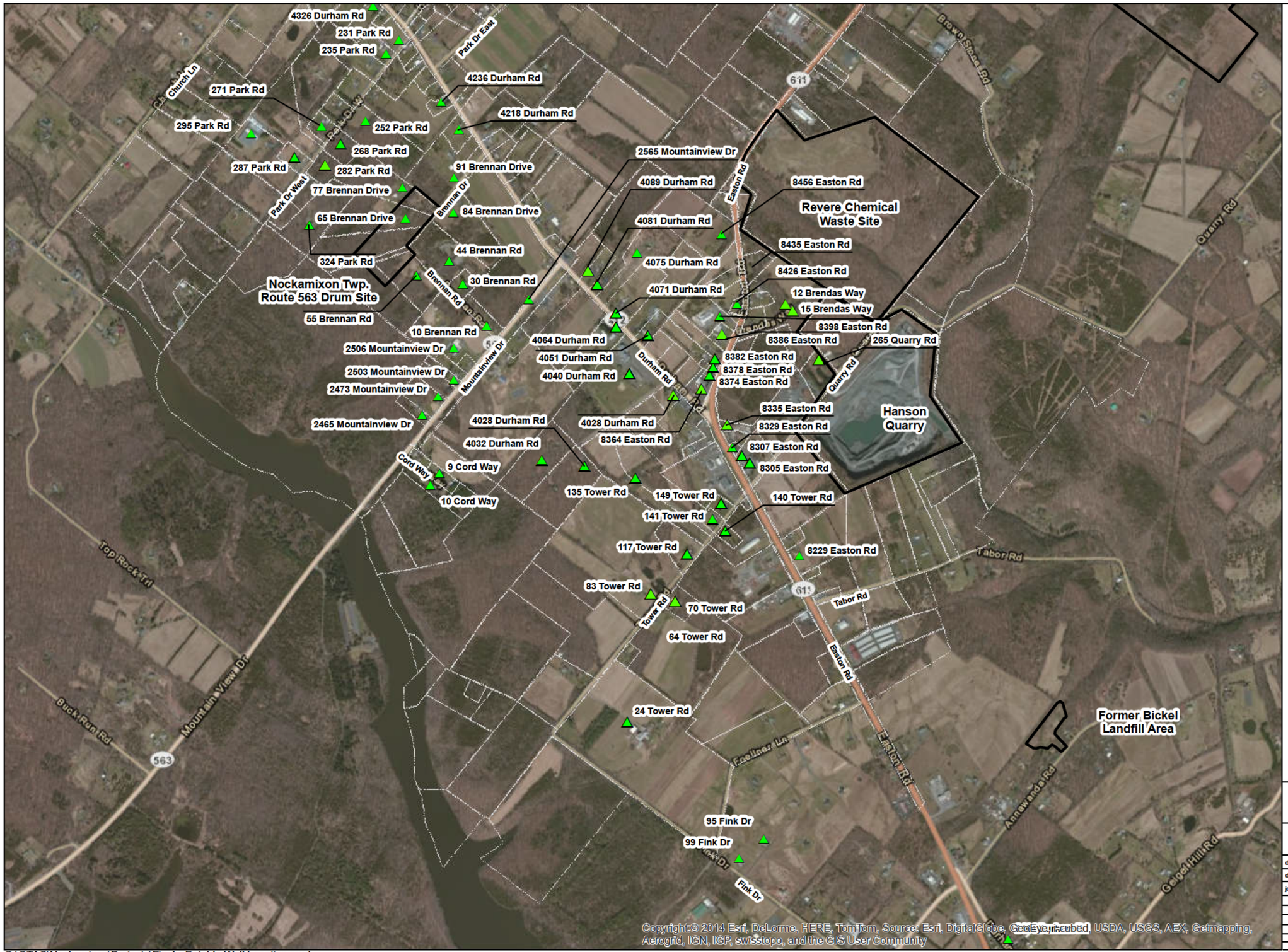
Local Geology Map

drawn	checked	approved	figure no.
JWS	RLM	RLM	3
date 6/15/10	date 6/15/10	date 12/5/2013	
job no. 4501020115/2070		file no. Fig 3 - Local Geology	

initials	date	revision

leidos

G:\GTAC\Nockamixon\Projects\REPORT\Fig 3 - Local Geology.mxd



Legend:

- PADEP Potable Well Groundwater Samples
- 8325 Property Address Number
- Parcel Boundary

N

Source Imagery:
USGS Ortho Aerial
c. 2005 Bedminster PA Quadrangle PA
Projection: NAD 1983, UTM Zone 18

0 600 1,200 2,400 Feet

1" = 1200 feet

GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Potable Well Location Map

drawn JWS	checked LAC	approved RLM	figure no. 4
date 8/15/10	date 12/5/13	date 12/6/2013	
job no 4501020115/2070		file no. Fig 4 - Potable Well Location	

initials	date	revision

leidos

G:\GTAC\Nockamixon\Projects\Fig 4 - Potable Well Location.mxd

Cabot Metals Site

Revere Chemical Waste Site

Nockamixon Twp. Route 563 Drum Site

Hanson Quarry

Former Bickel Landfill Area

Park Dr East

Park Dr West

Church Ln

Brennan Dr

Brennan Rd

Mountainview Dr

Cord Way

Durham Rd

Easton Rd

Quarry Rd

Tabor Rd

Tower Rd

Fink Dr

Haycock Run Rd

Top Rock Trl

Back Run Rd

Mountain View Dr

563

611

Tabor Rd

Geigel Hill Rd

Clay Ridge Rd

Durham Rd

S Park Rd

Park Rd

Legend:

Historical TCE Results

- Non-detect
- 0.1-4.9 µg/L
- 5.0-19.9 µg/L
- 20.0-99.9 µg/L
- 100+ µg/L
- Parcel Boundary

Home well samples collected between 2009 and 2013. The highest reported result for TCE at each location was used.

N

Source Imagery:
USGS Ortho Aerial
c. 2005 Bedminster PA Quadrangle PA
Projection: NAD 1983, UTM Zone 18

0 750 1,500 3,000 Feet

1 inch = 1,500 feet

GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

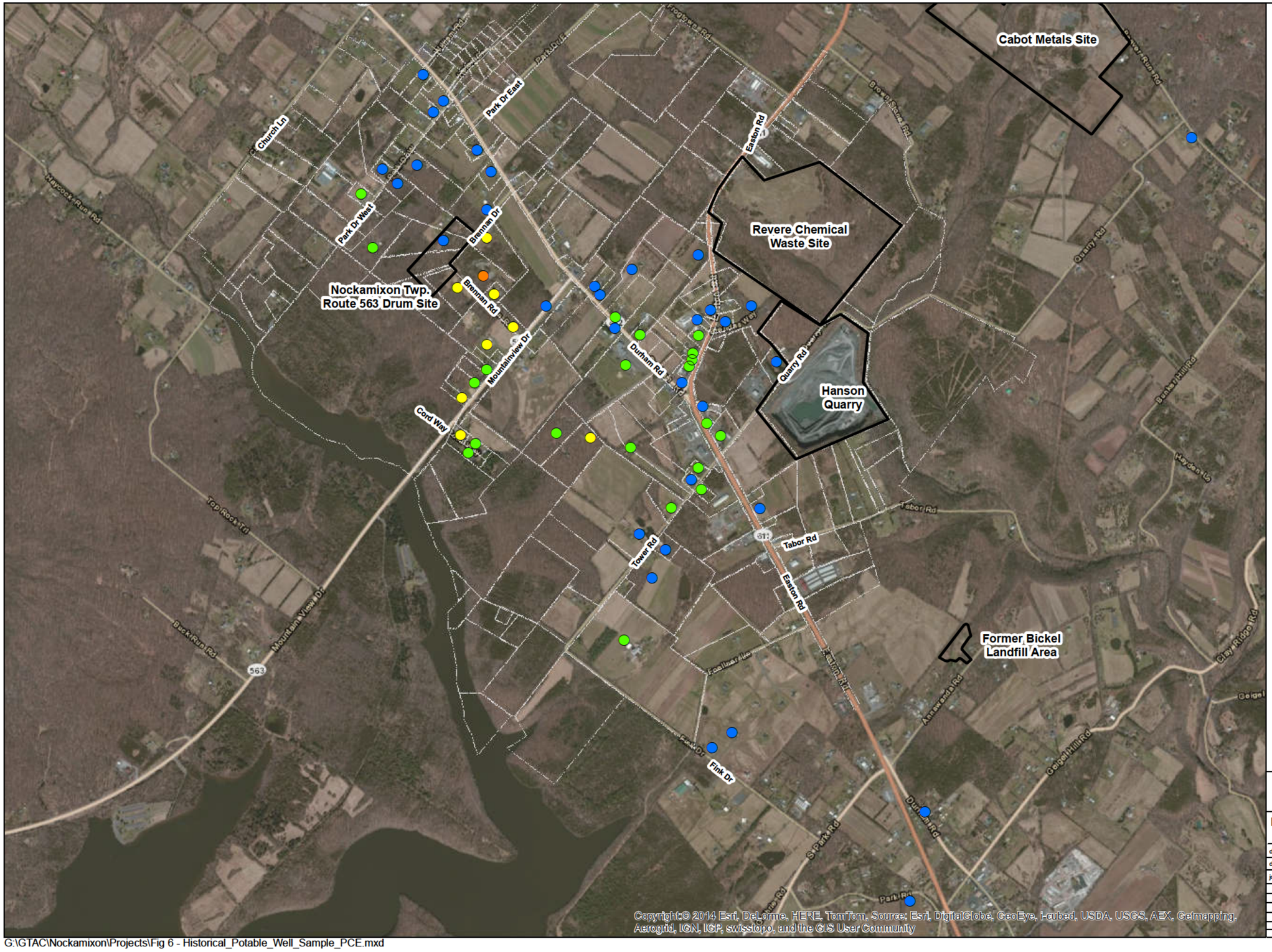
Historical Potable Well Sample Results Map – TCE Concentrations

drawn TAY	checked LAC	approved RLM	figure no. 5
date 12/5/2013	date 12/5/13	date 12/6/2013	
job no. 4501020115/2070			file no. Fig 5 - Historical_Potable_Well_Sample_TCE

initials	date	revision

leidos

G:\GTAC\Nockamixon\Projects\Fig 5 - Historical_Potable_Well_Sample_TCE.mxd



Legend:

Historical PCE Results

- Non-detect
- 0.1-4.9 µg/L
- 5.0-19.9 µg/L
- 20.0-99.9 µg/L
- Parcel Boundary

Home well samples collected between 2009 and 2013. The highest reported result for TCE at each location was used.

N

Source Imagery:
USGS Ortho Aerial
c. 2005 Bedminster PA Quadrangle PA
Projection: NAD 1983, UTM Zone 18

0 750 1,500 3,000 Feet

1 inch = 1,500 feet

GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Historical Potable Well Sample Results Map – PCE Concentrations

drawn TAY	checked LAC	approved RLM	figure no. 6
date 12/5/2013	date 12/5/13	date 12/6/2013	
job no. 4501020115/2070			file no. Fig 6 - Historical_Potable_Well_Sample_PCE

initials	date	revision

leidos

G:\GTAC\Nockamixon\Projects\Fig 6 - Historical_Potable_Well_Sample_PCE.mxd

Legend:

- Monitoring Well Location
- Parcel Boundaries
- A — A' Transect for Geologic Cross Section in Appendix G

N

0 400 800 1,600 Feet

1" = 800 feet

GTAC5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Monitoring Well Location Map

drawn	TAY	checked	LAC	approved	RLM	figure no.
date	11/19/13	date	12/5/13	date	12/6/13	7
job no.	4501020115/2070			file no.	Fig 7 - MW Location Map	

initials	date	revision

leidos

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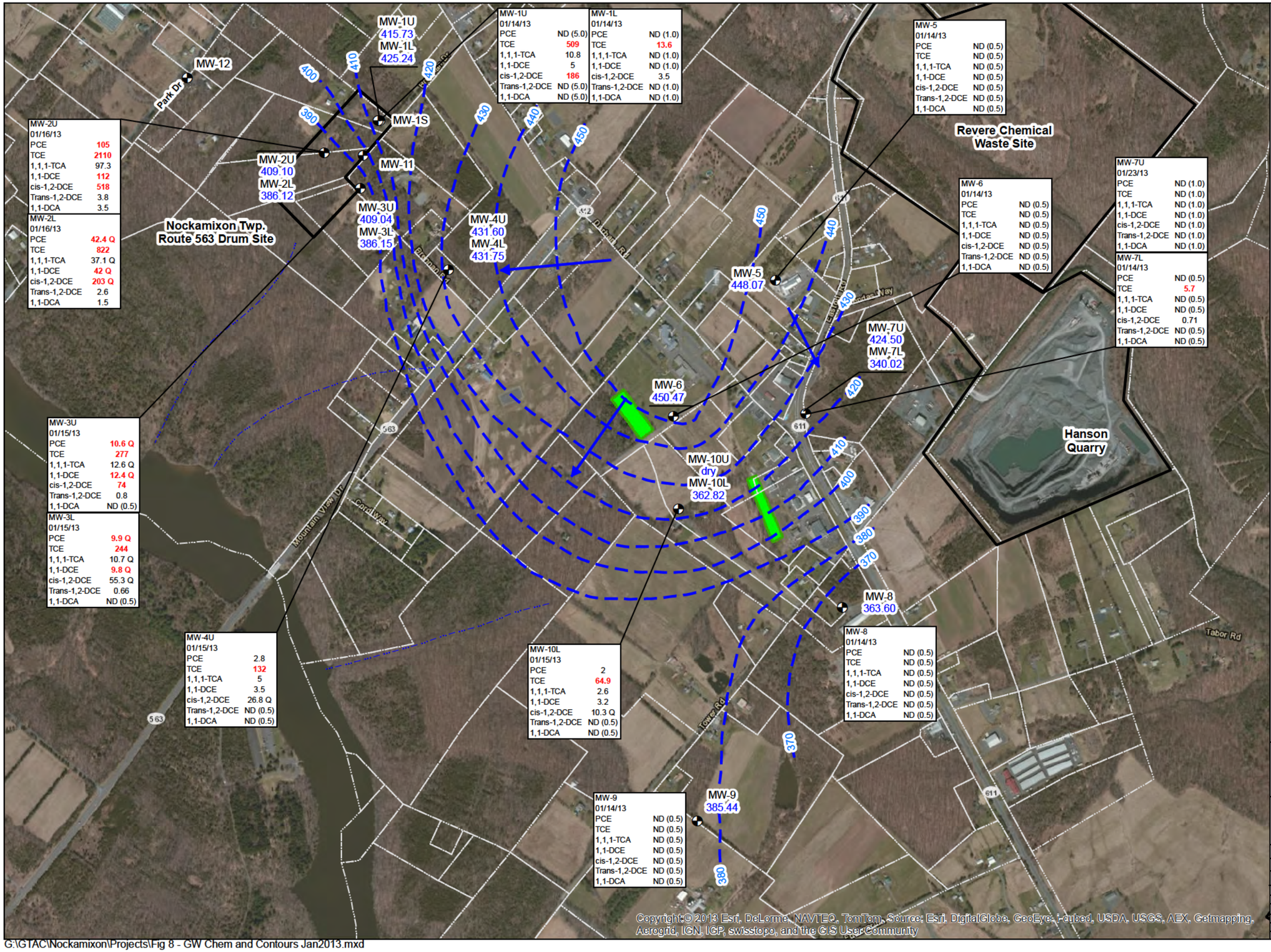


Legend

- Monitoring Well Location
- Groundwater Elevation Contours for Upper Screen Interval in feet AMSL (inferred)
- Ephemeral Streams
- Parcel Boundaries
- Large Scale Wastewater Treatment/ Discharge Device
- Inferred Groundwater Flow Direction

46 - Bold red text indicates concentrations that exceed the PADEP Act 2 Non-Residential, Used Aquifer

MW-10 not used in contouring

All results in µg/L

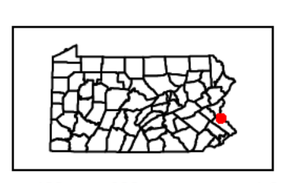
µg/L = micrograms per liter

MW-12L - lower screen groundwater value
389.43 - Groundwater Elevation in feet above mean sea level (AMSL)
MW-12U - upper screen groundwater value
389.43 - Groundwater Elevation in feet above mean sea level (AMSL)

Q - Contaminant Concentration reported from multiple analyses

ND - Non Detect

Abbreviation	Analyte	GW MCL
PCE	Tetrachloroethylene	5
TCE	Trichloroethene	5
1,1,1-TCA	1,1,1-Trichloroethane	200
1,1-DCE	1,1-Dichloroethylene	7
cis-1,2-DCE	cis-1,2-Dichloroethylene	70
Trans-1,2-DCE	Trans-1,2-Dichloroethylene	100
1,1-DCA	1,1-Dichloroethane	31



N

0 400 800 1,600 Feet

1" = 800 feet

GTAC5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Groundwater Chemistry and Contour Map – January 2013

drawn TAY	checked LAC	approved RLM	figure no. 8
date 12/27/2013	date	date	
job no. 4501020115/2070		file no. Fig 8 - GW Chem and Contours Jan2013	

initials	date	revision

leidos

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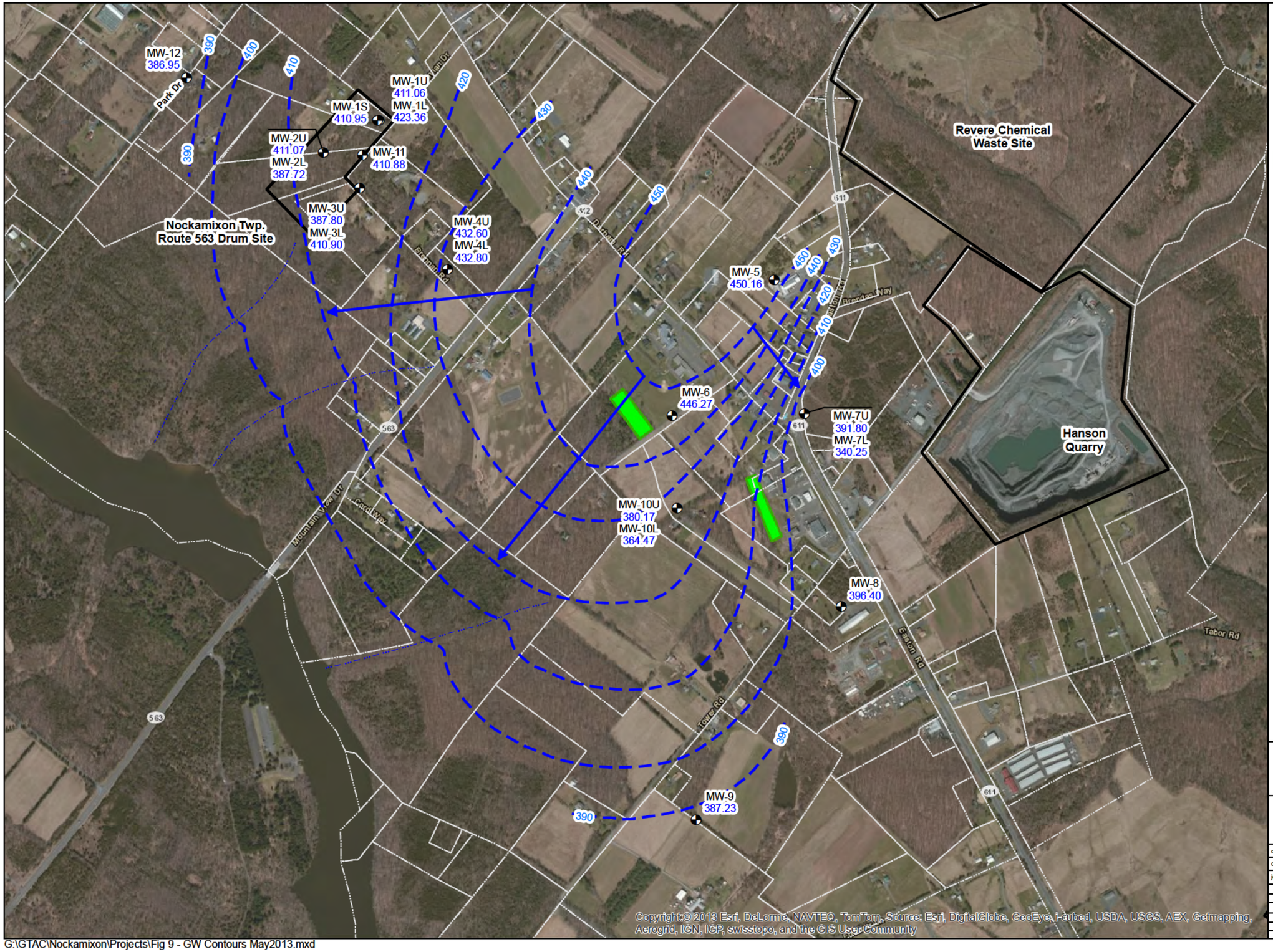

Legend

- Monitoring Well Location
- Groundwater Contours (inferred)
- Ephemeral Streams
- Parcel Boundaries
- Large Scale Wastewater Treatment/ Discharge Device
- Groundwater Flow Direction

MW-10 not used in contouring

MW-12L - lower screen groundwater value
389.43 - Groundwater Elevation in feet above mean sea level (AMSL)
MW-12U - upper screen groundwater value
389.43 - Groundwater Elevation in feet above mean sea level (AMSL)

N

0 400 800 1,600 Feet

1" = 800 feet

GTAC5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Groundwater Contour Map
May 20, 2013

drawn TAY	checked LAC	approved RLM	figure no.
date 12/27/2013	date	date	9
job no. 4501020115/2070		file no. Fig 9 - GW Contours May2013	

initials	date	revision

leidos

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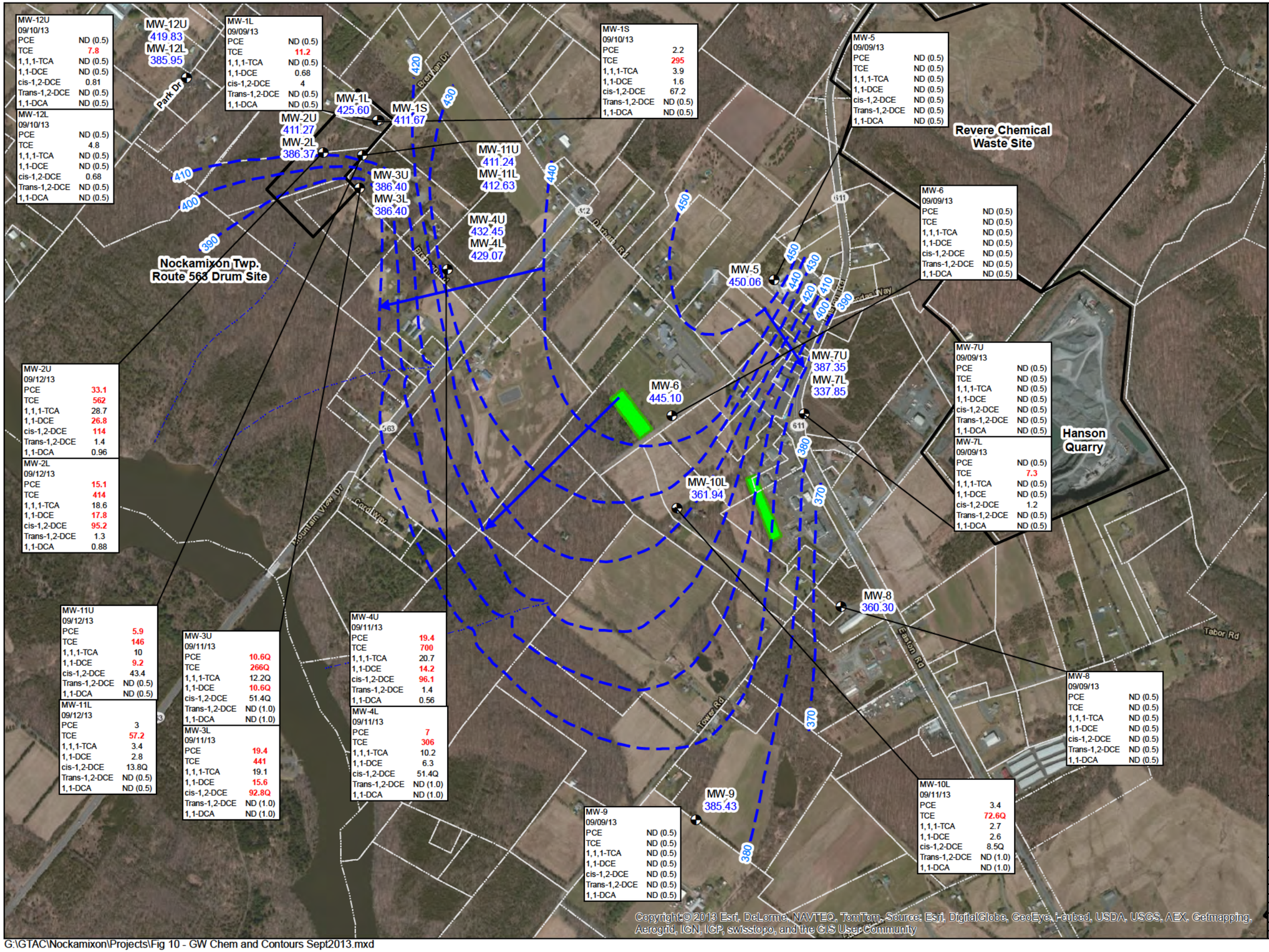


Legend

- Monitoring Well Location
- Groundwater Elevation Contours for Upper Screen Interval in feet AMSL (inferred)
- Ephemeral Streams
- Parcel Boundaries
- Large Scale Wastewater Treatment/ Discharge Device
- Inferred Groundwater Flow Direction

46 - Bold red text indicates concentrations that exceed the PADEP Act 2 Non-Residential, Used Aquifer

MW-10 not used in contouring

All results in µg/L

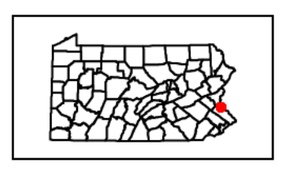
µg/L = micrograms per liter

MW-12L - lower screen groundwater value
389.43 - Groundwater Elevation in feet above mean sea level (AMSL)
MW-12U - upper screen groundwater value
389.43 - Groundwater Elevation in feet above mean sea level (AMSL)

Q - Contaminant Concentration reported from multiple analyses

ND - Non Detect

Abbreviation	Analyte	GW MCL
PCE	Tetrachloroethylene	5
TCE	Trichloroethene	5
1,1,1-TCA	1,1,1-Trichloroethane	200
1,1-DCE	1,1-Dichloroethylene	7
cis-1,2-DCE	cis-1,2-Dichloroethylene	70
Trans-1,2-DCE	Trans-1,2-Dichloroethylene	100
1,1-DCA	1,1-Dichloroethane	31



N

0 400 800 1,600 Feet

1" = 800 feet

GTAC5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Groundwater Chemistry and Contour Map – September 2013

drawn TAY	checked LAC	approved RLM	figure no. 10
date 12/27/2013	date	date	
job no. 450102011S/2070			file no. Fig 10 - GW Chem and Contours Sept2013

initials	date	revision

leidos

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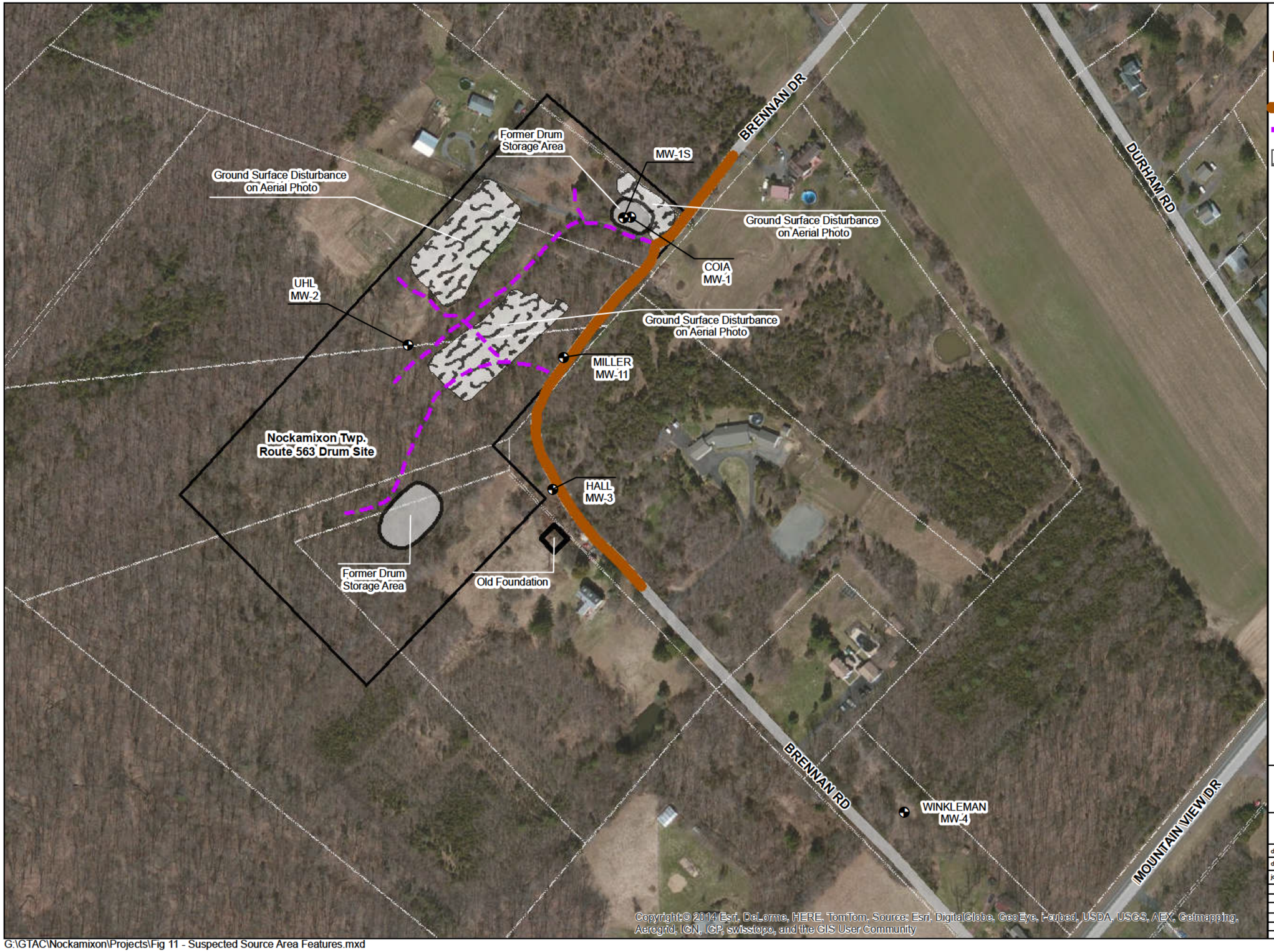

Legend

- Monitoring Well Location
- Former Roadway
- Former Path
- Ground Surface Disturbance on Aerial Photo

N

0 100 200 400 Feet

1 inch = 200 feet

GTAC5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Suspected Source Area Features Map

drawn TAY	checked LAC	approved RLM	figure no. 11
date 01/13/2014	date	date	
job no. 450102011S/2070		file no. Fig 11 - Suspected Source Area Features	

initials	date	revision

leidos

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TABLES

Table 1
Historic and Current Potable Well Sample Results
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Sample Location	Date	PCE	1,1,1,2-PCA	1,1,2,2-PCA	TCE	1,1,1-TCA	1,1,2-TCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1-DCA	1,2-DCA	VC
EPA Drinking Water Contaminants MCLs		**5**	**--**	**--**	**5**	**200**	**5**	**7**	**70**	**100**	**--**	**5**	**2**
PADEP Act 2 MCLs - GW in Residential, Used Aquifer		**5**	**70**	**0.3**	**5**	**200**	**5**	**7**	**70**	**100**	**27**	**5**	**2**
24 Tower Rd	11/15/10	3.73	ND	ND	**8.43**	0.69	ND	5.72	27.30	ND	2.88	ND	ND
	4/18/11	4.04	NA	NA	**8.38**	0.732	ND	6.25	30.40	ND	2.96	NA	NA
	12/28/11	3.88	NA	NA	**8.92**	0.731	ND	6.97	31.80	ND	3.32	NA	NA
	12/13/12	4.70 Q	NA	NA	**10.8 Q**	0.794	NA	**7.43 Q**	32.8 Q	NA	3.56 Q	NA	NA
64 Tower Rd	6/26/02	ND	ND	ND	0.17	ND	ND	ND	ND	ND	ND	ND	ND
	10/27/09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	11/15/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/18/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
70 Tower Road	4/18/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
83 Tower Rd	4/28/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	11/15/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/19/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
117 Tower Rd	6/26/02	0.462	ND	ND	**7.67**	0.539	ND	0.184	0.27	ND	ND	*0.0731 J*	ND
	4/30/10	0.602	ND	ND	**9.52**	0.506	ND	0.315	0.693	ND	ND	ND	ND
	4/26/11	0.668	NA	NA	**9.67**	0.526	ND	0.492	1.12	ND	ND	NA	NA
	4/25/13	0.587	NA	NA	**11.0**	0.575	NA	0.325	1.32	NA	NA	NA	NA
135 & 133 Tower Rd [(1)]	5/29/02	1.58	ND	ND	**26.80**	1.7	ND	0.81	1.41	ND	ND	0.12	ND
	10/27/09	1.77	ND	ND	**32.40**	1.47	ND	1.03	3.39	ND	ND	ND	ND
	4/27/10	2.63	ND	ND	**41.40**	1.74	ND	1.44	4.85	ND	ND	ND	ND
	11/15/10	2.92	ND	ND	**47.70**	1.72	ND	1.68	5.60	ND	ND	ND	ND
	4/21/11	2.84	NA	NA	**45.80**	1.77	ND	2.20	7.08	ND	ND	NA	NA
	12/28/11	2.60	NA	NA	**40.80**	1.56	ND	1.72	5.85	ND	ND	NA	NA
	12/13/12	3.5	NA	NA	**60.9**	ND	NA	ND	7.83	NA	NA	NA	NA
140 Tower Rd	6/26/02	0.187	ND	ND	3.21	0.245	ND	ND	0.12	ND	ND	0.05	ND
	4/20/11	0.513	NA	NA	**6.92**	0.384	ND	0.31	0.628	ND	ND	NA	NA
	3/15/12	0.443	NA	NA	**5.83**	ND	ND	ND	0.561	ND	ND	NA	NA
	12/18/12	0.630	NA	NA	**9.80**	0.486	NA	0.399	0.876	NA	ND	NA	NA
141 Tower Rd	6/26/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	8/10/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
149 Tower Rd	6/26/02	ND	ND	ND	0.12	ND	ND	ND	ND	ND	ND	ND	ND
	10/29/09	ND	ND	ND	**5.10**	ND	ND	ND	ND	ND	ND	ND	ND
	4/27/10	ND	ND	ND	4.14	ND	ND	ND	0.292	ND	ND	ND	ND
	11/15/10	0.387	ND	ND	**6.62**	0.35	ND	0.32	0.577	ND	ND	ND	ND
	4/27/11	0.288	NA	NA	4.58	0.314	ND	ND	0.499	ND	ND	NA	NA
	1/31/12	ND	NA	NA	3.59	ND	ND	ND	0.366	ND	ND	NA	NA
	12/13/12	0.357	NA	NA	**6.12**	0.363	NA	0.262	0.569	NA	ND	NA	NA
8229 Easton Rd	4/27/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
8305 Easton Rd	6/26/02	0.056	ND	ND	1.05	0.117	ND	ND	ND	ND	ND	ND	ND
	10/29/09	ND	ND	ND	1.92	ND	ND	ND	ND	ND	ND	ND	ND
	11/16/10	ND	ND	ND	2.92	ND	ND	ND	ND	ND	ND	ND	ND
	4/27/11	ND	NA	NA	2.48	ND	ND	ND	ND	ND	ND	NA	NA
8329 Easton Rd	10/27/09	ND	ND	ND	**6.31**	ND	ND	ND	*0.727 J*	ND	ND	ND	ND
	4/28/10	ND	ND	ND	2.54	ND	ND	ND	0.28	ND	ND	ND	ND
	11/16/10	0.719	ND	ND	**13.10**	0.573	ND	0.57	1.48	ND	ND	ND	ND
	4/19/11	0.308	NA	NA	4.11	ND	ND	ND	0.48	ND	ND	NA	NA
	12/28/11	ND	NA	NA	0.42	ND	ND	ND	ND	ND	ND	NA	NA
	12/13/12	0.447	NA	NA	**8.39 Q**	0.412	NA	0.352	1.12	NA	ND	NA	NA
8335 Easton Rd	4/28/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8364 Easton Rd (Suburban Ford)	5/29/02	0.058	ND	ND	3.51	0.059	ND	0.09	0.17	ND	ND	ND	ND
	5/9/11	0.447	NA	NA	**8.83**	0.381	ND	0.42	1.30	ND	ND	NA	NA
8374 Easton Rd	11/16/10	0.589	ND	ND	**11.60**	0.594	ND	0.50	1.31	ND	ND	ND	ND
	4/19/11	0.698	NA	NA	**10.40**	0.69	ND	0.52	1.34	ND	ND	NA	NA
	12/28/11	0.463	NA	NA	**8.35**	0.512	ND	0.39	1.09	ND	ND	NA	NA
	12/13/12	0.496	NA	NA	**9.08**	0.457	NA	0.370	1.01	NA	NA	NA	NA
8378 Easton Rd	12/13/10	0.692	ND	ND	**14.50**	0.711	ND	0.54	1.32	ND	ND	ND	ND
	4/19/11	0.761	NA	NA	**13.60**	0.638	ND	0.53	1.42	ND	ND	NA	NA
	1/31/12	0.377	NA	NA	**9.01**	0.461	ND	0.36	1.11	ND	ND	NA	NA
	12/13/12	0.729	NA	NA	**12.4 Q**	0.537	NA	0.472	1.19	NA	ND	NA	NA

Table 1
Historic and Current Potable Well Sample Results
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Sample Location	Date	PCE	1,1,1,2-PCA	1,1,2,2-PCA	TCE	1,1,1-TCA	1,1,2-TCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1-DCA	1,2-DCA	VC
EPA Drinking Water Contaminants MCLs		**5**	**--**	**--**	**5**	**200**	**5**	**7**	**70**	**100**	**--**	**5**	**2**
PADEP Act 2 MCLs - GW in Residential, Used Aquifer		**5**	**70**	**0.3**	**5**	**200**	**5**	**7**	**70**	**100**	**27**	**5**	**2**
8382 Easton Rd	4/27/10	0.389	ND	ND	**14.60**	0.418	ND	ND	0.56	ND	ND	ND	ND
	11/15/10	0.995	ND	ND	**26.30**	0.746	ND	0.59	1.05	ND	ND	ND	ND
	4/27/11	1.21	NA	NA	**32.30**	0.958	ND	1.07	1.96	ND	ND	NA	NA
	1/11/12	1.32	NA	NA	**30.20**	0.969	ND	0.91	1.98	ND	ND	NA	NA
	12/13/12	1.75	NA	NA	**29.8**	1.13	NA	1.07	2.50	NA	ND	NA	NA
8386 Easton Rd	6/26/02	0.10	ND	ND	2.39	0.25	ND	0.08	0.10	ND	ND	ND	ND
8392 Easton Rd	12/20/10	ND	ND	ND	2.44	ND	ND	ND	ND	ND	ND	ND	ND
8398 Easton Rd	6/1/11	ND	NA	NA	2.60	ND	ND	ND	0.29	ND	ND	NA	NA
8411 Easton Rd	7/6/12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8426 Easton Rd	6/26/12	ND	ND	ND	4.52	ND	ND	ND	ND	ND	ND	ND	ND
8456 Easton Rd	1/9/12	ND	NA	NA	0.694	ND	ND	ND	ND	ND	ND	NA	NA
2464 Durham Rd	5/9/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
4018 Durham Rd	10/27/09	ND	ND	ND	2.36	ND	ND	ND	ND	ND	ND	ND	ND
	4/27/10	ND	ND	ND	0.587	ND	ND	ND	ND	ND	ND	ND	ND
	11/17/10	ND	ND	ND	1.58	ND	ND	ND	ND	ND	ND	ND	ND
4028 Durham Rd	4/27/10	2.24	ND	ND	**40.10**	1.54	ND	1.29	4.96	ND	ND	ND	ND
	11/17/10	**5.12 Q**	ND	ND	**93.4 Q**	3.46 Q	ND	3.4 Q	12.2 Q	ND	ND	ND	ND
	11/17/10 (DUP)	**5.54 Q**	ND	ND	**98.6 Q**	3.46 Q	ND	3.26 Q	12.9 Q	ND	ND	ND	ND
	4/2/11	2.4	NA	NA	**43.30**	1.56	ND	1.89	6.86	ND	ND	NA	NA
	12/28/11	2.47	NA	NA	**44.50**	1.63	ND	1.78	7.10	ND	ND	NA	NA
4032 Durham Rd	5/29/02	0.0996	ND	ND	1.80	0.127	ND	ND	0.09	ND	ND	ND	ND
	10/27/09	ND	ND	ND	3.45	ND	ND	ND	ND	ND	ND	ND	ND
	4/27/11	ND	NA	NA	3.18	ND	ND	ND	0.53	ND	ND	NA	NA
4040 Durham Rd	10/27/09	*0.981 J*	ND	ND	**17.00**	*0.815 J*	ND	ND	1.71	ND	ND	ND	ND
	4/27/10	1.35	ND	ND	**20.90**	0.996	ND	0.70	2.47	ND	ND	ND	ND
	6/21/11	1.62	NA	NA	**27.40**	0.926	ND	0.48	3.67	ND	ND	NA	NA
	8/10/11	1.33	NA	NA	**22.20**	0.777	ND	0.80	3.12	ND	ND	NA	NA
	1/31/12	1.29	NA	NA	**20.10**	0.701	ND	0.29	2.64	ND	ND	NA	NA
	12/12/12	1.41	NA	NA	**22.3 Q**	0.918	NA	0.840	3.01 Q	NA	NA	NA	NA
4051 Durham Rd	5/29/02	0.384	ND	ND	**5.08**	0.382	ND	0.25	0.44	ND	ND	ND	ND
	10/29/09	*0.933 J*	ND	ND	**17.80**	*0.824 J*	ND	*0.599 J*	1.99	ND	ND	ND	ND
	4/27/10	1.26	ND	ND	**20.30**	0.878	ND	0.66	2.25	ND	ND	ND	ND
	11/17/10	1.60	ND	ND	**26.80**	0.986	ND	0.95	3.57	ND	ND	ND	ND
	4/27/11	1.30	NA	NA	**24.30**	1.01	ND	1.13	4.08	ND	ND	NA	NA
	1/11/12	1.30	NA	NA	**22.00**	0.827	ND	0.89	3.22	ND	ND	NA	NA
	2/9/12	1.24	NA	NA	**20.80**	0.921	ND	0.85	3.18	ND	ND	NA	NA
	12/12/12	1.40	NA	NA	**22.8 Q**	0.907	NA	NA	NA	NA	NA	NA	NA
4066 & 4064 Durham Rd [(2)]	5/29/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/27/09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/27/10	ND	ND	ND	0.555	ND	ND	ND	ND	ND	ND	ND	ND
	4/27/10	ND	ND	ND	0.854	ND	ND	ND	ND	ND	ND	ND	ND
	11/15/10	ND	ND	ND	0.272	ND	ND	ND	ND	ND	ND	ND	ND
	4/27/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
4071 Durham Rd	6/26/02	0.0927	ND	ND	1.68	0.12	ND	ND	0.12	ND	ND	ND	ND
	10/29/09	ND	ND	ND	4.11	ND	ND	ND	ND	ND	ND	ND	ND
	4/27/10	ND	ND	ND	4.93	ND	ND	ND	0.51	ND	ND	ND	ND
	4/27/11	ND	NA	NA	2.72	ND	ND	ND	0.45	ND	ND	NA	NA
	1/11/12	ND	NA	NA	0.672	ND	ND	ND	ND	ND	ND	NA	NA
	12/12/12	NA	NA	NA	4.46 Q	NA	NA	NA	NA	NA	NA	NA	NA
4075 Durham Rd	4/18/11	ND	NA	NA	0.695	ND	ND	ND	ND	ND	ND	NA	NA
4081 Durham Rd	6/26/02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/27/09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/27/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/27/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
4089 Durham Rd	4/27/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	11/17/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4218 Durham Rd	5/31/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
4236 Durham Rd	5/11/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA

Table 1
Historic and Current Potable Well Sample Results
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Sample Location	Date	PCE	1,1,1,2-PCA	1,1,2,2-PCA	TCE	1,1,1-TCA	1,1,2-TCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1-DCA	1,2-DCA	VC
EPA Drinking Water Contaminants MCLs		**5**	**--**	**--**	**5**	**200**	**5**	**7**	**70**	**100**	**--**	**5**	**2**
PADEP Act 2 MCLs - GW in Residential, Used Aquifer		**5**	**70**	**0.3**	**5**	**200**	**5**	**7**	**70**	**100**	**27**	**5**	**2**
4326 Durham Rd	6/21/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
3 Park Dr	5/9/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
231 Park Dr	5/31/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
235 Park Dr	5/9/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
252 Park Dr	6/21/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
268 Park Dr	11/17/10	ND	ND	ND	1.00	ND	ND	ND	ND	ND	ND	ND	ND
	4/20/11	ND	NA	NA	0.914	ND	ND	ND	ND	ND	ND	NA	NA
271 Park Dr	4/27/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
282 Park Dr	10/27/09	ND	ND	ND	**6.5**	ND	ND	ND	*0.677 J*	ND	ND	ND	ND
	4/30/10	ND	ND	ND	**7.2**	ND	ND	ND	0.86	ND	ND	ND	ND
287 Park Dr	11/16/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/21/11	3.59 Q	NA	NA	**91.3**	5.32 Q	ND	5.82 Q	8.69 Q	ND	ND	NA	NA
	12/28/11	4.39 Q	NA	NA	**110**	6.29 Q	ND	6.28 Q	9.30 Q	ND	ND	NA	NA
294 Park Dr	4/21/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
	4/25/13	0.365	NA	NA	**9.38**	0.337	NA	0.271	1.14	NA	NA	NA	NA
	7/24/13	ND	NA	NA	**7.56**	0.304	NA	0.275	1.08	NA	NA	NA	NA
324 Park Dr	6/21/11	0.355	NA	NA	**10.9**	0.55	ND	0.47	0.745	ND	ND	NA	NA
	12/28/11	0.411	NA	NA	**12.4**	ND	0.63	0.60	1.07	ND	ND	NA	NA
	12/12/12	0.471	NA	NA	**11.3 Q**	0.556	NA	0.573	0.789	NA	NA	NA	NA
246 Beaver Run Rd	10/29/09	ND	ND	ND	1.41	ND	ND	ND	ND	ND	ND	ND	ND
12 Brendas Way	4/28/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	5/11/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
15 Brendas Way	4/28/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	5/11/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
265 Quarry Rd	4/28/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	11/16/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10 Brennan Rd	8/10/11	**11.9 Q**	NA	NA	**363**	11.2Q	0.38	**7.48Q**	57.2 Q	ND	0.33	NA	NA
	1/11/12	**12.5 Q**	NA	NA	**386**	11.6 Q	0.30	**8.54 Q**	62.20	ND	NA	0.31	NA
	12/18/12	**7.48**	NA	NA	**216**	6.47	NA	4.59	30.3	NA	ND	NA	NA
30 Brennan Rd	4/18/11	**8.28 Q**	NA	NA	**211 Q**	7.60 Q	ND	5.33 Q	37.50	ND	ND	NA	NA
	12/29/11	0.751	NA	NA	**12.9**	0.38	ND	0.31	2.12	ND	ND	NA	NA
44 Brennan Rd	4/18/11	**24.3**	NA	NA	**331**	17.1 Q	0.48	**12.2 Q**	**91**	ND	0.59	NA	NA
	12/28/11	**23.2 Q**	NA	NA	**411**	19.2 Q	0.53	**14.7 Q**	**105**	ND	0.64	NA	NA
55 Brennan Rd	4/21/11	**15.1 Q**	NA	NA	**254 Q**	15.2 Q	ND	**14.2 Q**	**72.5 Q**	0.38	0.50	NA	NA
	12/28/11	**18.40**	NA	NA	**320**	16.6 Q	0.41	**13.2 Q**	**80.50**	ND	0.52	NA	NA
65 Brennan Dr	11/25/13	0.46	ND	ND	**12**	ND	ND	0.30	0.74	ND	ND	0.67	ND
77 Brennan Rd	5/11/11	ND	NA	NA	**7.62**	0.28	ND	ND	1.12	ND	ND	NA	NA
	8/15/12	ND	NA	NA	**9.23**	0.356	NA	NA	1.44	NA	NA	NA	NA
	4/8/13	ND	NA	NA	**7.00**	ND	NA	NA	1.06	NA	NA	NA	NA
84 Brennan Rd	5/31/11	0.706	NA	NA	**9.85**	0.506	ND	0.45	1.58	ND	ND	NA	NA
	1/16/13	1.29	ND	ND	**16**	0.709	ND	0.643	2.34	ND	ND	ND	ND
	4/8/13	**8.28**	NA	NA	**43.6**	NA	NA	0.385	1.07	NA	NA	NA	NA
91 Brennan Rd	4/18/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
9 Cord Way	8/10/11	0.674	NA	NA	**7.13**	ND	ND	ND	0.35	ND	ND	NA	NA
	1/11/12	0.631	NA	NA	**8.21**	ND	ND	0.28	0.64	ND	ND	NA	NA
	12/12/12	1.26	NA	NA	**17.0 Q**	0.464	NA	0.517	1.30	NA	NA	NA	NA
10 Cord Way	4/27/11	0.318	NA	NA	2.08	ND	ND	ND	ND	ND	ND	NA	NA
2442 Mountainview	1/16/13	**9.05**	ND	ND	**57.5**	0.283	ND	0.538	1.49	ND	ND	ND	ND
	4/8/13	**8.28**	NA	NA	**43.6**	NA	NA	0.385	1.07	NA	NA	NA	NA
2465 Mountainview Dr	5/9/11	**7.11**	NA	NA	**44.9**	ND	ND	0.606	11.60	ND	ND	NA	NA
	12/28/11	**7.49**	NA	NA	**46.8**	ND	ND	0.529	11.20	ND	ND	NA	NA
	12/12/12	**5.10 Q**	NA	NA	**32.8**	ND	NA	0.316	6.52	NA	NA	NA	NA
2473 Mountainview Dr	1/31/12	0.319	NA	NA	3.49	ND	ND	ND	0.42	ND	ND	NA	NA
2503 Mountainview Dr	6/26/12	1.97	ND	ND	**61.9**	2.07	ND	1.26	8.68 Q	ND	ND	ND	ND
2506 Mountainview Dr	6/22/11	**6.10 Q**	NA	NA	**135**	4.75 Q	ND	3.76 Q	21.4 Q	ND	ND	NA	NA
	4/8/13	**5.68 Q**	NA	NA	**137**	4.58 Q	NA	3.92 Q	22.0 Q	NA	NA	NA	NA

Table 1
Historic and Current Potable Well Sample Results
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Sample Location	Date	PCE	1,1,1,2-PCA	1,1,2,2-PCA	TCE	1,1,1-TCA	1,1,2-TCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1-DCA	1,2-DCA	VC
EPA Drinking Water Contaminants MCLs		**5**	**--**	**--**	**5**	**200**	**5**	**7**	**70**	**100**	**--**	**5**	**2**
PADEP Act 2 MCLs - GW in Residential, Used Aquifer		**5**	**70**	**0.3**	**5**	**200**	**5**	**7**	**70**	**100**	**27**	**5**	**2**
2565 Mountainview Dr	4/26/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
95 Fink Dr	6/22/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
99 Fink Dr	4/27/11	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	NA	NA
Trip Blank	11/15/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	11/16/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	11/17/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/13/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/20/10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
All results in µg/L
BOLD WITH SHADING = Result Above the EPA Drinking Water Contaminants MCLs Standard
Italic **J =** Result is lab-estimated value due to low detection level
ND = Compound Not Detected
Q = Result Qualified By Laboratory
CVOCs = Chlorinated Volatile Organic Compounds
µg/L = micrograms per liter
NA = Not Available

(1) = 135 Tower Rd and 133 Tower Rd share a common well source.
(2) = 4064 Durham Rd and 4066 Durham Rd share a common well source.
PCE = Tetrachloroethene
PCA = Tetrachloroethane
TCE = Trichloroethene
TCA = Trichloroethane
DCE = Dichloroethene
DCA = Dichloroethane
VC = Vinyl Chloride

Table 2
Monitoring Well Construction Details
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Well	Install Date	Well Diameter (inches)	Steel Casing Length (fbg)	Well Depth (fbg)	Screen Length (feet)	Screened Interval (fbg)	Latitude	Longitude	Ground Surface Elevation (ft amsl)	TOC Elevation (ft amsl)	DTW 5/30/2012 (ft)	Groundwater Elevation 5/30/2012 (ft amsl)	DTW 8/13/2012 (ft)	Groundwater Elevation 8/13/2012 (ft amsl)	DTW 1/23/2013 (ft)	Groundwater Elevation 1/23/2013 (ft amsl)	DTW 5/20/2013 (ft)	Groundwater Elevation 5/20/2013 (ft amsl)	DTW 9/9/2013 (ft)	Groundwater Elevation 9/9/2013 (ft amsl)	Notes
MW-1	04/30/12	6	40	300	--	--	40.501783	-75.188379	502.71	504.76	99.23	405.53	104.01	400.75	--	--	--	--	--	--	Original Boring
MW-1U	12/18/12	2	--	114	30	113-143				--	--	--	--	--	89.03	415.73	93.70	411.06	--	--	Bentonite in screen. No longer usable.
MW-1L	12/18/12	2	--	218	70	170-230				--	--	--	--	--	79.52	425.24	81.40	423.36	79.16	425.60	Opening: 0.040 Slot
MW-1S	05/16/13	6	40	145	--	--	40.501782	-75.188434	501.58	504.15	--	--	--	--	--	--	93.20	410.95	93.09	411.67	Open Borehole. MW-1-Upper replacement.
MW-2	05/02/12	6	40	250	--	--	40.501080	-75.190104	479.39	481.42	76.67	404.75	81.18	400.24	--	--	--	--	--	--	Original Boring
MW-2U	01/10/13	2	--	154	20	134-154				--	--	--	--	--	72.32	409.10	70.35	411.07	70.15	411.27	Opening: 0.040 Slot
MW-2L	01/10/13	2	--	190.5	20	170.5-190.5				--	--	--	--	--	95.30	386.12	93.70	387.72	95.05	386.37	Opening: 0.040 Slot
MW-3	05/10/12	6	40	250	--	--	40.500218	-75.189037	478.58	480.70	82.65	398.05	83.58	397.12	--	--	--	--	--	--	Original Boring
MW-3U	01/09/13	2	--	118	30	89-119				--	--	--	--	--	71.66	409.04	92.90	387.80	69.69	386.40	Opening: 0.040 Slot
MW-3L	12/17/12	2	--	190	20	167-187				--	--	--	--	--	94.55	386.15	69.80	410.90	94.30	386.40	Opening: 0.040 Slot
MW-4	05/16/12	6	40	300	--	--	40.498283	-75.186434	480.06	482.95	58.10	424.85	61.04	421.91	--	--	--	--	--	--	Original Boring
MW-4U	3/8/2013	2	--	129	80	49-129				--	--	--	--	--	51.35	431.60	50.35	432.60	50.50	432.45	Opening: 0.020 Slot
MW-4L	3/8/2013	2	--	248	80	168-248				--	--	--	--	--	51.20	431.75	50.15	432.80	53.88	429.07	Opening: 0.020 Slot
MW-5	05/07/12	6	40	300	--	--	40.497808	-75.176507	510.42	512.96	168.60	344.36	110.55	402.41	64.89	448.07	62.80	450.16	62.90	450.06	Open Borehole
MW-6	05/09/12	6	40	300	--	--	40.494727	-75.179733	506.95	509.27	61.65	447.62	63.21	446.06	58.80	450.47	63.00	446.27	64.17	445.10	Open Borehole
MW-7	05/08/12	6	40	300	--	--	40.494684	-75.175704	502.72	504.35	172.95	331.40	172.76	331.59	--	--	--	--	--	--	Original Boring
MW-7U	01/02/13	2	--	195.5	100	95.5-195.5				--	--	--	--	--	79.85	424.50	112.55	391.80	117.00	387.35	Opening: 0.040 Slot
MW-7L	12/20/12	2	--	297	30	267-297				--	--	--	--	--	164.33	340.02	164.10	340.25	166.50	337.85	Opening: 0.040 Slot
MW-8	05/12/12	6	40	300	--	--	40.490165	-75.174763	487.81	489.65	133.35	356.30	136.55	353.10	126.05	363.60	123.95	396.40	129.35	360.30	Open Borehole
MW-9	05/11/12	6	40	250	--	--	40.485319	-75.179371	478.28	480.48	93.05	387.43	98.28	382.20	95.04	385.44	93.25	387.23	95.05	385.43	Open Borehole (partial obstruction at 93')
MW-10	05/15/12	6	40	300	--	--	40.492570	-75.179665	506.39	508.47	133.58	374.89	131.78	376.69	--	--	--	--	--	--	Original Boring
MW-10U	12/20/12	2	--	127	40	109-149				--	--	--	--	--	dry	dry	128.30	380.17	--	--	Bentonite in screen. No longer usable.
MW-10L	12/18/12	2	--	215	40	175-215				--	--	--	--	--	145.65	362.82	144.00	364.47	146.53	361.94	Opening: 0.040 Slot
MW-11	05/15/13	6	40	250	--	--	40.50098	-75.188923	485.18	487.68	--	--	--	--	--	--	76.8	410.88	--	--	Original Boring
MW-11U	08/23/13	2	--	145	50	95-145				--	--	--	--	--	--	--	--	--	76.44	411.24	Opening: 0.020 Slot
MW-11L	08/23/13	2	--	204	40	164-204				--	--	--	--	--	--	--	--	--	75.05	412.63	Opening: 0.020 Slot
MW-12	05/14/13	6	40	300	--	--	40.50292	-75.194193	458.00	460.05	--	--	--	--	--	--	73.1	386.95	--	--	Original Boring
MW-12U	08/22/13	2	--	155	90	65-155				--	--	--	--	--	--	--	--	--	40.22	419.83	Opening: 0.020 Slot
MW-12L	08/22/13	2	--	225	35	190-225				--	--	--	--	--	--	--	--	--	74.1	385.95	Opening: 0.020 Slot

Notes:
fbg - feet below grade
gpm - gallons per minute
TOC - top of casing

Table 3
MW-1 Soil Sampling Results
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Compound	MSC - Direct Contact	MSC - Soil to GW	MW-1 (4'-5')
1,1,1,2-Tetrachloroethane	60	18	ND (0.052)
1,1,1-Trichloroethane (TCA)	10,000	20	2.34 Q
1,1,2,2-Tetrachloroethane	7.7	0.08	ND (0.052)
1,1,2-Trichloroethane	28	0.5	ND (0.052)
1,1-Dichloroethane	280	3.1	ND (0.052)
1,1-Dichloroethene	3,800	0.7	ND (0.052)
1,1-Dichloropropene	--	--	ND (0.052)
1,2,3-Trichlorobenzene	--	--	ND (0.052)
1,2,3-Trichloropropane	2.6	4	ND (0.052)
1,2,4-Trichlorobenzene	2,200	27	ND (0.052)
1,2,4-Trimethylbenzene	110	8.4	1.9 Q
1,2-Dibromo-3-chloropropane	0.029	0.02	*ND (0.052)*
1,2-Dibromoethane	0.74	0.005	*ND (0.052)*
1,2-Dichlorobenzene	3,800	60	ND (0.052)
1,2-Dichloroethane	17	0.5	ND (0.052)
1,2-Dichloropropane	45	0.5	ND (0.052)
1,3,5-Trimethylbenzene	110	2.3	1.21 Q
1,3-Dichlorobenzene	660	61	ND (0.052)
1,3-Dichloropropane	--	--	ND (0.052)
1,4-Dichlorobenzene	40	10	ND (0.052)
2,2-Dichloropropane	--	--	ND (0.052)
2-Hexanone	96	1.1	ND (0.26)
4-Isopropyltoluene	--	--	ND (0.052)
Acetone	10,000	3,300	ND (0.26)
Benzene	57	0.5	ND (0.052)
Bromobenzene	--	--	ND (0.052)
Bromodichloromethane	12	8	ND (0.052)
Bromoform	410	8	ND (0.052)
Bromomethane	96	1	ND (0.052)
Carbon Disulfide	10,000	150	ND (0.052)
Carbon Tetrachloride	30	0.5	ND (0.052)
Chlorobenzene	960	10	ND (0.052)
Chloroethane	6,200	23	ND (0.052)
Chloroethene (vinyl chloride)	1.9	0.2	ND (0.052)
Chloroform	19	8	ND (0.052)
Chloromethane	250	3	ND (0.052)
cis-1,2-Dichloroethene	2,200	7	0.216
cis-1,3-Dichloropropene	--	--	ND (0.052)
Dibromochloromethane	17	8	ND (0.052)
Dibromomethane	2,200	37	ND (0.052)
Dichlorodifluoromethane	3,900	100	ND (0.052)
Ethylbenzene	10,000	70	0.376
Hexachlorobutadiene	220	10	ND (0.052)

Compound	MSC - Direct Contact	MSC - Soil to GW	MW-1 (4'-5')
Isopropylbenzene	7,700	600	0.666 Q
m/p-Xylene	--	--	1.2 Q
MEK	10,000	400	ND (0.26)
Methyl Tert-Butyl Ether	620	2	ND (0.052)
Methylene Chloride	950	0.5	ND (0.052)
MIBK	10,000	290	ND (0.26)
Naphthalene	4,400	25	ND (0.052)
n-Butylbenzene	8,800	950	ND (0.052)
n-Propylbenzene	8,800	290	0.725 Q
o-Chlorotoluene	4,400	20	ND (0.052)
o-Xylene	--	--	2.16 Q
p-Chlorotoluene	10,000	10	ND (0.052)
PCTFB	--	--	ND (0.052)
Sec-Butylbenzene	8,800	350	ND (0.052)
Styrene	10,000	24	ND (0.052)
t-Butyl alcohol	--	--	ND (0.52)
tert-Butyl Acetate	--	--	ND (0.26)
Tert-Butylbenzene	8,800	270	ND (0.052)
Tetrachloroethene (PCE)	340	0.5	**55.6 Q**
Tetrahydrofuran	230	2.5	ND (0.052)
Toluene	10,000	100	ND (0.052)
Total Xylenes	1,900	1,000	3.36 Q
trans-1,2-Dichloroethene	1,100	10	ND (0.052)
trans-1,3-Dichloropropene	--	--	ND (0.052)
Trichloroethene (TCE)	260	0.5	**5.14 Q**
Trichlorofluoromethane	10,000	200	ND (0.052)
Vinyl Acetate	3,900	42	ND (0.052)

Notes:
All values in mg/kg (ppm)
MSC - Direct Contact = Medium-Specific Concentrations for Organic Related Substances in Soil, Direct Contact Numeric Values, Residential setting, 0-15 feet
MSC - Soil to GW = Medium-Specific Concentrations for Organic Related Substances in Soil, Soil to Groundwater Numeric Values for Used Aquifers with TDS ≤ 2500, Residential setting
ND = Concentrations not detected above the indicated value
Q = Contaminanant concentration was reported from multiple analyses
Italicized values indicate the Method Detection Limit was above either MSC
Bolded values indicate exceedance of the MSC - Soil to GW

Table 4
Monitoring Well Straddle Packer Results
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Sample Location	Sample Depth	Date	PCE	1,1,1,2-PCA	1,1,2,2-PCA	TCE	1,1,1-TCE	1,1,2-TCE	1,1-DCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCA	1,2-DCA	VC
MCL or SHS			5	70	0.84	5	200	5	7	70	100	31	5	2
MW-1	115-145	06/28/12	ND (0.5)	ND (0.5)	ND (0.5)	**41.4**	ND (0.5)	ND (0.5)	ND (0.5)	**7.2**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	170-200	06/28/12	ND (0.5)	ND (0.5)	ND (0.5)	**20.7**	ND (0.5)	ND (0.5)	ND (0.5)	**2**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	210-240	06/28/12	**3.3**	ND (1.0)	ND (1.0)	**648**	**14.7**	**1.1**	**5.6**	**220**	**1.3**	ND (1.0)	ND (1.0)	ND (1.0)
MW-2	140-160	07/09/12	**217**	ND (0.5)	ND (0.5)	**3180 Q**	**131**	ND (0.5)	**112**	**612 Q**	**6.6**	**3.2**	ND (0.5)	ND (0.5)
	180-200	07/09/12	**106**	ND (0.5)	ND (0.5)	**1660**	**76.4**	ND (0.5)	**57.8 Q**	**321**	**4.3**	**1.7**	ND (0.5)	ND (0.5)
MW-3	100-120	07/10/12	**12.2**	ND (0.5)	ND (0.5)	**214**	**16.5**	ND (0.5)	**7.9**	**45.7**	**1.2**	ND (0.5)	ND (0.5)	ND (0.5)
	175-195	07/09/12	**11.3**	ND (0.5)	ND (0.5)	**244**	**16.1**	ND (0.5)	**9.4**	**49.8**	**1.2**	ND (0.5)	ND (0.5)	ND (0.5)
MW-4	OPEN-95	06/27/12	**25**	ND (0.5)	ND (0.5)	**796**	**25.2**	ND (0.5)	**12.3**	**117**	**2**	**0.57**	ND (0.5)	ND (0.5)
	100-130	06/27/12	**18.4**	ND (0.5)	ND (0.5)	**658**	**22**	ND (0.5)	**11.4**	**105**	**2.1**	**0.51**	ND (0.5)	ND (0.5)
	190-220	06/27/12	**15.5**	ND (1.0)	ND (1.0)	**582**	**21.5**	ND (1.0)	**11.9**	**110 Q**	**1.4**	ND (1.0)	ND (1.0)	ND (1.0)
MW-5	OPEN-195	07/03/12	ND (0.5)	ND (0.5)	ND (0.5)	**1.6**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-6	OPEN-120	07/05/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-7	230-260	06/25/12	ND (0.5)	ND (0.5)	ND (0.5)	**3.6**	ND (0.5)	ND (0.5)	ND (0.5)	**0.57**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	270-300	06/25/12	**0.78**	ND (0.5)	ND (0.5)	**15**	**0.73**	ND (0.5)	**0.69**	**2**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-8	OPEN-140	07/02/12	ND (0.5)	ND (0.5)	ND (0.5)	**1.3**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	185-205	07/02/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	245-265	06/29/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	275-300	06/29/12	ND (0.5)	ND (0.5)	ND (0.5)	**1.3**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	275-300 (dup)	06/29/12	ND (0.5)	ND (0.5)	ND (0.5)	**1.4**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-9	OPEN-100	06/26/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	170-200	06/26/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	220-250	06/26/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-10	OPEN-155	07/06/12	**1.5**	ND (0.5)	ND (0.5)	**27.8**	**0.91**	ND (0.5)	**0.71**	**2.7**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	187-207	07/06/12	**1.2**	ND (0.5)	ND (0.5)	**24.6 Q**	**0.83**	ND (0.5)	**0.73**	**2.5**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-12	0-155	06/26/13	ND (0.5)	ND (0.5)	ND (0.5)	**7.1 Q**	ND (0.5)	ND (0.5)	ND (0.5)	0.89	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	210-230	06/26/13	ND (0.5)	ND (0.5)	ND (0.5)	0.61	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	245-265	06/25/13	ND (0.5)	ND (0.5)	ND (0.5)	**5.2**	ND (0.5)	ND (0.5)	ND (0.5)	0.59	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-1 TOTE	--	06/28/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-2 TOTE	--	07/10/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-3 TOTE	--	07/10/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-4 TOTE	--	06/28/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)

Table 4
Monitoring Well Straddle Packer Results
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Sample Location	Sample Depth	Date	PCE	1,1,1,2-PCA	1,1,2,2-PCA	TCE	1,1,1-TCE	1,1,2-TCE	1,1-DCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCA	1,2-DCA	VC
MCL or SHS			5	70	0.84	5	200	5	7	70	100	31	5	2
Trip Blank	--	06/25/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	06/26/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	06/26/12	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)
	--	06/27/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	06/28/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	06/29/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	07/02/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	07/03/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	07/05/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	07/06/12	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)
	--	07/06/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	07/09/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	07/09/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	07/10/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	06/25/13	--	--	ND (0.5)	--	--	ND (0.5)	--	--	--	--	--	ND (0.5)
	--	06/26/13	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Rinse Blank	--	06/29/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	--	07/09/12	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)

Notes:
All results in µg/L
µg/L = micrograms per liter
BOLD = Contaminant Concentration Detected Above Laboratory Detection Limit
BOLD WITH SHADING = Contaminant Concentration Exceeds MSC (Used Residential Aquifers; TDS ≤ 2500)
MSC = Medium Specific Concentration
ND = Compound Not Detected at Listed Laboratory Detection Limit
Q = Contaminant Concentration reported from multiple analyses
SHS = Statewide Health Standard
mg/L = milligrams per liter
-- = Not Available
* = Medium Specific Concentration is a Secondary Contaminant

PCE = Tetrachloroethene
PCA = Tetrachloroethane
TCE = Trichloroethene
TCA = Trichloroethane
DCE = Dichloroethene
DCA = Dichloroethane
VC = Vinyl Chloride

Table 5
Monitoring Well Straddle Packer General Water Quality
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Well ID	Zone Interval	pH	Cond	Turb	DO	Temp	ORP
MW-1	115-145	7.76	0.9	0	1.83	16.5	5
	170-200	7.72	0.9	0	0	15.5	-26
	210-240	7.82	0.9	24.4	0.5	16.6	-54
	255-285	DNS	DNS	DNS	DNS	DNS	DNS
MW-2	113-133	DNS	DNS	DNS	DNS	DNS	DNS
	140-160	7.67	0.461	102	1.2	12.2	18
	180-200	7.69	0.542	80	4.7	15.4	15.3
MW-3	100-120	7.37	0.609	491	0	14.8	53
	140-160	DNS	DNS	DNS	DNS	DNS	DNS
	175-195	7.35	0.66	224	3.1	14.3	41
	225-245	DNS	DNS	DNS	DNS	DNS	DNS
MW-4	Open-95	7.67	0.576	31.7	3.81	14.9	46
	100-130	7.72	0.9	21.9	2.22	18	57
	190-220	7.75	0.607	48.8	1.95	17.7	DNS
	250-280	DNS	DNS	DNS	DNS	DNS	DNS
MW-5	Open-175	8.12	0.453	210	4.92	20.4	39
	185-205	DNS	DNS	DNS	DNS	DNS	DNS
	213-233	DNS	DNS	DNS	DNS	DNS	DNS
	250-Open	DNS	DNS	DNS	DNS	DNS	DNS
MW-6	Open-120	8.02	0.503	509.3	16.85	19.9	116
	190-210	DNS	DNS	DNS	DNS	DNS	DNS
	250-Open	DNS	DNS	DNS	DNS	DNS	DNS
MW-7	Open-195	DNS	DNS	DNS	DNS	DNS	DNS
	230-260	7.67	1.6	88.5	1.97	21.1	0
	270-Open	7.62	0.99	51.9	0	17	0
MW-8	Open-140	7.55	1.53	0	8.03	20.6	78
	185-205	7.47	1.35	0	5.21	17.4	82
	245-265	7.65	1.61	3.9	0	16.1	-20
	275-Open	7.7	1.71	15	2.12	21	19
MW-9	Open-100	7.67	0.542	1.8	6.68	16.1	0
	170-200	7.73	0.573	47.2	7.02	15.7	0
	220-250	767	0.596	18.5	3.56	15.8	0
MW-10	Open-155	7.53	0.701	0	2.28	17.1	45
	190-210	7.6	0.815	0	4	19.1	89
	215-235	DNS	DNS	DNS	DNS	DNS	DNS
	260-Open	DNS	DNS	DNS	DNS	DNS	DNS

Table 5
Monitoring Well Straddle Packer General Water Quality
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Well ID	Zone Interval	pH	Cond	Turb	DO	Temp	ORP
MW-12	Open-155	7.49	0.522	42.4	3.61	19.78	DNS
	160-180	7.59	0.489	156	6.89	16.98	DNS
	190-210	7.27	0.631	0.8	6.5	12.97	DNS
	210-230	7.39	0.509	0.3	4.43	13.15	DNS
	245-265	7.48	0.473	21.6	5.13	15.85	DNS

Notes:
Cond = Conductivitiy in mS/cm (millisemens/centimeter)
Turb = Turbidity in ntu (nephelometric turbidity units)
DO = Dissolved Oxygen in mg/L (milligrams per liter)
Temp = Temperature in °C (degrees Celcius)
ORP = Oxidation/Reduction Potential in mV (milliVolts)

Table 6
Monitoring Well Straddle Packer Ion/Anion Results
GTAC5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Sample Location	Sample Depth	Date	Total Alkalinity as CaCO3 (mg/L)	Total Barium (ug/L)	Bicarbonate Alkalinity (mg/L)	Total Calcium (mg/L)	Carbonate Alkalinity (mg/L)	Chloride (mg/L)	Total Chloride (mg/L)	Total Iron (ug/L)	Total Magnesium (mg/L)	Total Manganese (ug/L)	Total Potassium (mg/L)	Total Sodium (mg/L)	Total Strontium (ug/L)	Sulfate (mg/L)	Total Sulfate (mg/L)
MCL or SHS			--	2,000	--	--	--	250*	250*	300*	--	300	--	--	--	250*	250*
MW-1	115-145	6/28/12	--	142	180.6	67.8	0	--	86.7	284	29	10	1	21	3,928	--	31
	170-200	6/28/12	--	172	182.8	68	0	--	86	107	30.7	10	1	17.7	4,083	--	30.4
	210-240	6/28/12	173.2	76	173.2	69.6	--	--	79.7	**11,500**	28.6	72	2	19.4	3,149	--	33.3
MW-2	140-160	7/9/12	168.6	20	168.6	61	--	--	17.4	**1,535**	10.3	156	1.01	19.4	347	--	25.1
	180-200	7/9/12	179	41	179	64.9	--	--	26.9	**1,013**	14.1	64	1.8	19.7	1,486	--	35.8
MW-3	100-120	7/10/12	193.8	32	193.8	77.4	--	--	36.5	**447**	15.4	38	1	18.4	570	--	39.4
	175-195	7/9/12	192.8	29	192.8	77.6	--	--	39	162	15.2	10	1	19	584	--	38.5
MW-4	OPEN-95	6/27/12	192.6	41	192.6	74.8	--	--	28.4	**5,551**	15	148	1.16	19.1	493	--	33.6
	100-130	6/27/12	195	43	195	74.7	--	--	27.8	**11,100**	15	157	1	19.1	595	--	35.2
	190-220	6/27/12	190.8	36	190.8	73.5	--	--	28	**4,177**	15.6	52	2	19.5	862	--	34.2
MW-5	OPEN-195	7/3/12	--	80	167.2	50.3	0	--	13.8	**6,803**	21.1	136	4	18	684	--	28.6
MW-6	OPEN-120	7/5/12	--	98	158	76.4	0	--	26.7	**5,112**	12.8	252	2	11	635	--	52.7
MW-7	230-260	6/25/12	178	118	--	103	--	174	--	**17,900**	33.1	178	3.1	31.1	2,119	61.8	--
	270-300	6/25/12	179	100	--	72.7	--	35	--	**545**	16.2	15	1	19.4	1714	72.7	--
MW-8	OPEN-140	7/2/12	--	296	231.4	123	0	--	**252.6**	**1,060**	57.5	21	2	37.1	904	--	30.2
	185-205	7/2/12	--	273	226	114	0	--	210.8	247	48.2	89	2	30.5	847	--	33.3
	245-265	6/29/12	--	311	243.2	127	0	--	**256.1**	58	56.5	84	2	35.6	1,107	--	34.6
	275-300	6/29/12	--	283	236.4	112	0	--	216	**2,428**	50.5	151	2	32.1	1,013	--	28.8
MW-9	OPEN-100	6/26/12	190.4	183	190.4	65.9	--	--	20.7	**845**	21.1	30	1	13.2	544	--	32.9
	170-200	6/26/12	186	120	186	60.6	--	20.2	--	**5,924**	19.6	102	2	13.2	615	37.8	--
	220-250	6/26/12	191.4	161	191.4	60	--	20.5	--	**4,100**	19.3	68	2	12.7	609	37.1	--
MW-10	OPEN-155	7/6/12	190.2	139	190.2	70.9	--	--	68.7	284	23.9	10	1.08	15.3	1,332	--	42.8
	187-207	7/6/12		129	187.2	72.7	0	--	64	**924**	24.5	37	1.116	15.5	1,206	--	41.2

Notes:
mg/L = milligrams per liter
ug/L = micrograms per liter
-- = Not Available
BOLD WITH SHADING = Contaminant Concentration Exceeds MSC (Used Residential Aquifers; TDS ≤ 2500)
* = Medium Specific Concentration is a Secondary Contaminant
MSC = Medium Specific Concentration
SHS = Statewide Health Standard

Table 7
Monitoring Well Sampling Results
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Sample Location	Date	Dup/PDB	PCE	1,1,1,2-PCA	1,1,2,2-PCA	TCE	1,1,1-TCA	1,1,2-TCA	1,1-DCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCA	1,2-DCA	VC
MCL or SHS			5	70	0.84	5	200	5	7	70	100	31	5	2
MW-1U	01/14/13		ND (5.0)	ND (5.0)	ND (5.0)	**509**	**10.8**	ND (5.0)	**5**	**186**	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
MW-1S	09/10/13		**2.2**	ND (0.5)	ND (0.5)	**295**	**3.9**	ND (0.5)	**1.6**	**67.2**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/11/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	**23.9**	**0.53**	ND (0.5)	ND (0.5)	**6.6**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-1L	01/14/13		ND (1.0)	ND (1.0)	ND (1.0)	**13.6**	ND (1.0)	ND (1.0)	ND (1.0)	**3.5**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	09/09/13		ND (0.5)	ND (0.5)	ND (0.5)	**11.2**	ND (0.5)	ND (0.5)	**0.68**	**4**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/11/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	**7**	ND (0.5)	ND (0.5)	ND (0.5)	**2.5**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-2U	01/16/13		**105**	ND (0.5)	ND (0.5)	**2110**	**97.3**	ND (0.5)	**112**	**518**	**3.8**	**3.5**	ND (0.5)	ND (0.5)
	09/12/13		**33.1**	ND (0.5)	ND (0.5)	**562**	**28.7**	ND (0.5)	**26.8**	**114**	**1.4**	**0.96**	ND (0.5)	ND (0.5)
	12/11/13	PDB	**21**	ND (0.5)	ND (0.5)	**772**	**36.9**	ND (0.5)	**57.4**	**254**	**3**	**4.8**	ND (0.5)	ND (0.5)
MW-2L	01/16/13		**42.4 Q**	ND (0.5)	ND (0.5)	**822**	**37.1 Q**	ND (0.5)	**42 Q**	**203 Q**	**2.6**	**1.5**	ND (0.5)	ND (0.5)
	01/16/13	Dup	**42 Q**	ND (0.5)	ND (0.5)	**875**	**39.2 Q**	ND (0.5)	**43.8 Q**	**204 Q**	**2.8**	**1.3**	ND (0.5)	ND (0.5)
	09/12/13		**15.1**	ND (0.5)	ND (0.5)	**414**	**18.6**	ND (0.5)	**17.8**	**95.2**	**1.3**	**0.88**	ND (0.5)	ND (0.5)
	09/12/13	Dup	**14.7**	ND (1)	ND (1)	**537**	**16.7**	ND (1)	**16.7**	**91.4Q**	**1.3**	ND (1)	ND (1)	ND (1)
	12/11/13	PDB	**3.9**	ND (0.5)	ND (0.5)	**499**	**18.7**	ND (0.5)	**30.2**	**279**	**2.4**	**2.6**	ND (0.5)	ND (0.5)
MW-3U	01/15/13		**10.6 Q**	ND (0.5)	ND (0.5)	**277**	**12.6 Q**	ND (0.5)	**12.4 Q**	**74**	**0.8**	ND (0.5)	ND (0.5)	ND (0.5)
	01/15/13	Dup	**11.2 Q**	ND (0.5)	ND (0.5)	**291**	**13.4 Q**	ND (0.5)	**13.4 Q**	**72.7**	**1.2**	**0.55**	ND (0.5)	ND (0.5)
	09/11/13		**10.6Q**	ND (1.0)	ND (1.0)	**266Q**	**12.2Q**	ND (1.0)	**10.6Q**	**51.4Q**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	12/11/13	PDB	**1.3**	ND (0.5)	ND (0.5)	**198**	**4.4**	ND (0.5)	**5.4**	**56 Q**	**0.85**	ND (0.5)	ND (1.0)	ND (0.5)
MW-3L	01/15/13		**9.9 Q**	ND (0.5)	ND (0.5)	**244**	**10.7 Q**	ND (0.5)	**9.8 Q**	**55.3 Q**	**0.66**	ND (0.5)	ND (0.5)	ND (0.5)
	09/11/13		**19.4**	ND (1.0)	ND (1.0)	**441**	**19.1**	ND (1.0)	**15.6**	**92.8Q**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	12/11/13	PDB	**2.4**	ND (0.5)	ND (0.5)	**150**	**7.8**	ND (0.5)	**7.2**	**55.1**	ND (0.5)	ND (0.5)	ND (1.0)	ND (0.5)
MW-4U	01/15/13		**2.8**	ND (0.5)	ND (0.5)	**132**	**5**	ND (0.5)	**3.5**	**26.8 Q**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	09/11/13		**19.4**	ND (0.5)	ND (0.5)	**700**	**20.7**	ND (0.5)	**14.2**	**96.1**	**1.4**	**0.56**	ND (0.5)	ND (0.5)
	12/11/13	PDB	**5**	ND (0.5)	ND (0.5)	**373**	**8.2**	ND (0.5)	**6.6**	**57.6 Q**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-4L	09/11/13		**7**	ND (1.0)	ND (1.0)	**306**	**10.2**	ND (1.0)	**6.3**	**51.4Q**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	12/11/13	PDB	**1.1**	ND (0.5)	ND (0.5)	**118**	**5.7**	ND (0.5)	**4.4**	**56.1**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)

Table 7
Monitoring Well Sampling Results
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Sample Location	Date	Dup/PDB	PCE	1,1,1,2-PCA	1,1,2,2-PCA	TCE	1,1,1-TCA	1,1,2-TCA	1,1-DCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCA	1,2-DCA	VC
MCL or SHS			5	70	0.84	5	200	5	7	70	100	31	5	2
MW-5	01/14/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	09/09/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/12/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-6	01/14/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	09/09/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/11/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-7U	01/23/13		ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	09/09/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/12/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	**8.5**	ND (0.5)	ND (0.5)	ND (0.5)	**1.3**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-7L	01/14/13		ND (0.5)	ND (0.5)	ND (0.5)	**5.7**	ND (0.5)	ND (0.5)	ND (0.5)	**0.71**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	09/09/13		ND (0.5)	ND (0.5)	ND (0.5)	**7.3**	ND (0.5)	ND (0.5)	ND (0.5)	**1.2**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/12/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-8	01/14/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	09/09/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/12/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-9	01/14/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	09/09/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/12/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/12/13	Dup	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-10L	01/15/13		**2**	ND (0.5)	ND (0.5)	**64.9**	**2.6**	ND (0.5)	**3.2**	**10.3 Q**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	09/11/13		**3.4**	ND (1.0)	ND (1.0)	**72.6Q**	**2.7**	ND (1.0)	**2.6**	**8.5Q**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
	12/12/13	PDB	**2.5**	ND (0.5)	ND (0.5)	**47.9**	**2**	ND (0.5)	**2.3**	**7.9 Q**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-11U	09/12/13		**5.9**	ND (0.5)	ND (0.5)	**146**	**10**	ND (0.5)	**9.2**	**43.4**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/11/13	PDB	**3.7**	ND (0.5)	ND (0.5)	**135**	**6.9**	ND (0.5)	**6.9**	**36.4**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-11L	09/12/13		**3**	ND (0.5)	ND (0.5)	**57.2**	**3.4**	ND (0.5)	**2.8**	**13.8Q**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/11/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)

Table 7
Monitoring Well Sampling Results
GTAC 5-1-222
Nockamixon TCE Site
Nockamixon Township, PA

Sample Location	Date	Dup/PDB	PCE	1,1,1,2-PCA	1,1,2,2-PCA	TCE	1,1,1-TCA	1,1,2-TCA	1,1-DCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCA	1,2-DCA	VC
MCL or SHS			5	70	0.84	5	200	5	7	70	100	31	5	2
MW-12U	09/10/13		ND (0.5)	ND (0.5)	ND (0.5)	**7.8**	ND (0.5)	ND (0.5)	ND (0.5)	**0.81**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	09/10/13	Dup	ND (0.5)	ND (0.5)	ND (0.5)	**8.2**	ND (0.5)	ND (0.5)	ND (0.5)	**0.78**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/12/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	**0.71**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
MW-12L	09/10/13		ND (0.5)	ND (0.5)	ND (0.5)	**4.8**	ND (0.5)	ND (0.5)	ND (0.5)	**0.68**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
	12/12/13	PDB	ND (0.5)	ND (0.5)	ND (0.5)	**0.57**	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Trip Blank	01/14/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Trip Blank	01/15/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Trip Blank	01/16/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Trip Blank	01/23/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Trip Blank 2	09/10/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Trip Blank 2A	09/10/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Trip Blank 3	09/11/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Trip Blank 4	09/12/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Trip Blank	12/12/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.25)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.25)
Trip Blank	12/11/13		--	--	ND (0.25)	--	--	ND (0.5)	--	ND (0.25)	--	--	--	--
Rinse Blank	01/15/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Rinse Blank	09/12/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)
Rinse Blank 1	09/10/13		ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)

Notes:

All results in µg/L
µg/L = micrograms per liter
BOLD = Contaminant Concentration Detected Above Laboratory Detection Limit
BOLD WITH SHADING = Contaminant Concentration Exceeds the Identified Screening Criteria
MCL = EPA Drinking Water Criteria Maximum Contaminant Level
ND = Compound Not Detected at Listed Laboratory Detection Limit
Q = Contaminant Concentration reported from multiple analyses
SHS = Statewide Health Standard
-- = Not Available
* = Medium Specific Concentration is a Secondary Contaminant
Dup = Duplicate Sample
PDB = Passive Bag Diffusion

PCE = Tetrachloroethene
PCA = Tetrachloroethane
TCE = Trichloroethene
TCA = Trichloroethane
DCE = Dichloroethene
DCA = Dichloroethane
VC = Vinyl Chloride
MTBE = 2-Methoxy- 2-methylpropane
MIBK = 4-Methyl-2- pentanone