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United States
Environmental Protection
Agency

Retrospective Case Study in Northeastern Pennsylvania

STUDY OF THE POTENTIAL IMPACTS OF HYDRAULIC FRACTURING ON DRINKING WATER RESOURCES

United States Environmental Protection Agency
Office of Research and Development

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Retrospective Case Study in Northeastern Pennsylvania Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

U.S. Environmental Protection Agency
Office of Research and Development
Washington, DC

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Acronyms and Abbreviations

ADQ	audit of data quality
ATSDR	Agency for Toxic Substances and Disease Registry
CH_4	methane
C_2H_6	ethane
$C_2H_6^+$	combined ethane + propane + butane
CLP	Contract Laboratory Program
CO_2	carbon dioxide
CRDS	cavity ring-down spectrometry
DIC	dissolved inorganic carbon
DOC	dissolved organic carbon
DOI	Department of Interior
DRO	diesel-range organics
$\delta^{18}O_{H2O}$	oxygen-18/oxygen-16 isotopic ratio in water
$\delta^{2}H_{H2O}$	deuterium/hydrogen isotopic ratio in water
$\delta^{13}C_{CH4}$	carbon-13/carbon-12 isotopic ratio in methane (= $\delta^{13}C_1$)
$\delta^{2}H_{CH4}$	deuterium/hydrogen isotopic ratio in methane (= δCD_1)
$\delta^{13}C_{C2H6}$	carbon-13/carbon-12 isotopic ratio in ethane (= $\delta^{13}C_2$)
$\delta^{13}C_{DIC}$	carbon-13/carbon-12 isotopic ratio in DIC
EPA	(U.S.) Environmental Protection Agency
EDR	Environmental Data Resources, Inc.
GC/MS	gas chromatography/mass spectrometry
GPS	global positioning system
gal/min	gallons per minute
gal/min ft	gallons per minute per foot
GRO	gasoline-range organics
GWERD	Ground Water and Ecosystems Restoration Division
H_2SO_4	sulfuric acid
HPLC	high-performance liquid chromatography
IRMS	isotope ratio mass spectrometry
LC-MS-MS	liquid chromatography–tandem mass spectrometry
MCL	maximum contaminant level
MDL	method detection limit

μg/L	micrograms per liter
μS/cm	microsiemens per centimeter
mg/L	milligrams per liter
mmol/L	millimoles per liter
mol/L	moles per liter
NaCl	sodium chloride
$NaHCO_3$	sodium bicarbonate
n.d.	not dated
NEPA	northeastern Pennsylvania
NIST	National Institute of Standards and Technology
NLCD	National Land Cover Database
NOV	Notice of Violation
NRMRL	National Risk Management Research Laboratory
NTU	nephelometric turbidity unit
NURE	National Uranium Resource Evaluation
NWIS	National Water Information System
ORD	Office of Research and Development
ORP	oxidation-reduction potential
PA DEP	Pennsylvania Department of Environmental Protection
pCi/L	picocuries per liter
permil	‰, parts per thousand
ppm	parts per million
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
SC	specific conductance (conductivity)
SMCL	secondary maximum contaminant level
SVOC	semivolatile organic compound
TDS	total dissolved solids
TIC	tentatively identified compound
TSA	technical systems audit
USGS	U.S. Geological Survey
VOC	volatile organic compound

VPDB	Vienna Pee Dee Belemnite
VSMOW	Vienna Standard Mean Ocean Water

Preface

The U.S. Environmental Protection Agency (EPA) is conducting a study of the potential impacts of hydraulic fracturing for oil and gas on drinking water resources. This study was initiated in Fiscal Year 2010 when Congress urged the EPA to examine the relationship between hydraulic fracturing and drinking water resources in the United States. In response, EPA developed a research plan (*Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*) that was reviewed by the Agency's Science Advisory Board (SAB) and issued in 2011. A progress report on the study (*Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources: Progress Report)*, detailing the EPA's research approaches and next steps, was released in late 2012 and was followed by a consultation with individual experts convened under the auspices of the SAB.

The EPA's study includes the development of several research projects, extensive review of the literature and technical input from state, industry, and non-governmental organizations as well as the public and other stakeholders. A series of technical roundtables and in-depth technical workshops were held to help address specific research questions and to inform the work of the study. The study is designed to address research questions posed for each stage of the hydraulic fracturing water cycle:

- Water Acquisition: What are the possible impacts of large volume water withdrawals from ground and surface waters on drinking water resources?
- Chemical Mixing: What are the possible impacts of surface spills of hydraulic fracturing fluid on or near well pads on drinking water resources?
- Well Injection: What are the possible impacts of the injection and fracturing process on drinking water resources?
- Flowback and Produced Water: What are the possible impacts of surface spills of flowback and produced water on or near well pads on drinking water resources?
- Wastewater Treatment and Waste Disposal: What are the possible impacts of inadequate treatment of hydraulic fracturing wastewaters on drinking water resources?

This report, *Retrospective Case Study in Northeastern Pennsylvania*, is the product of one of the research projects conducted as part of the EPA's study. It has undergone independent, external peer review in accordance with Agency policy, and all of the peer review comments received were considered in the report's development.

The EPA's study will contribute to the understanding of the potential impacts of hydraulic fracturing activities for oil and gas on drinking water resources and the factors that may influence those impacts. The study will help facilitate and inform dialogue among interested stakeholders, including Congress, other Federal agencies, states, tribal government, the international community, industry, non-governmental organizations, academia, and the general public.

Authors

Ralph D. Ludwig, US EPA/ORD/NRMRL

Douglas G. Beak, US EPA/ORD/NRMRL

Richard T. Wilkin, US EPA/ORD/NRMRL

Christopher J. Ruybal, Student Services Contractor for US EPA (contract EP-13-C-000135)

David J. Rectenwald, US EPA/Region 3

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Executive Summary

In December 2009, Congress urged the US Environmental Protection Agency (EPA) to study the relationship between hydraulic fracturing and drinking water resources. This report provides the results of one of five retrospective case studies conducted as a component of EPA's national study on the potential impacts of hydraulic fracturing on drinking water resources (US EPA, 2012). The retrospective case studies focused on investigating reported instances of drinking water contamination in areas where hydraulic fracturing has already occurred. This report describes the retrospective case study conducted in northeastern Pennsylvania, in Bradford and Susquehanna counties.

Approximately 37% of the population of Pennsylvania, or 4.5 million people, obtain water from ground water wells, with private wells being abundant in both Bradford and Susquehanna counties. In recent years, northeastern Pennsylvania has experienced some of the most intensive hydraulic fracturing activity in the U.S., as reflected by the high density of gas wells currently dotting the landscape in this part of the state. Bradford County alone reportedly had over 1,000 drilled unconventional gas wells by mid-2013, more than any other county in Pennsylvania. The significant increase in hydraulic fracturing activity in northeastern Pennsylvania has led to increasing concerns regarding potential impacts on homeowner wells. The retrospective case study conducted in northeastern Pennsylvania focused on establishing whether anomalies in ground water quality or water quality impairments exist in the vicinity of gas wells in the study area and, if so, whether such anomalies or water quality impairments may be attributable to hydraulic fracturing activities. The study involved three rounds of water sampling and analyses conducted over a span of 1.5 years at 36 homeowner (domestic) wells, two springs, and two surface water locations. Sampling was conducted primarily in Bradford County, mainly across the southern half of the county, while sampling in Susquehanna County was limited to three homeowner properties. Sampling locations were selected largely on the basis of homeowner-specific complaints or concerns regarding potential impacts on homeowner drinking water wells and springs (e.g., increased turbidity, effervescing, discoloration, staining, odor, etc.) from nearby hydraulic fracturing activities. With one exception, all sampling locations were within 1 mile of one or more drilled gas wells and, with three exceptions, all sampling locations were within 1 mile of one or more gas wells that had been hydraulically fractured (stimulated) prior to water sampling in this study. Collectively, a total of approximately 100 drilled gas wells, most of which were fractured, were within 1 mile of sampling locations in the study.

A multiple-lines-of-evidence approach was used in evaluating the data from the study and establishing potential cause and effect relationships. The results of analysis of a broad suite of inorganic and organic constituents/compounds potentially linked to hydraulic fracturing activities indicated no evidence of impacts on ground water other than stray gas in the form of methane and ethane. The presence of low levels of trimethylbenzenes near or below method quantitation limits at two homeowner locations and toluene below the method quantitation limit in a sample from another homeowner well are attributed to other anthropogenic sources due to the absence of corroborating lines of evidence implicating hydraulic fracturing activities as the source. The presence of total dissolved solids (TDS), chloride, sodium, barium, strontium, and combined radium-226 and radium-228 in a few homeowner wells at concentrations above those more commonly found in the study area is attributed to localized natural background conditions known to occur in the study area in certain valley settings. Manganese and/or iron concentrations were found to exceed secondary MCLs at over 40% of the ground water locations

sampled in the study, consistent with historical pre-2007 data for the study area. The source of high sulfate concentrations (>1,000 milligrams per liter [mg/L]) measured in one homeowner well is unclear, although geochemical modeling indicates the sulfate concentrations would be consistent with the presence and dissolution of the mineral gypsum. High sulfate concentrations are not expected to originate from Marcellus Shale flowback/produced waters, which generally exhibit sulfate concentrations less than 100 mg/L. A nearby pond (not used as a drinking water source) sampled to determine potential links to the elevated sulfate concentrations in the homeowner well indicated the pond was not the source of the sulfate. The pond did have elevated levels of chloride and total dissolved solids that may be due to past reported fluid and/or solid releases that occurred on an adjacent well pad where hydraulic fracturing had taken place.

The recent highly accelerated pace of gas exploration and production in the study area has coincided with an increase in the number of reported incidents of stray gas migration. Based on operator and Pennsylvania Department of Environmental Protection (PA DEP) data—and data from this study—there is evidence of stray gas migration associated with the increased gas development activities in the study area. This evidence comes from pre-drill and post-drill gas data that show changes in gas concentrations and/or methane-to-ethane ratios before and after gas drilling, and also from gas isotope data (including isotope reversal differences) that appear to indicate gas in some homeowner wells is consistent with gas originating from deeper formations, including Middle Devonian strata (where the Marcellus Shale is located). Stray gas, however, would not be unique to current hydraulic fracturing activities and has been an issue with past oil and gas exploration in northeastern Pennsylvania before the advent of modern-day hydraulic fracturing. Oil and gas exploration in the study area has shown that gas is encountered at almost all depths down to the Marcellus Shale. Methane gas occurs naturally as background gas in many homeowner wells in northeastern Pennsylvania and surrounding area occasionally at concentrations above both PA DEP's action level of 7 mg/L and the Department of Interior (Office of Surface Mining) recommended action level of 10 mg/L, particularly in Na-Cl and Na-HCO_3 type ground water.

The potential impact of stray gas migration, regardless of depth of origin, can be a concern. In addition to posing an explosion risk (if allowed to accumulate in confined spaces), the sudden influx of stray gas into a well may cause suspension of well sediments and dislodging of naturally occurring mineral deposits (precipitates) on the surfaces of the well and wellbore, resulting in increased turbidity and discoloration of the well water. The sudden or increased presence of methane in wells, if sustained, may also promote more reducing conditions, potentially leading to reductive dissolution of iron and manganese and the possible liberation of naturally occurring contaminants such as arsenic potentially associated with iron and manganese. Arsenic concentrations measured in this study, however, were consistently below the MCL of 10 µg/L and generally less than 5 µg/L indicating arsenic mobilization was not a significant issue.

One homeowner well located in a river valley setting in Bradford County was of particular interest in this study because hydraulic fracturing was conducted at a nearby gas well during the course of the study following the first round of sampling. Stream and river valleys in the study area are believed to exhibit a higher natural fracture density in the underlying bedrock, resulting in a potentially greater abundance of preferential pathways for the flow of natural gas from depth to the surface. It has been hypothesized that the similarity in geochemistry of ground water in these settings with fluid geochemistry in deeper formations is evidence of a pre-existing network of cross-formational pathways that has enhanced hydraulic connectivity to the deeper formations. As such, this type of setting may be more vulnerable to impacts from hydraulic fracturing of the Marcellus Shale. Based on the multiple-lines-of-evidence approach employed in this study, pre- and post-hydraulic fracturing data—coupled with pre-drill operator data from the homeowner location—did not show evidence of impacts on the homeowner well from Marcellus Shale-derived brine or gas within the timeframe of this study.

Stray gas appears to be primarily—if not entirely—originating from shallower formations above the Marcellus Shale. Evaluation of methane and ethane isotope data and methane-to-ethane ratios indicated gas detected at elevated concentrations in homeowner wells in this study, whether stray gas from hydraulic fracturing activities or not, was generally thermogenic in origin. However, the evaluation could not determine with certainty the specific formation(s) from which the thermogenic gas was originating. This is largely due to the range of gas isotopic signatures and isotope reversal differences that appear to be characteristic of given formations and the significant overlap that apparently occurs with respect to isotopic signatures and isotope reversal differences amongst the different formations. Isotopic signatures and isotope reversal differences for one cluster of homeowner wells in the study indicated the gas in the homeowner wells was likely originating from deeper Middle Devonian strata and possibly the Marcellus Shale itself. If originating from the Marcellus Shale, it would still be unknown whether the gas were originating from the hydraulic fracturing (stimulation) process or from other sources (e.g., well construction issues).

Key observations/findings from this study are summarized below.

- No evidence of impacts on homeowner wells and springs from flowback water, produced water, or injected hydraulic fracturing fluids was found in the study. Detections of inorganic and organic constituents (other than methane and ethane) in ground water samples could not be attributed to hydraulic fracturing activities.
- One or more homeowner wells evaluated in the study have been impacted by stray gas associated with nearby hydraulic fracturing activities. Stray gas (in the form of methane and ethane) entering homeowner wells can account for observed changes to well water appearance and quality (e.g., effervescing, increased turbidity, discoloration) reported by some homeowners.
- The specific formation(s) from which stray gas is originating could not be determined with certainty although stray gas appeared to be primarily—if not entirely—originating from formations above the Marcellus Shale.
- Gas isotope data for one cluster of homeowner wells sampled in the study indicated gas in the homeowner wells likely originated from deeper Middle Devonian strata and possibly from the Marcellus Shale itself.
- Iron and/or manganese concentrations exceeded secondary MCLs at over 40% of ground water locations sampled in the study consistent with historical data for the study area.

- The presence of total dissolved solids (TDS), chloride, sodium, barium, strontium, and combined radium-226 and radium-228 in a few homeowner wells at concentrations above those more commonly found in the study area is attributed to localized natural background conditions known to occur in the study area in certain valley settings.
- Elevated levels of chloride and total dissolved solids were observed in a homeowner pond (not used as a drinking water source) and may be due to past reported fluid and/or solid releases that occurred on an adjacent well pad where hydraulic fracturing activities had taken place.

1. Introduction

Recent advances in drilling technologies (horizontal drilling) and well stimulation (hydraulic fracturing) have resulted in large-scale development of vast, unconventional reserves of oil and gas across a wide range of geographic regions and geologic formations in the United States. These reserves are considered unconventional because they are bound up in low-permeability reservoirs such as shale, tight sands, limestone, and coal beds, and recovery of these reserves was previously uneconomical. While some of this new development is occurring in areas with mature oil and gas fields, large areas with very little or no previous oil and gas development also are now being developed. As a result, there are rising concerns over potential impacts on drinking water resources. Concerns include the potential for contamination of shallow ground water by stray gases (methane), formation waters (brines), and fracturing chemicals associated with unconventional gas development.

In December 2009, Congress urged EPA to study the relationship between hydraulic fracturing and drinking water. The study was to be conducted using a credible approach that relied on the best available science as well as independent sources of information and through a transparent, peer-reviewed process that would ensure the validity and accuracy of the data. EPA consulted with other federal agencies and appropriate state and interstate regulatory agencies in carrying out the study (US EPA, 2010). In February 2011, EPA issued the “Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources” (US EPA, 2011a). The final “Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources” was released in November 2011 (US EPA, 2011b).

In 2011, EPA began to research the potential impacts of hydraulic fracturing on drinking water resources, if any, and to identify the driving factors that could affect the severity and frequency of any such impacts. EPA scientists focused primarily on hydraulic fracturing of shale formations, with some study of other oil- and gas-producing formations, including coal beds. EPA designed the scope of the research around five stages of the hydraulic fracturing water cycle (US EPA, 2012). Each stage of the cycle is associated with a primary research question:

- Water acquisition. What are the potential impacts of large-volume water withdrawals from ground water and surface waters on drinking water resources?
- Chemical mixing. What are the potential impacts of hydraulic fracturing fluid surface spills at or near well pads on drinking water resources?
- Well injection. What are the potential impacts of the injection and fracturing process on drinking water resources?
- Flowback and produced water. What are the potential impacts of flowback and produced water (collectively referred to as “hydraulic fracturing wastewater”) surface spills on or near well pads on drinking water resources?
- Wastewater treatment and waste disposal: What are the potential impacts of inadequate treatment of hydraulic fracturing wastewater on drinking water resources?

Before release of the study plan, EPA invited the public to nominate specific regions of the United States for inclusion as potential sites for case studies. The plan identified 41 potential retrospective case study sites. The retrospective case studies were to investigate reported instances of drinking water resource contamination in areas where hydraulic fracturing had already occurred and were intended to inform several of the primary research questions related to chemical mixing, well injection, and flowback and produced water. Of the 41 sites nominated during the stakeholder process, EPA selected five sites across the United States at which to conduct retrospective case studies. The sites were deemed illustrative of the types of problems that were reported to EPA during stakeholder meetings held in 2010 and 2011. EPA's plan for the retrospective case studies was to make a determination on the presence and extent of drinking water resource contamination and whether hydraulic fracturing or related processes contributed to the contamination. Thus, the retrospective sites were expected to provide EPA with information regarding key factors that could be associated with drinking water contamination (US EPA, 2011b).

In 2011, EPA began conducting investigations at the five selected retrospective case study locations in Washington County, Pennsylvania (southwestern Pennsylvania); Bradford and Susquehanna Counties, Pennsylvania (northeastern Pennsylvania); Wise County, Texas; Las Animas and Huerfano counties, Colorado (Raton Basin); and Dunn County, North Dakota (Killdeer). This report presents the findings of the retrospective study conducted in Bradford and Susquehanna counties in northeastern Pennsylvania (Figure 1). Hydraulic fracturing in Bradford and Susquehanna counties focuses on recovering natural gas from the Marcellus Shale, a prodigious reservoir of natural gas in the Appalachian Basin.

The Commonwealth of Pennsylvania relies heavily on ground water as a drinking water source and has historically been second only to Michigan in size of population served by private wells (Swistock et al., 2009). Ground water wells supply drinking water to approximately 37% of Pennsylvania's population, or 4.5 million people (Pennsylvania Department of Environmental Protection [PA DEP], 2012), with private wells being abundant in both Bradford and Susquehanna counties. In recent years, northeastern Pennsylvania has seen some of the most intensive gas drilling activity in the U.S., as reflected by the high density of gas wells currently dotting the landscape in this part of the country. Based on PA DEP data (PA DEP, 2015), Bradford County alone had over 1,000 drilled unconventional oil and gas wells by mid-2013, the most of any county in Pennsylvania. Figure 2 illustrates the rate of increase of oil and gas drilling activity (primarily unconventional gas drilling) in Bradford County over a five-year period from July 2008 to July 2013. The significant increase in gas drilling activity has led to increasing concerns regarding potential impacts on homeowner wells.

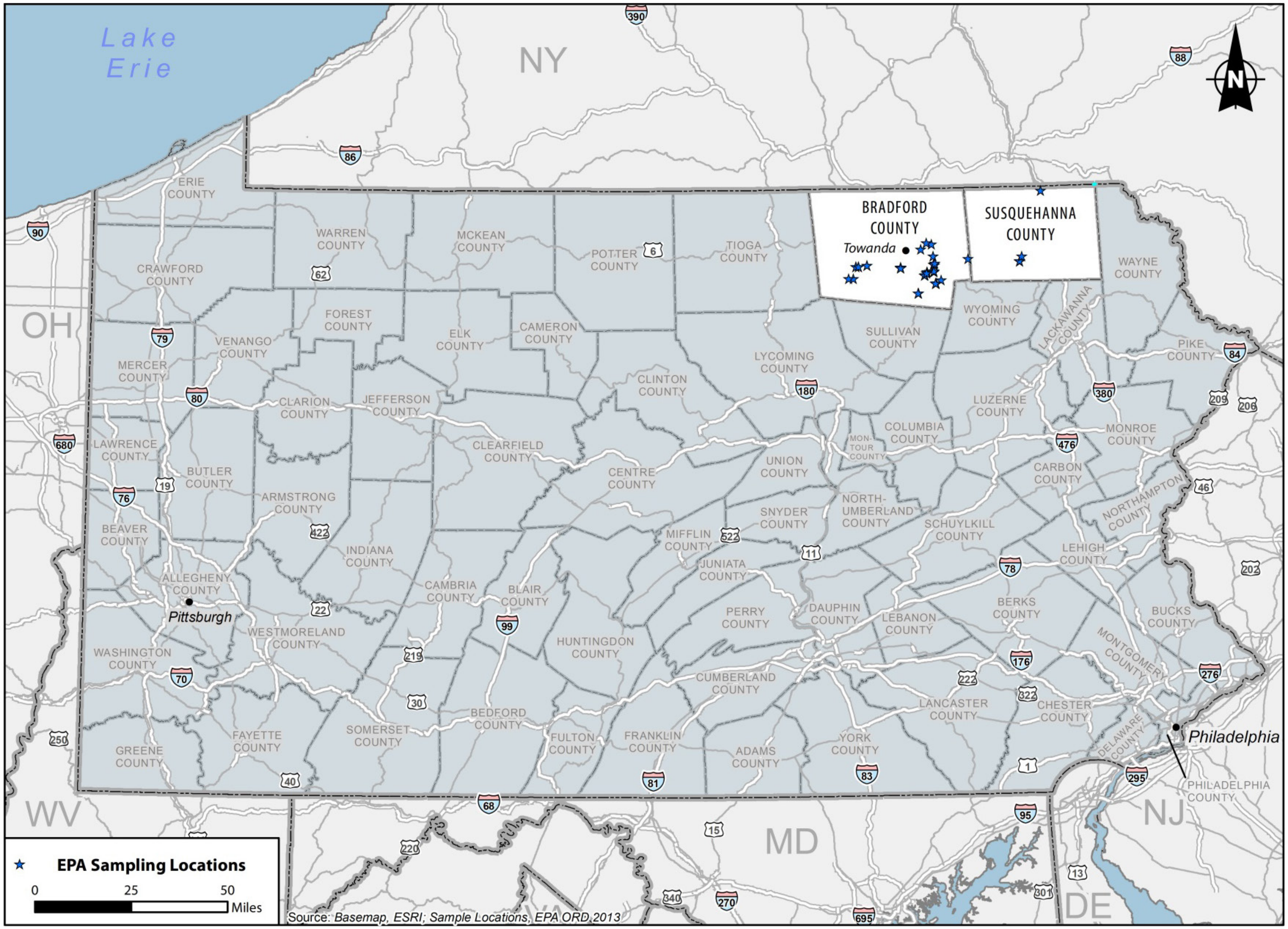


Figure 1. Location map of study area in northeastern Pennsylvania.

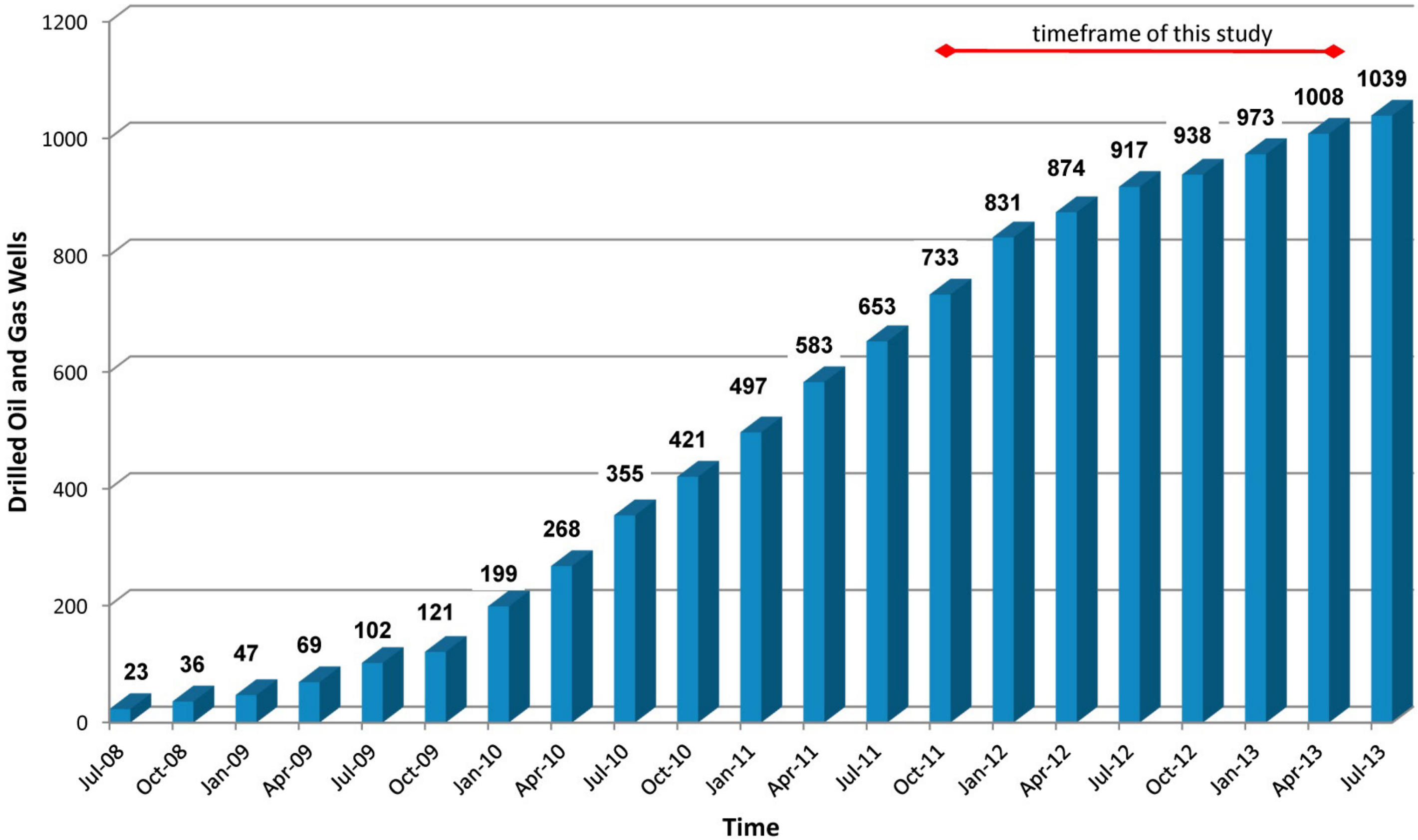


Figure 2. Drilled gas and oil wells in Bradford County since January 2000 showing totals beginning as of July 2008. Approximately 98% of drilled wells are unconventional wells and over 99% are gas wells. Approximately 94% of wells as of July 2013 were classified as active by the PA DEP (PA DEP, 2015).

2. Purpose and Scope

As a component of EPA's National Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (US EPA, 2012), five retrospective case studies were conducted to investigate reported instances of drinking water resource contamination in areas of natural gas development and use of hydraulic fracturing technology. These studies were intended to inform primary research questions related to the hydraulic fracturing water cycle (US EPA, 2012).

This report provides the results of the retrospective case study and describes general water quality, geochemistry, and isotopic parameters of shallow ground water in Bradford County and Susquehanna County, Pennsylvania. Water quality results are used to evaluate the potential impacts on shallow ground water drinking water resources, if any, from various land use activities, including but not limited to shale-gas drilling and production. The evaluation of potential impacts included consideration of the chemicals commonly used in hydraulic fracturing, analyses of dissolved gases and their isotopic compositions, deep brine geochemistry in relation to shallow ground water geochemistry, historical ground water quality in Bradford and Susquehanna counties, and time-dependent geochemical trends. Potential causes of water quality impairment, if any, that were considered include: industrial/ commercial land use; historical land use (e.g., farming and mining); current drilling processes and practices; historical drilling practices; and naturally occurring sources.

This report presents analytical data for water samples from 42 locations representing homeowner (domestic) wells, springs, and surface water bodies that were sampled at least once during three rounds spanning a period of 19 months (October/November 2011, April/May 2012, and May 2013). Although the study was conducted in both Bradford and Susquehanna counties, the majority of sampling was conducted in Bradford County. Sampling locations were selected primarily on the basis of individual homeowner complaints/concerns regarding potential impacts on homeowner well water from nearby hydraulic fracturing activities (e.g., increased turbidity, effervescing, staining, odors, etc.). Sampling in Bradford County was conducted mainly across the southern half of the county (see Figure 3), while sampling in Susquehanna County was conducted in the Dimock area and at one location in the northern portion of the county, near the New York State border (see Figure 4).

The water samples were analyzed for over 225 constituents, including organic compounds, nutrients, major ions, metals and trace elements, radioactivity, dissolved gases, and selected isotopes. Ground water quality data and summary statistics are presented for analyzed constituents/parameters. In addition to chemical data collected specifically for this study, the report includes analysis of historical data from the US Geological Survey (USGS) National Water Information System (NWIS) database (USGS, 2013), the USGS National Uranium Resource Evaluation (NURE) database (USGS, 2012c), and other sources of water quality data for northeastern Pennsylvania.

The retrospective case study sites differ with respect to geologic and hydrologic characteristics; however, generally similar research approaches were followed at the case study locations to assess potential drinking water impacts. As described in US EPA (2012), a tiered approach was followed to guide the progress of the retrospective case studies. The tiered scheme uses the results of successive steps, or tiers, to refine research activities. This report documents progress through the Tier 2 stage and includes the results of water sampling activities and evaluation of potential water quality impacts. The approach for Tier 2 efforts included: literature review of background geology and hydrology; selection of sampling locations and the development of a site-specific quality assurance project plan (QAPP); sampling and analysis of water wells, springs, and surface water; analysis of historical background data and evaluation of results from this study against the historical background data; statistical and geochemical evaluation of water quality data; evaluation of potential drinking water contamination; and identification of potential sources of identified contamination, if applicable.

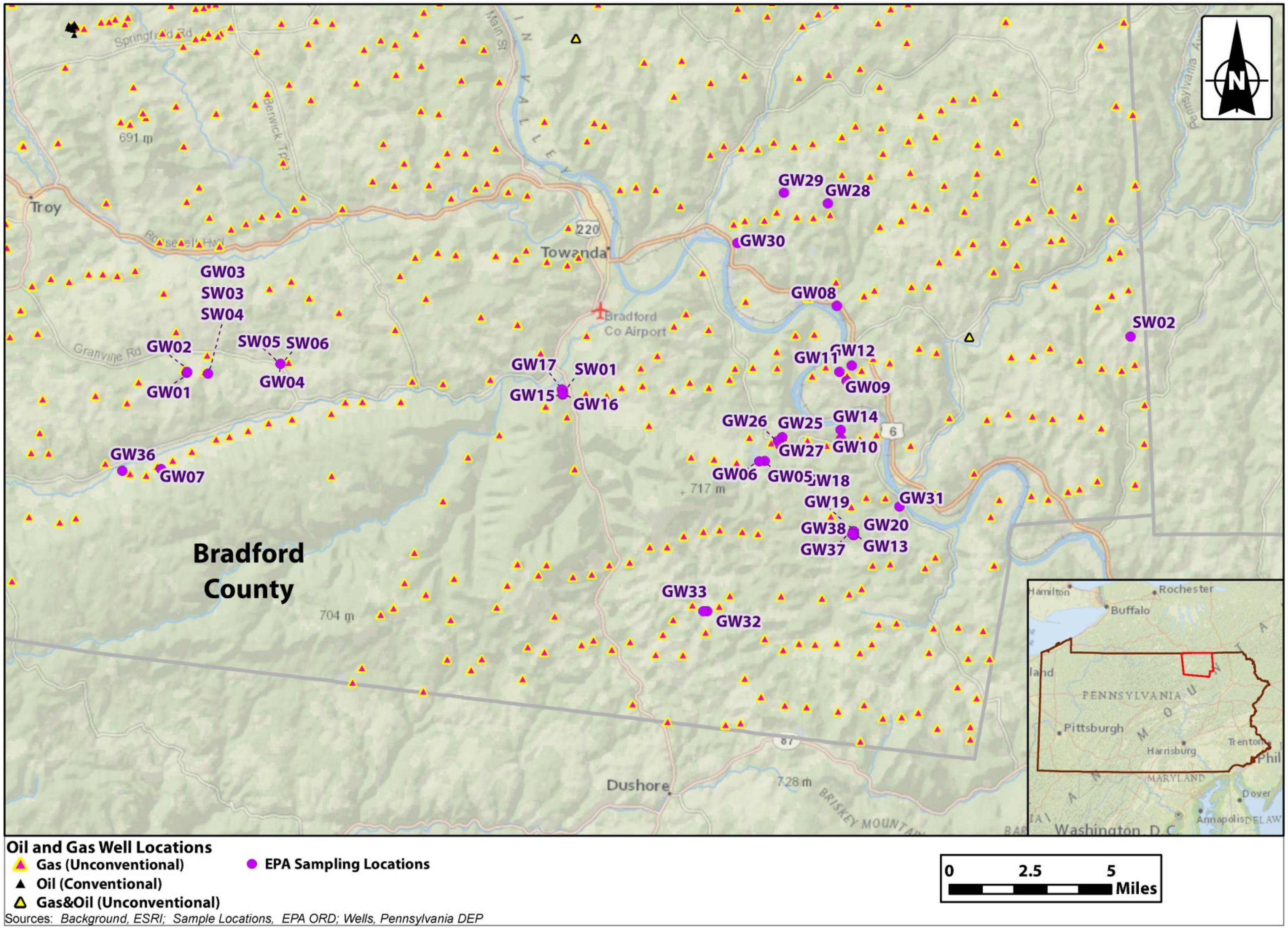


Figure 3. Case study sample location map, Bradford County, Pennsylvania, showing study sampling locations relative to locations of gas and oil wells. No conventional gas wells are reported for area of Bradford County shown. Gas and oil well locations shown may include some locations that were permitted but not yet drilled or fractured at completion of this study.

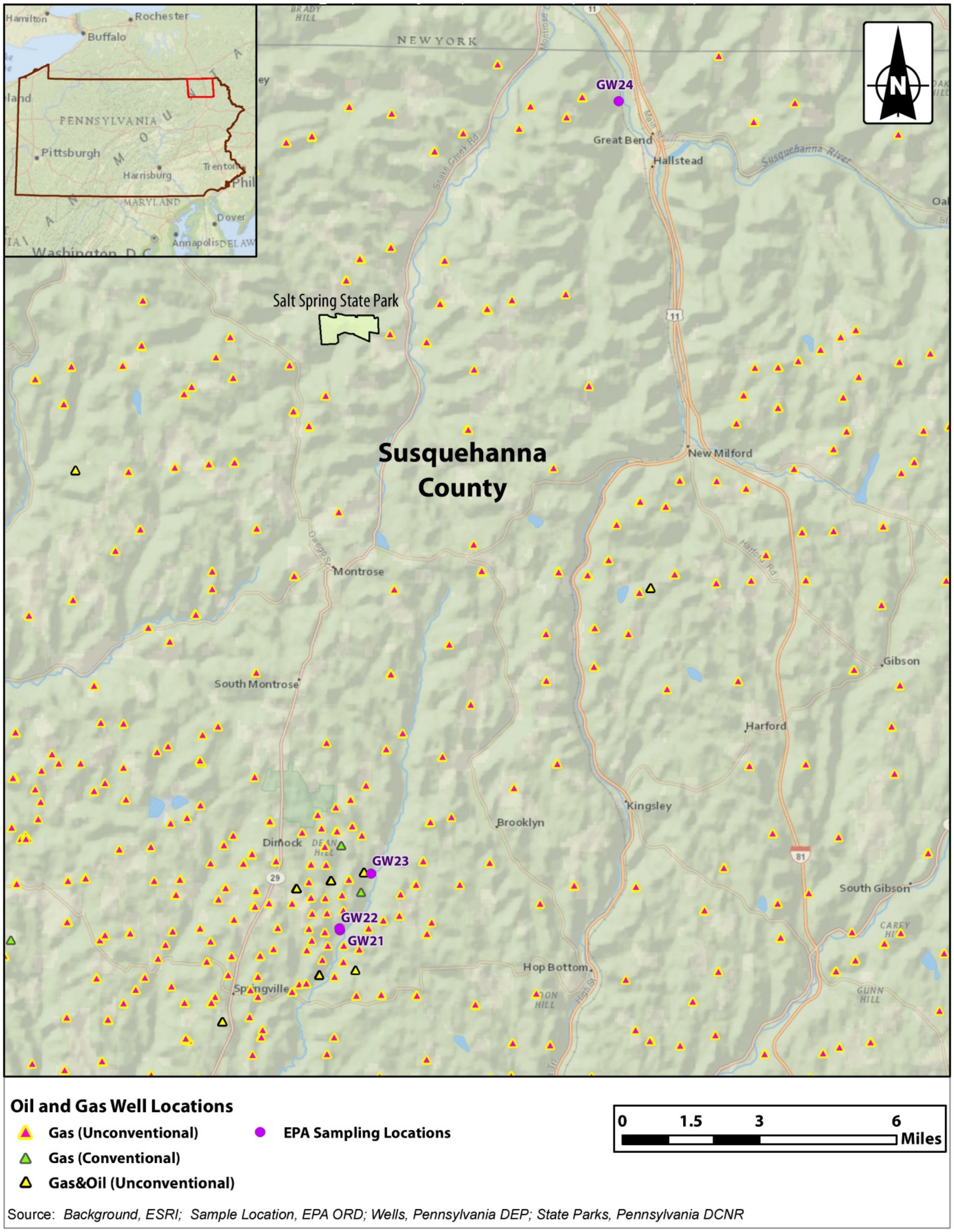


Figure 4. Case study sample location map, Susquehanna County, Pennsylvania, showing study sampling locations relative to locations of gas and oil wells. Gas and oil well locations shown may include some locations that were permitted but not yet drilled or fractured at completion of this study.

3. Study Area Background

3.1. Geology

The study area is part of the Glaciated Low Plateau Section of the Appalachians Plateau Province (Pennsylvania Department of Conservation and Natural Resources [PA DCNR], n.d.). The Glaciated Low Plateau Section is described as a diversified topography consisting of rounded hills and broad to narrow valleys modified by glacial erosion and deposition reflecting the interplay between bedrock of various types, mainly sandstones and siltstones, and glacial erosion and deposition. More erosion-resistant rocks form the hills, while less erosion-resistant rocks occur in the valleys. Glacial deposits, mainly glacial till or sand and gravel, occur primarily in the valley bottoms and margins (PA DCNR, n.d.).

Geologic maps for Bradford and Susquehanna counties are shown in Figures 5 and 6. The geology of the study area has been extensively described (Williams et al., 1998; Carter and Harper, 2002; Taylor, 1984; Milici and Swezey, 2006). The study area is underlain by unconsolidated deposits of glacial and post-glacial origin and nearly flat-lying sedimentary bedrock. The surficial cover comprises glacial and post-glacial deposits (till, stratified drift, alluvium, and swamp deposits) and tends to be thickest in the valleys. The glacial sediments and Quaternary alluvium found in the valleys along rivers and major streams form extensive unconfined or confined aquifers (Williams et al., 1998). The bedrock consists primarily of shale, siltstone, and sandstone of Devonian to Pennsylvanian age. A generalized geologic cross section of the bedrock sequence beneath the study area is provided in Figure 7. The Devonian bedrock includes the Lock Haven and Catskill formations, both of which are important sources of drinking water in the study area. According to Williams et al. (1998), lacustrine deposits of silt, clay, and very fine sand form areally extensive confining units that can exceed 100 feet in thickness in the major valleys. These lacustrine deposits are less extensive in the upland valleys. The Marcellus Shale, also known as the Marcellus Formation, is a Middle Devonian-age shale (about 390 million years), with a black color, low density, and high organic carbon content. It occurs in the subsurface beneath much of Ohio, West Virginia, Pennsylvania, and New York, as well as smaller areas of Maryland, Kentucky, Tennessee, and Virginia. In Bradford and Susquehanna counties, the Marcellus Shale lies 4,000 to 8,000 feet below the surface and ranges in thickness from 150 to 300 feet. The Marcellus Shale is part of a transgressive sedimentary package formed by the deposition of terrestrial and marine material in a shallow, inland sea. It is underlain by the sandstones and siltstones of the Onondaga Formation and overlain by laminated shales, siltstones, and fine-grained sandstones of the Mahantango Formation.

Both lithostratigraphy and sequence stratigraphy have been used to define the bedrock stratigraphic units in northeastern Pennsylvania. Definition using lithostratigraphy implies a more homogeneous and simplified stratigraphy (and character of the rock units), whereas sequence stratigraphy identifies the heterogeneity in the stratigraphic units that "more faithfully records the variations in rock types and structure" (Woodrow and Fletcher, 2002). At the exposure at Wayalusing Rocks, in southeastern Bradford County along the Susquehanna River, Elick (2002) describes interfingered marine and non-marine continental facies at the lower part of the Catskill Formation and the top of the Lock Haven Formation. Numerous interbedded units of silty mudrock, platy shale, shaley siltstone, and medium-grained sandstone occur at this outcrop. Although this particular exposure is at a topographic high

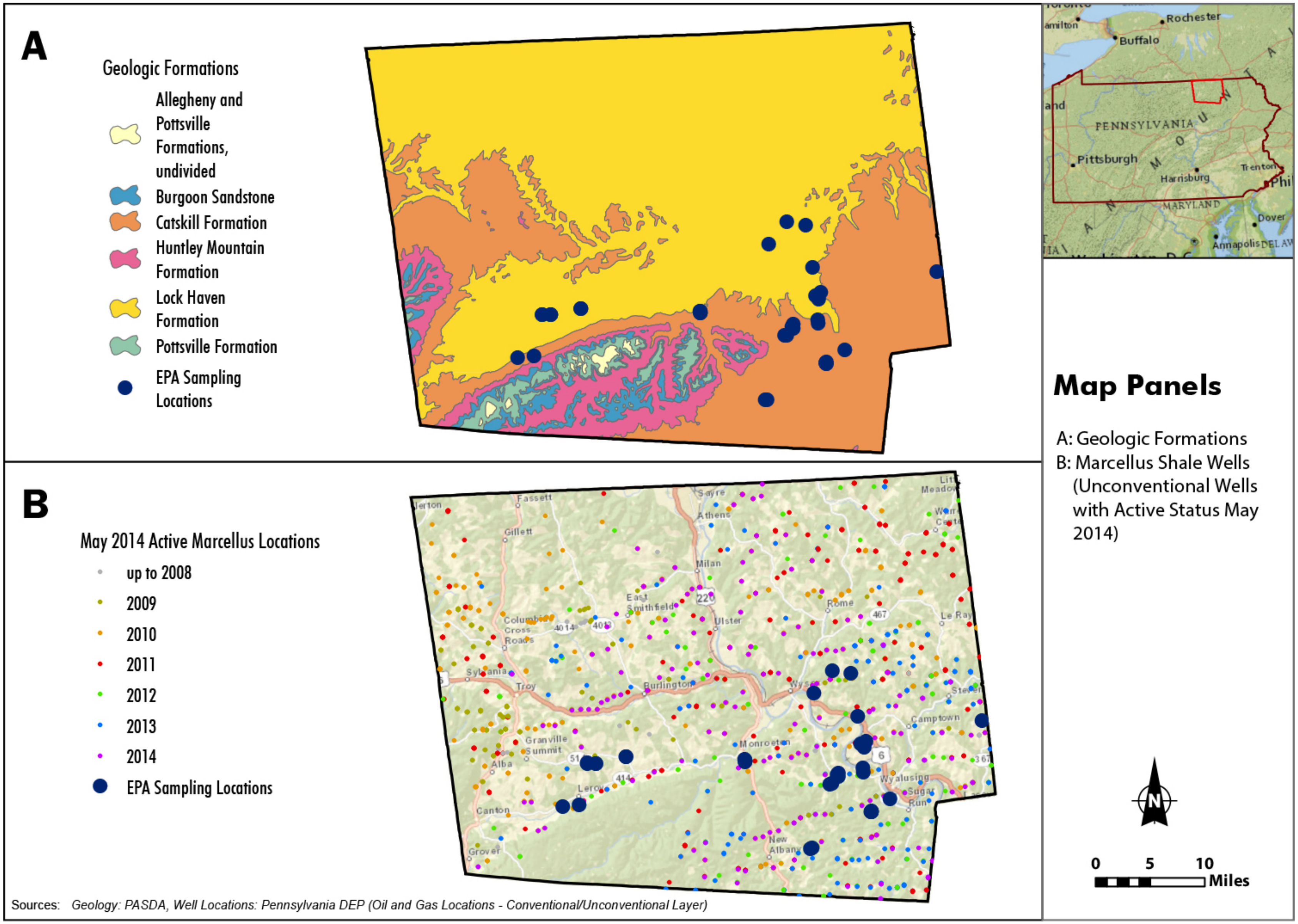


Figure 5. Maps showing geology and Marcellus Shale gas well distribution, by year, in Bradford County, Pennsylvania.

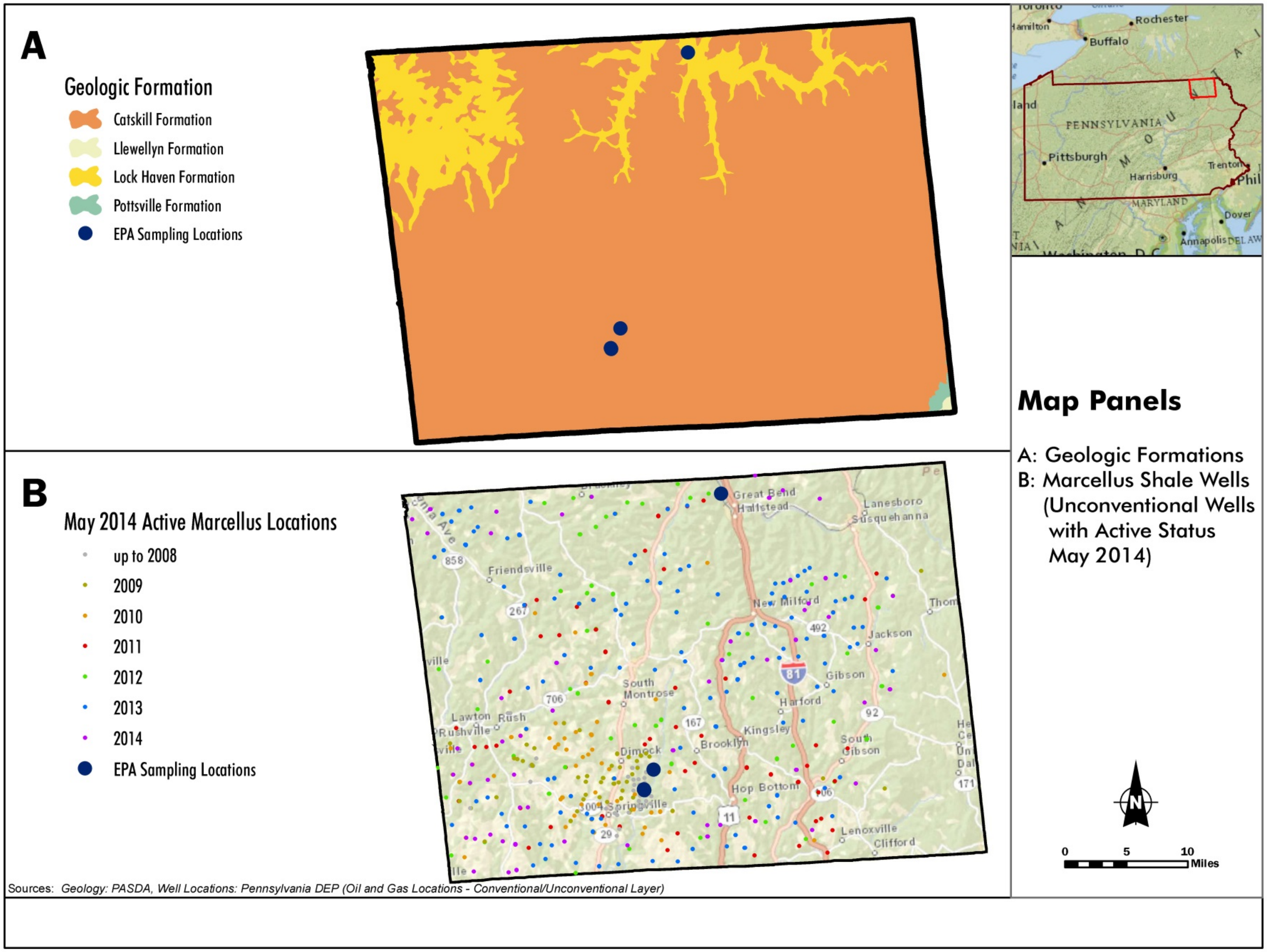


Figure 6. Maps showing geology and Marcellus Shale gas well distribution, by year, in Susquehanna County, Pennsylvania.

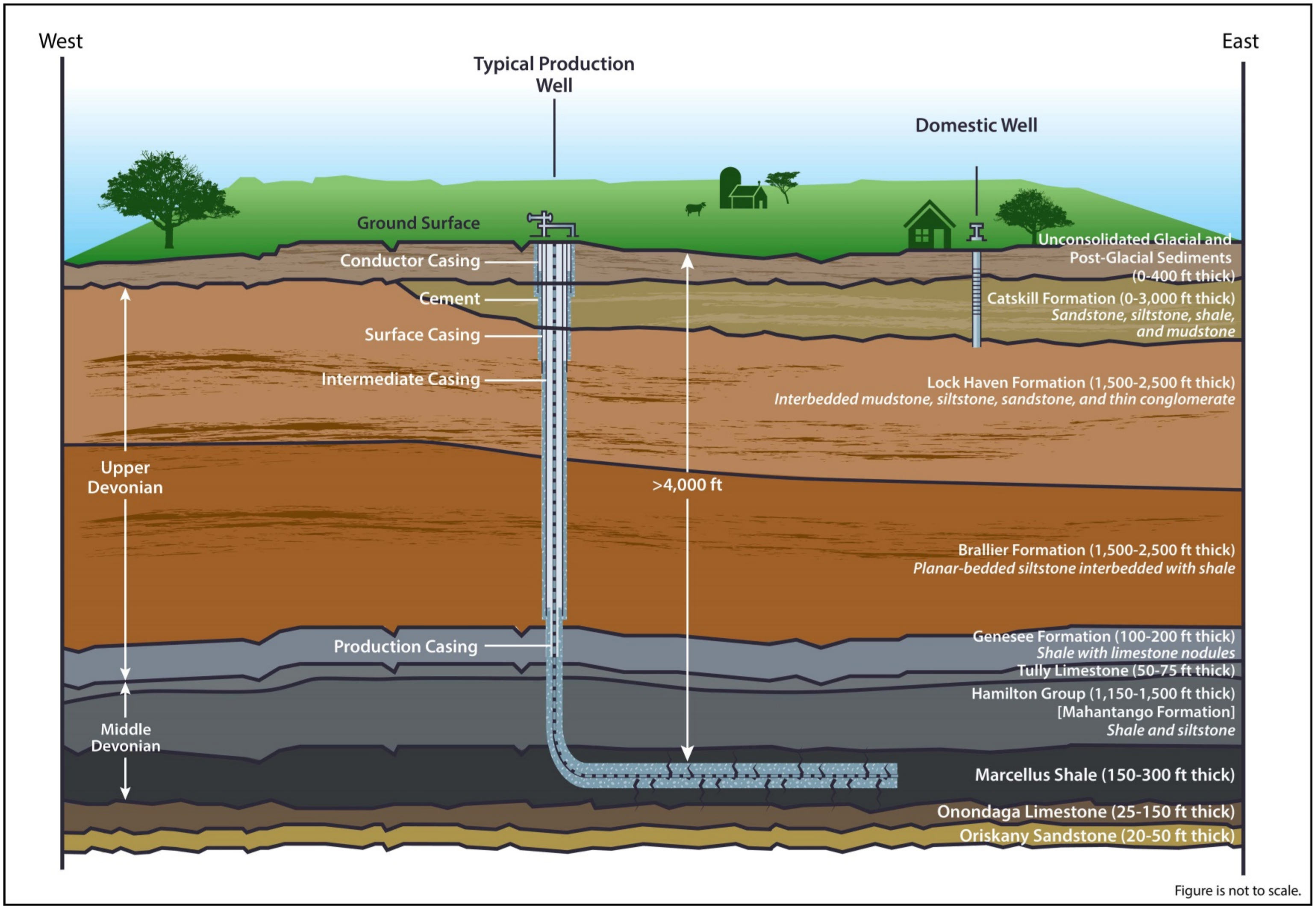


Figure 7. Generalized geologic cross-section of study area in Bradford and Susquehanna Counties, Pennsylvania. Unconsolidated glacial and post-glacial sediments shown are thickest in valley settings and are generally thin or absent in upland settings. (Data sources: Baldassare et al., 2014; Taylor, 1984; USGS: http://mrdata.usgs.gov/geology).

above the adjoining valley, it illustrates the complexity that occurs in portions of these formations. The Lock Haven Formation in the study area is described by Baldassare et al. (2014) as consisting of interbedded thick, multicolored, primarily marine, silty, micaceous mudrocks and fine- to coarse-grained, thin- to thick-bedded siltstones, sandstone, and conglomerates, while the Catskill Formation is described as consisting of red, gray, or mottled red and green, mixed continental, fluvial-deltaic, and marginal-marine strata. Strata older than the Lock Haven in the study area, as described by Baldassare et al. (2014), include the Upper Devonian Brallier Formation consisting of interbedded siltstones and shales, with some rare, fine-grained sandstones and shales of the Upper Devonian Harrell Formation (Genesee of New York), with basal black shales of the Burket Member (Geneseo of New York). The numerous sequences and variations in lithology illustrate that the bedrock overlying the Marcellus Shale cannot be considered as a massive and monolithic unit. The lithology, stratigraphy, and structural geology of the bedrock (and its thickness) have an impact on the potential migration of ground water and/or gas through the bedrock. The thicknesses (and depths) of each formation can vary laterally. Structural traps can be due to anticlines or faulting (in association with a specific lithology), while fractures can potentially form preferential flow paths for fluids.

Within the Marcellus Shale, natural gas occurs within the pore spaces and vertical fractures, or joints, of the shale and is adsorbed onto mineral grains and organic material. In order to recover gas in the study area most efficiently, the horizontal legs (laterals) of gas wells are generally oriented north-northwest or south-southeast (see Figure 8), perpendicular to a naturally occurring, older (J_1) joint set and parallel to a less well developed naturally occurring, younger (J_2) joint set. Well stimulation via hydraulic fracturing is outward from the horizontal well perpendicular to the J_2 fractures so that the J_2 fractures are intersected and drained as the stimulated fractures move outward (Engelder et al., 2009).

3.2. Hydrogeology

Surface water in the study area is part of the Upper Susquehanna River basin. The main branches of the Susquehanna River flow south, while the smaller tributaries are constrained by the northeast-southwest orientation of the Appalachian Mountains. Summer storms produce about half of the average precipitation of approximately 40 inches per year (SRBC 2006), while the remainder of the precipitation, and much of the ground water recharge, occurs during winter and the spring melt (PA DEP, 2012). Williams et al. (1998) estimate an average recharge rate from precipitation in the valleys of approximately 1.8 inches per year. These resources provide water for domestic use, municipal water, manufacturing, irrigation, and hydraulic fracturing.

The ground water flow regime in the study area has been extensively described by Williams et al. (1998). The glaciated valleys are classified into two major zones: (1) zones of unrestricted ground water flow containing water of the calcium carbonate type, and (2) zones of restricted ground water flow containing water of the sodium chloride type. Williams et al. (1998) state that unrestricted ground water flow occurs in the unconfined and confined stratified-drift aquifers and in many of the till and shallow bedrock systems, whereas restricted flow occurs in the bedrock of the major valleys and, in some areas, in the overlying till and confined stratified-drift aquifers. Stratified drift aquifers (confined

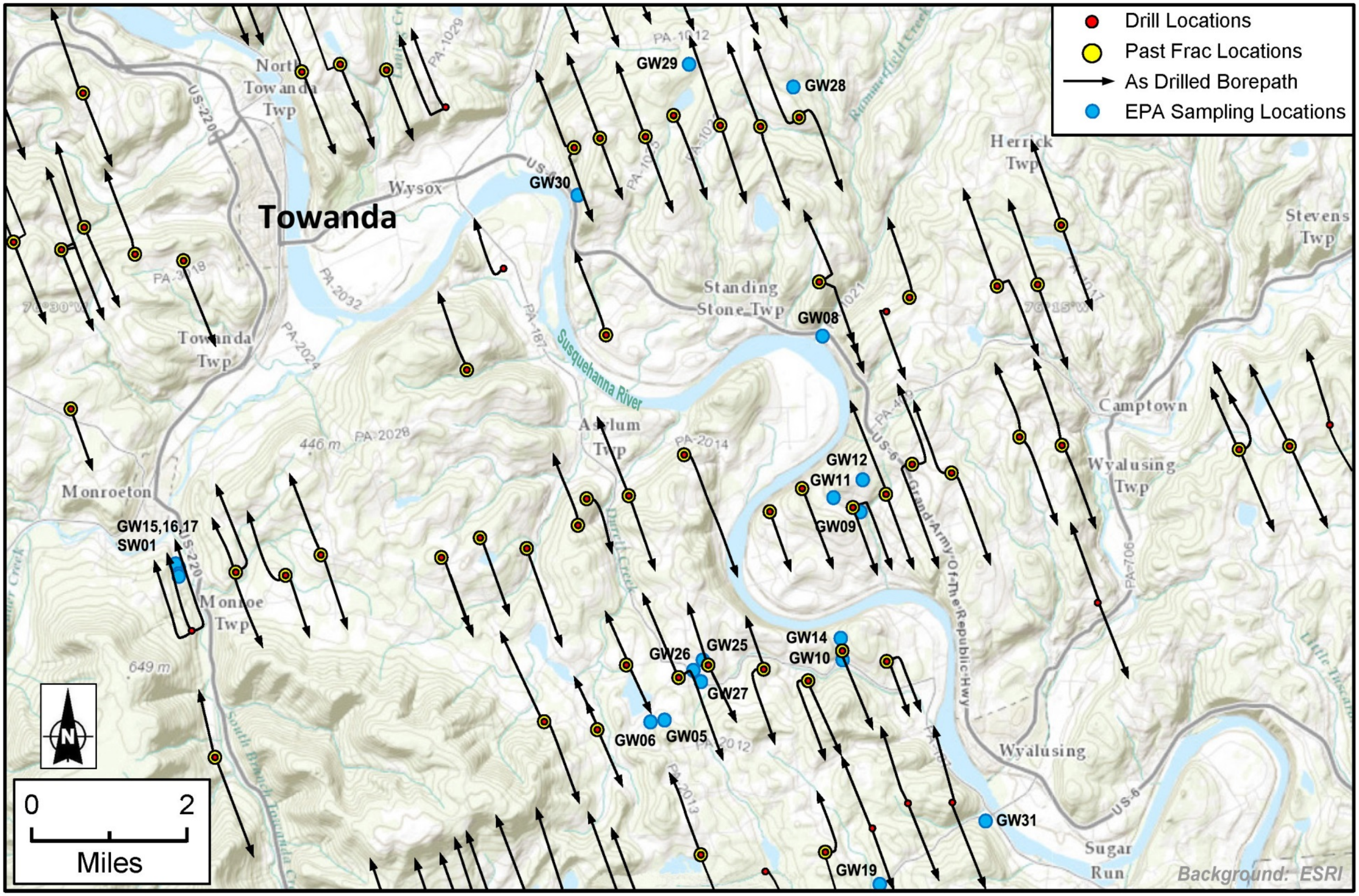


Figure 8. Map showing north-northwest and south-southeast orientation of gas well laterals in Towanda area of Bradford County as of February 2012 (Data source: Chesapeake Energy 2/12/2012). Note: Some gas wells shown were drilled but not yet fractured as of 2/12/2012. Also shown are homeowner well and spring locations within map extent that were sampled in this study.

and unconfined) and the Lock Haven and Catskill bedrock formations serve as primary ground water drinking sources in the study area, with till also occasionally being tapped as a drinking water source in some locations (Williams et al., 1998). The confined aquifers in the study area are composed of sand and gravel deposits of glacial, ice-contact origin and are typically buried by pro-glacial lake deposits; the unconfined aquifers are composed of sand and gravel deposited by glacial outwash or melt-waters. Depth to ground water (potentiometric surface) varies throughout the study area, ranging from 1 foot to 300 feet for the wells sampled in this study. Wells completed in stratified-drift aquifers generally have specific capacities an order of magnitude greater than those completed in the till or bedrock. The median specific capacity in confined stratified-drift aquifers is about 11 gallons per minute per foot (gal/min ft) of drawdown, and in unconfined stratified-drift aquifers is about 24 gal/min ft (Williams et al., 1998). Most wells in the Catskill Formation have higher yields than those in the Lock Haven Formation due to the generally more coarse grained properties of the Catskill Formation.

The primary ground water type found in the study area is calcium bicarbonate ($Ca\text{-}HCO_3$) water with sodium bicarbonate ($Na\text{-}HCO_3$) and sodium chloride (Na-Cl) type water being found to a lesser extent (Williams et al., 1998; Molofsky et al., 2013). According to Williams et al. (1998), sodium chloride type water, which tends to occur in zones of more restricted flow, generally contains higher levels of total dissolved solids (TDS) and higher concentrations of dissolved barium (Ba), dissolved sodium (Na), and dissolved chloride (Cl). In their evaluation of ground water in Bradford, Tioga, and Potter counties in northeastern Pennsylvania, Williams et al. (1998) identified 44 wells with Na-Cl type water almost all of which are located in stream and river valleys. According to Williams et al (1998), 23 of these wells were completed in the Lock Haven formation, 15 in the Catskill formation, four in the confined stratified drift, and two in the till. The natural presence of TDS, Ba, Na, and Cl at often elevated concentrations in the study area relative to applicable secondary or primary maximum contaminant levels (MCLs) complicates their use as indicators of potential impacts. Naturally occurring iron (Fe) and manganese (Mn) concentrations in ground water in the study area can also be elevated and frequently exceed the secondary MCLs of 0.3 milligrams per liter (mg/L) and 0.05 mg/L, respectively (Williams et al., 1998).

3.3. Oil and Gas Production

Oil and gas exploration and production are not new to northeastern Pennsylvania and began as early as the 1860s. However, as of 2002, much of the region remained unexplored or underexplored, as evidenced by the sparse presence of both dry holes and established oil and gas fields (Carter and Harper, 2002). The limited exploration in this part of Pennsylvania was at least partially attributable to adherence to the carbon-ratio theory, which predicted the absence of hydrocarbons in northeastern Pennsylvania due to the low percentage of fixed carbon present in coals in the area (Carter and Harper, 2002). Zampogna et al. (2012) describe the history of oil and gas activities in northeastern Pennsylvania (Bradford, Susquehanna, and Wyoming counties), identifying 33 oil or gas wells in Bradford County and 11 in Susquehanna County from the 1860s to the 1980s. Historical oil and gas production in northeastern Pennsylvania was essentially limited to Devonian strata, with the Lock Haven Formation producing oil and gas, and the Oriskany Sandstone below the Marcellus Formation producing gas only. In Bradford County in the 1990s, there were 11 wells producing gas in three gas fields in the Oriskany Sandstone (Carter and Harper, 2002). The use of hydraulic fracturing to enhance the extraction of oil and gas from subsurface formations began in the early 1950s, with hydraulic fracturing being limited to vertical well systems. However, with the advent of horizontal directional drilling and improved hydraulic fracturing techniques, as well as the increased price of gas, the extraction of gas from low-permeability (unconventional) deposits such as the Marcellus Shale became economically viable. The advances in hydraulic fracturing and horizontal directional drilling technologies have made the Marcellus Shale one of the most important natural gas resources in the United States, with the capacity to possibly produce several hundred trillion cubic feet of gas (Milici and Swezey, 2006; Engelder et al., 2009). The sudden economic viability of gas production from the Marcellus Shale resulted in a significant acceleration in drilling activities and production in the region after 2008. By mid-2013, as noted earlier, there were more than 1,000 drilled unconventional oil and gas wells in Bradford County (primarily Marcellus gas wells) compared to only one unconventional well prior to 2008 (PA DEP, 2015). Locations of Marcellus Shale gas wells by year in Bradford and Susquehanna Counties are shown in Figures 5 and 6.

3.4. Land Use

According to Bradford County's 2004 Comprehensive Plan, "Residents today still enjoy a predominantly rural landscape of forested hills and mountains, agricultural valleys, and small towns and villages at rural cross roads." Historically, timber production was a major industry, and agriculture was and remains a major industry, with Bradford County being one of the leading agricultural counties in Pennsylvania. The largest population centers and industrial areas in the county are located along the Susquehanna River (Bradford County Office of Community Planning and Grants, 2010). In recent years, the county has become a center of natural gas production, and in the first half of 2012 was the leading natural gas producing county in Pennsylvania, accounting for 26% of the state's natural gas production (Marcellus Drilling News 2012).

Susquehanna County is largely undeveloped, with agricultural and forested land predominating (Michael Baker, Inc., 2012). Dairy farming is a major industry in the county, and livestock production accounts for 94% of the value of the county's agricultural products (City Data, 2013). In the first half of 2012, Susquehanna was the second largest natural gas producing county in Pennsylvania, accounting for 21% of the state's natural gas production (Marcellus Drilling News, 2012).

Maps comparing land use in Bradford and Susquehanna counties in 1992 and 2006, based on data from the National Land Cover Database (NLCD), are provided in Figures 9 and 10. Tables 1a and 1b, also based on the NLCD, present data on land use in the counties in 1992 and 2006. The NLCD is based on 30-meter-resolution data from the Landsat satellite (USGS, 2012a). The 2006 dataset was the most recent land use information available.

Although the data for land use in the two years (1992 and 1996) are not comparable due to changes in input data and mapping methodologies (Multi-Resolution Land Characteristics Consortium, 2013), the NLCD data indicate that, in both years, forest cover was the largest land use in the counties, followed by cultivated land, and that these two land use categories accounted for an overwhelming majority of the land use in the counties. The data also indicate land use patterns did not significantly change between 1992 and 2006. Additional land use analysis, with particular focus on the areas adjacent to the sampling points of this study, is presented in Appendix C.

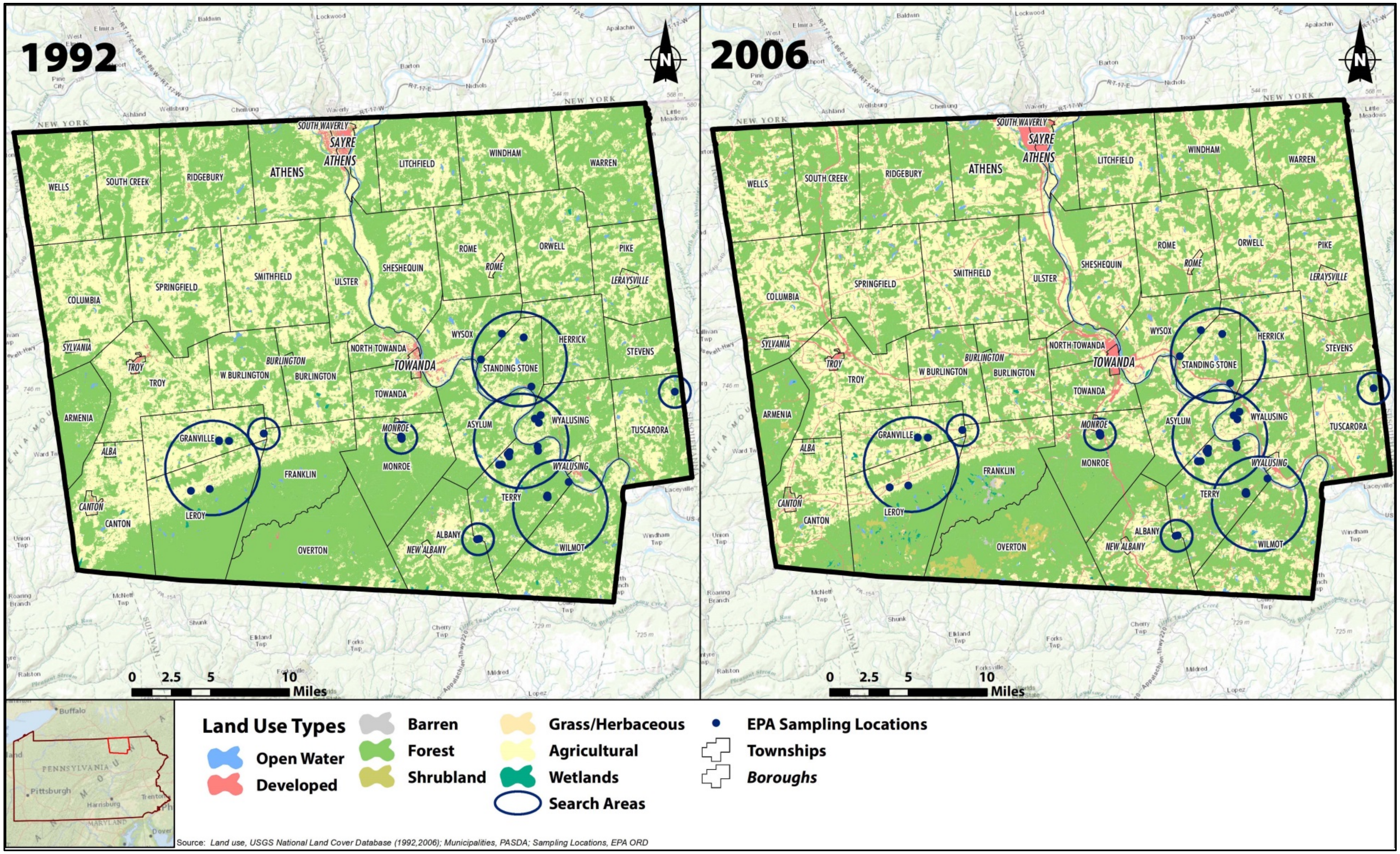


Figure 9. Bradford County, Pennsylvania – land use in 1992 and 2006 (Source. USGS National Land Cover Database [1992, 2006]). Buffer areas around the sampling locations of this study were used for the analysis of land use and environmental record searches (see Appendix C).

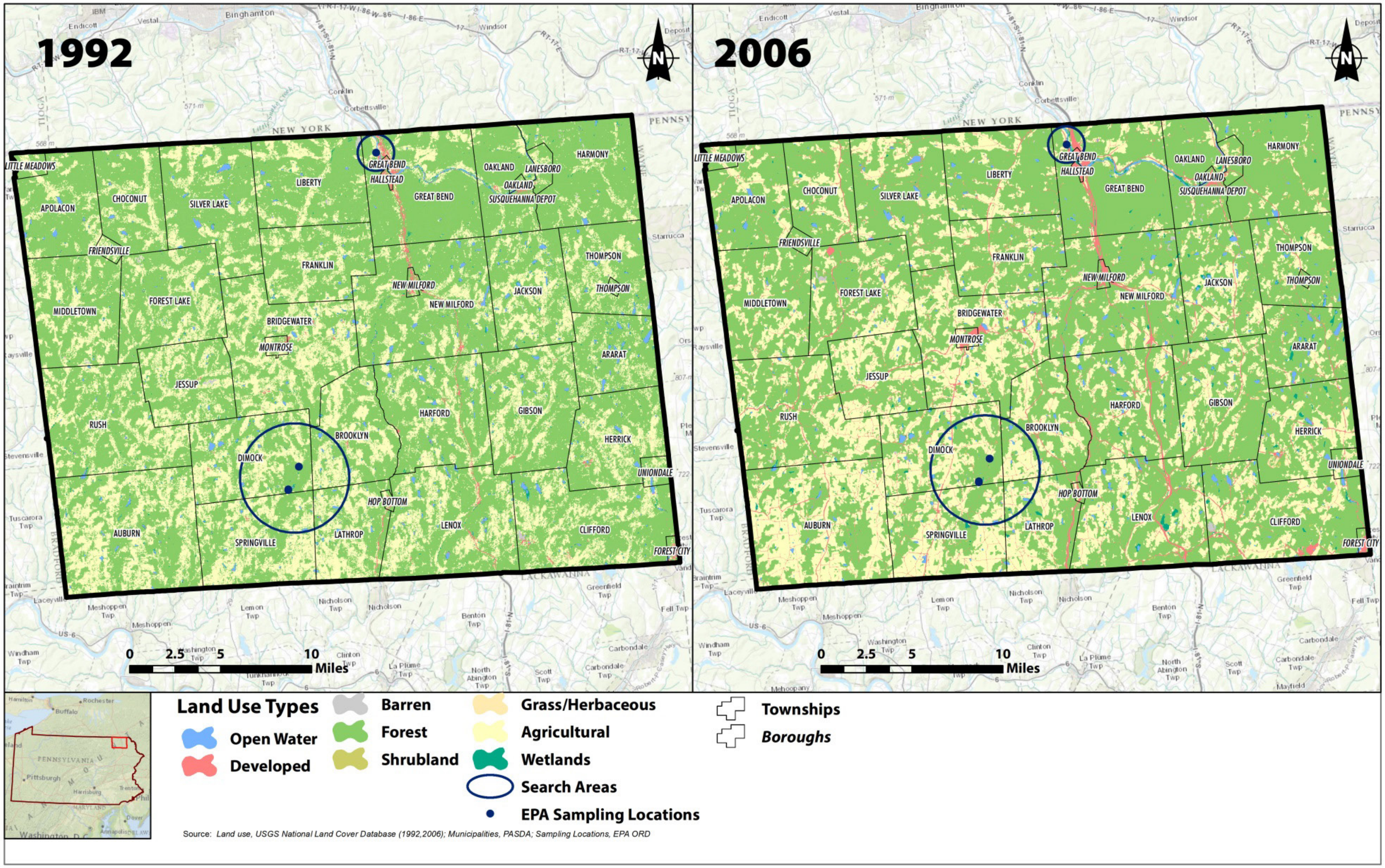


Figure 10. Susquehanna County, Pennsylvania – land use in 1992 and 2006 (Source: USGS National Land Cover Database [1992, 2006]). Buffer areas around the sampling locations of this study were used for the analysis of land use and environmental record searches (see Appendix C).

Table 1a. Land use in Bradford County in 1992 and 2006.

Land Use	1992		2006	
	Square Miles	% of Total	Square Miles	% of Total
Deciduous Forest	523	45%	417	36%
Pasture/Hay	369	32%	278	24%
Mixed Forest	103	9%	172	15%
Evergreen Forest	85	7%	66	6%
Row/Cultivated Crops	62	5%	135	12%
Open Water	12	1%	11	1%
Other	12	1%	86	7%
Total	1,164	100%	1,164	100%

Note. Totals may not sum exactly due to rounding. Data source. U.S. Department of Agriculture, 2012

Table 1b. Land use in Susquehanna County in 1992 and 2006.

Land Use	1992		2006	
	Square Miles	% of Total	Square Miles	% of Total
Deciduous Forest	436	52%	341	41%
Pasture/Hay	176	21%	136	16%
Mixed Forest	107	13%	140	17%
Evergreen Forest	65	8%	55	7%
Row/Cultivated Crops	32	4%	99	12%
Open Water	11	1%	10	1%
Other	9	1%	54	7%
Total	835	100%	835	100%

Note. Totals may not sum exactly due to rounding. Data source: U.S. Department of Agriculture, 2012

Table 2 provides an estimate of the areas affected by natural gas development in Bradford and Susquehanna counties. The website of the Pennsylvania Department of Environmental Protection (PA DEP) provided the number of permitted well pads in each of the counties as of May 19, 2014. (PA DEP, 2014a). Most wells at these pads are "unconventional" (PA DEP, 2014b)[1], suggesting they are completed in the Marcellus Shale and have been stimulated using hydraulic fracturing. A USGS study of the landscape impacts of natural gas extraction in Pennsylvania provided the estimate of the area disturbed (i.e., affected) by well pads associated with the extraction of shale gas through hydraulic

[1] The online database from which these data were drawn provides an option for selecting records relating to unconventional wells only or all wells. Selecting either option results in identical lists that include only unconventional wells.

fracturing (USGS, 2012b). In both counties, less than 1% of the county land area is potentially affected by gas development.

Table 2. Area potentially affected by gas development in Bradford and Susquehanna Counties.

Item	County	
	Bradford	**Susquehanna**
Number of Well Pads (1)	644	414
Affected Acres per Well Pad (2), (i)	10.1	
Affected Area in Square Miles (ii)	10.2	6.6
Total Area of County in Square Miles (3)	1,147	823
Percentage of County Area Potentially Affected by Well Pads	0.9%	0.8%

Sources:
(1) PA DEP (2014a)
(2) US Geological Survey (2012b)
(3) US Census Bureau (2012)

Notes:
(i) Original source in hectares, converted to acres (2.471 acres per hectare).
(ii) 640 acres per square mile.

3.5. Potential Contaminant Sources

In order to help determine whether hydraulic fracturing was the cause or one of the causes of potential impacts on water quality assessed in this study, a consistent and rigorous approach was adopted for evaluating potential contaminant sources using causal assessment. Causal assessment is defined as the organization and analysis of available evidence to evaluate links between apparent environmental impacts and potential causes, and the assessment of the level of confidence in these causal links.

An exhaustive list of candidate causes, i.e., hypothesized causes of environmental impairment that are sufficiently credible to be analyzed (EPA, 2000a), was developed for the Bradford and Susquehanna county areas of this retrospective case study. Each environmental stressor was evaluated by examining potential causes and effects. Candidate causes included all potential sources that could stress the environment and thereby contribute to any detected levels of surface and/or ground water contamination. Candidate causes were categorized as follows: industrial/commercial land use, historical land use (e.g., farming and mining), current drilling processes/practices, historical drilling practices, and naturally occurring sources.

In order to determine whether there are potential sources of contamination unrelated to drilling and hydraulic fracturing activities, a detailed background assessment was conducted as described below. The background assessment is presented in detail in Appendix C.

Detailed background assessments included searches of the following databases:

- **Environmental records search:** Environmental record searches were performed by Environmental Data Resources, Inc. (EDR). EDR's service includes searching publicly available databases and also providing data from their own proprietary databases.

- **Well inventory**: Existing oil and gas well inventories were prepared on the same search areas used for the EDR reports using PA DEP's oil and gas well database.
- **State record summary:** PA DEP's Environment Facility Application Compliance Tracking System (*e*FACTS; http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_site.aspx) was used to find up-to-date well records for the study areas. This database provides information on inspection and pollution prevention visits, including lists of all inspections that have occurred at each well on record, whether violations were noted, and any enforcement that may have resulted. The system provides multiple options to search for records.

The issues concerning ground water in Bradford County and Susquehanna County include complaints about changes in water quality believed by homeowners to be associated with gas drilling (e.g., turbidity, effervescing, discoloration, staining, odor, etc.). Although numerous gas wells have been recently drilled and continue to be drilled in these areas, no specific gas well was targeted as a potential candidate cause at the initiation of the study, since changes in water quality could also be due to historical land use, historical drilling practices, and naturally occurring sources.

Williams et al. (1998) identified sewage, animal wastes, chemical fertilizers, industrial chemicals and wastes, and petroleum products as sources of contamination to ground water locally in the study area. Battelle (2013) concluded the main causes of historical (pre-2007) water quality impairments in Bradford and Susquehanna counties have been agriculture and road runoff, with additional contributions from habitation modification, septic systems, non-point sources, point sources, and resource extraction from coal and non-coal mineral mining. They state that agricultural runoff can include insecticides, herbicides, fungicides, fertilizers, metals, and other constituents (dissolved solids, bromide, selenium), and road runoff can include chloride, sodium, and bromide.

4. Study Methods

This section describes the methods used in this study for the collection of water samples, sample analysis, quality assurance/quality control (QA/QC), data reduction, and data analysis. A more detailed description of the sampling methods, analytical methods, and QA/QC is provided in the Quality Assurance Project Plan (QAPP) (EPA 2013) [http://www2.epa.gov/sites/production/files/documents/bradford-review-casestudy.pdf]. The analytical methods and field measurements employed in the study are discussed in Sections 2.2 and 2.4, respectively, of the QAPP. A list of the analytes, parameters, and sample results are provided in Appendix B. Water analyses were conducted for over 225 analytes covering a large range of organic and inorganic constituents, including gasoline-range organics (GRO), diesel-range organics (DRO), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), glycol ethers (2-butoxyethanol, diethylene, triethylene, and tetraethylene glycol), low-molecular-weight acids (lactate, formate, acetate, proprionate, isobutyrate, and butyrate), dissolved gases (methane, ethane, propane, n-butane), major and trace cations and anions, dissolved organic carbon (DOC), dissolved inorganic carbon (DIC), stable isotopes ($\delta^{13}C_{CH4}$, $\delta^{2}H_{CH4}$, $\delta^{13}C_{C2H6}$, $\delta^{13}C_{DIC}$, $\delta^{18}O_{H2O}$, $\delta^{2}H_{H20}$, and $^{87}Sr/^{86}Sr$), and radioactivity (radium-226, radium-228, gross alpha activity, and gross beta activity). Field parameters measured included temperature, specific conductance, pH, dissolved oxygen, oxidation-reduction potential (ORP), alkalinity, turbidity, ferrous iron, and hydrogen sulfide. These analyses cover a broad spectrum of compounds and indicators that are potentially linked to hydraulic fracturing activities and/or that aid in providing a conceptual framework for evaluating potential impacts. Of the analyses noted above, those that are considered critical analyses supporting the primary objective of the project—i.e., to determine whether drinking water (ground water) resources in the selected areas of Bradford and Susquehanna counties have been impacted by hydraulic fracturing activities—include GRO, DRO, VOCs (ethanol, isopropyl alcohol, tert-butyl alcohol, naphthalene, benzene, toluene, ethylbenzene, and xylenes), SVOCs, dissolved gases (methane, ethane, propane, n-butane), major cations (Ca, Mg, Na, K), major anions (Cl, SO_4), and trace elements (As, Se, Sr, Ba).

4.1. Sampling Locations

Three rounds of sampling were conducted as part of this study at a total of 36 homeowner wells, two springs, one pond, and one stream in northeastern Pennsylvania. Samples were collected from 33 homeowner wells and two springs in the first round; 22 homeowner wells, one spring, the stream, and the pond in the second round; and 21 homeowner wells and one spring in the third round. An iterative approach was employed in the sampling program whereby the results from a preceding sampling event were used to refine the focus of subsequent sampling events. Most homeowners who had come forward to lodge complaints or express concerns regarding potential impacts of nearby hydraulic fracturing activities on their well water were accommodated in the first round of sampling. The second and third sampling rounds generally focused on those locations that in the first round of sampling were observed to exhibit more elevated concentrations of one or more constituents of interest possibly linked to hydraulic fracturing activities (e.g., methane, chloride, sodium, TDS, barium, radium, bromide, strontium, manganese, iron, etc.).

Most sampling locations in the study were in Bradford County; the exceptions were three homeowner locations (four wells) in Susquehanna County, which were sampled in the first round only (see Figures 3 and 4). With one exception, all sampling locations were within 1 mile of one or more drilled gas wells and, with three exceptions, all sampling locations were within 1 mile of one or more drilled gas wells that had been hydraulically fractured prior to water sampling in this study. With three exceptions, one or more fractured laterals were present areally within 3,000 feet of each of the sampling locations prior to water sampling. Collectively, there were a total of approximately 100 drilled gas wells within 1 mile of sampling locations in the study (see Appendix C, Table C-27), with most wells having been fractured prior to water sampling. The two springs sampled in the study had originally served as drinking water sources for homeowners but were eventually replaced by drilled drinking water wells. The pond sampled in the study was located immediately adjacent to and downhill of a well pad (Vannoy pad) where fluid releases were reported to have occurred in 2009 (see Appendix C). The primary focus of the pond sampling was to determine whether links, if any, existed between potential pond impacts and potential impacts on the nearby homeowner well. The stream sampled in the study was close to a homeowner well observed to exhibit more elevated levels of barium, TDS, and combined radium-226 and radium-228. As in the case of the pond, the stream was sampled to establish links, if any, between potential stream impacts and potential well impacts.

The completion depths of homeowner wells sampled in the study were, in most cases, uncertain and were based primarily on homeowner knowledge of their wells. Well depths could not be determined in the field due to the homeowner pumps in the wells posing an obstruction to the use of well depth measuring devices. Temporary removal of homeowner pumps from the wells to allow for depth measurements was not feasible, since it would have required specialized equipment and services and may have caused a significant interruption in the availability of water to the homeowner. A search of state records, including a visit to state offices, yielded only limited information on the construction and depth of the homeowner wells that were sampled.

Although the first round of sampling was conducted in both Bradford County and Susquehanna County, sampling in the two subsequent rounds was limited to Bradford County only. This is due to EPA Region 3 becoming actively involved in evaluating drinking water quality in Susquehanna County (Dimock) in early 2012, soon after completion of the first round of sampling in this study. Three of four homeowner wells sampled in this study in Susquehanna County were located in Dimock; therefore, in order to avoid redundancy in efforts by Region 3 and EPA's Office of Research and Development (ORD), it was decided to focus on Bradford County for this study. The fourth homeowner well sampled in Susquehanna County was not located in Dimock but was also not sampled in rounds 2 and 3 because of liability concerns associated with very high turbidity generated in the well during purging. As will be addressed later in the report, there is no basis for linking the high turbidity in this homeowner well to hydraulic fracturing since the nearest hydraulically fractured gas well was more than two miles from the homeowner well at the time of sampling.

Some locations in the study were sampled once, some twice, and some in all three rounds. In addition to the second and third sampling rounds generally focusing on those locations that in the first round of sampling were observed to exhibit more elevated concentrations of one or more constituents of interest possibly linked to hydraulic fracturing activities, other reasons for sampling some locations only once included accessibility issues and homeowner well functionality problems. Also, most of the locations sampled only once in this study had been previously sampled by others (e.g., by PA DEP or operators) so that data from past sampling events could be compared with data from this study to evaluate the need for additional sampling. Table 3 lists the wells and springs sampled during each round in this study. Also shown in Table 3 are presumed well depths (based on homeowner knowledge) and the formation(s) into which the homeowner wells are likely completed.

Table 3. Wells, springs, and surface waters sampled in this study.

Sample Id	Rounds Sampled	Presumed Well Depth (ft)	Water Type*	Likely Formation(s) of Completion
NEPAGW01	1,2,3	206	Na-HCO_3	Lock Haven
NEPAGW02	1,2,3	245	Na-HCO_3	Lock Haven
NEPAGW03	1,2,3	178	Ca-SO_4	Lock Haven
NEPAGW04	1,2	37	Na-Cl	Lock Haven
NEPAGW05	1	280	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW06	1,2,3	119	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW07	1	unknown	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW08	1,2,3	260	Na-Cl	Stratified Drift and/or Lock Haven
NEPAGW09	1,2,3	150	Ca-HCO_3	Lock Haven
NEPAGW10	1,2,3	175	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW11	1,2,3	250	Na-HCO_3	Lock Haven
NEPAGW12	1,3	440	Ca-HCO_3	Lock Haven
NEPAGW13	1,2	200	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW14	1,2,3	340	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW15	1,2,3	220	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW16	1,2,3	86	Na-HCO_3	Stratified Drift
NEPAGW17	1,2	100	Na-Cl	Stratified Drift
NEPAGW18	1,2	203	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW19	1	142	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW20	1,2	160	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW21	1	unknown	Ca-HCO_3	Stratified Drift and/or Catskill
NEPAGW22	1	unknown	**	Stratified Drift and/or Catskill
NEPAGW23	1	120	Ca-HCO_3	Stratified Drift and/or Catskill
NEPAGW24	1	unknown	Ca-HCO_3	Stratified Drift and/or Lock Haven
NEPAGW25	1	unknown	Na-HCO_3	Catskill and/or Lock Haven
NEPAGW26	1,2,3	unknown	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW27	1,2,3	220	Na-HCO_3	Catskill and/or Lock Haven
NEPAGW28	1,3	225	Ca-HCO_3	Lock Haven
NEPAGW29	1,2,3	unknown	Ca-HCO_3	Lock Haven
NEPAGW30	1	390	Ca-HCO_3	Lock Haven
NEPAGW31	1	300	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW32	1,2,3	179	Ca-HCO_3	Catskill and/or Lock Haven

Table 3. Wells, springs, and surface waters sampled in this study.

Sample Id	Rounds Sampled	Presumed Well Depth (ft)	Water Type*	Likely Formation(s) of Completion
NEPAGW33	1,2,3	115	Na-HCO_3	Catskill and/or Lock Haven
NEPAGW36	2,3	unknown	Ca-HCO_3	Lock Haven
NEPAGW37	3	200-240	Ca-HCO_3	Catskill and/or Lock Haven
NEPAGW38	3	130	Ca-HCO_3	Catskill and/or Lock Haven
NEPASW01	1,2,3	spring	Ca-HCO_3	—
NEPASW02	1	spring	Ca-HCO_3	—
NEPASW03	2	pond	—	—
NEPASW04	2	pond	—	—
NEPASW05	2	stream	—	—
NEPASW06	2	stream	—	—

*based on AqQA criteria; **ion balance >15%.

4.2. Water Collection from Homeowner Wells

The methods for collecting samples from wells, springs, and surface waters are described in the QAPP prepared for this study (EPA, 2013). In the case of wells, samples were collected either from a homeowner tap located upstream of any home water treatment systems, where applicable, or directly from the well in cases where a separate submersible pump (Proactive Monsoon) was used. Where possible, samples were also collected upstream of pressure tanks. For wells that could be accessed directly, depth to ground water (potentiometric surface) was measured and recorded using a Solinst Model 101 electronic water level indicator or a Ravensgate 200U sonic water level measuring device. The existing homeowner well pump, where possible, was used to purge the well and subsequently sample the well. In cases where a homeowner pump was not present, a separate submersible pump (Proactive Monsoon) was introduced into the well to allow for sample collection. The rate of purging was determined by measuring the volume of water collected after a unit of time into a large metered pail or equivalent container. During purging, water level measurements were recorded regularly to monitor drawdown in the well. If drawdown was initially observed to be substantial, purge rates were decreased accordingly to minimize drawdown while still ensuring an adequate purge rate. In general, wells were purged for at least one hour prior to sample collection at rates of up to 10 gallons (≈38 liters) per minute. Following completion of well purging, a metal (brass) adaptor with attached polyethylene tubing was connected to the homeowner tap. In cases where split sampling was conducted with the operator, a Y-shaped metal (brass) adaptor was employed instead, allowing for the attachment of two separate lines of polyethylene tubing. Water flow at a rate of 1 to 2 liters per minute was then directed through a flow-through cell attached to a YSI 556 multi-parameter probe unit. Sample collection commenced once stabilization of geochemical parameters occurred (pH, temperature, conductivity, dissolved oxygen [DO], and, if possible, ORP). Unfiltered samples for the analyses of dissolved gases, VOCs, SVOCs, DRO, GRO, glycol ethers, low-molecular-weight acids, total metals, gross alpha activity, gross beta activity, Ra-226, Ra-228, $\delta^{13}C_{CH4}$, $\delta^{13}C_{C2H6}$, and $\delta^{2}H_{CH4}$ were collected first. Next, a high-capacity filter (0.45-micron pore size Millipore brand) was attached to the end of the tubing and a series of filtered samples were collected for dissolved metals, anions, nutrients, DIC, $\delta^{13}C_{DIC}$, $\delta^{18}O_{H2O}$, $\delta^{2}H_{H20}$, and $^{87}Sr/^{86}Sr$ analyses. Prior to filling sample bottles, at least 100 milliliters (mL) of ground water was passed through the filter to waste. Sample preservation and holding time requirements for each sample type are described in Table A1 (Appendix A). All samples were placed on ice in a cooler following collection and kept on ice until arrival at the designated analytical laboratory. Smaller plastic bottles were placed in sealed plastic bags; glass bottles and vials were wrapped in bubble wrap; and large plastic bottles (with the exception of samples to be analyzed for $\delta^{13}C_{CH4}$, $\delta^{13}C_{C2H6}$, and $\delta^{2}H_{CH4}$) were placed in the cooler in an upright position. Sample bottles for $\delta^{13}C_{CH4}$, $\delta^{13}C_{C2H6}$, and $\delta^{2}H_{CH4}$ analyses were placed in an inverted position in coolers and maintained in the inverted position throughout shipment to the designated analytical laboratory. Coolers were taped shut, affixed with a custody seal, and shipped to designated analytical laboratories, generally within 24 hours to 48 hours of collection, depending on sample holding time requirements.

4.3. Sampling at Springs and Surface Water Locations

The two springs sampled in the study were either sampled directly at their location or from a homeowner tap connected to the spring. If sampled at their location, a peristaltic pump (Pegasus Pump Company Alexis®) or bladder pump (QED Sample Pro) was used, as appropriate. The bladder pump was employed for collection of VOC and GRO samples to minimize loss by volatilization; otherwise, the peristaltic pump was used. Samples from the pond and stream were similarly collected employing a peristaltic pump (Pegasus Pump Company Alexis®) or bladder pump (QED Sample Pro), as appropriate, for the type of sample being collected. Samples obtained directly from springs, and surface water samples obtained from the pond and stream, were collected by extracting water from beneath the surface using dedicated polyethylene tubing affixed to a long aluminum pole and connected to a peristaltic pump or bladder pump, as appropriate. (Samples collected from springs via a homeowner tap were collected by the method used for domestic well sampling.) Sampling of surface waters and springs was, in all cases, performed to minimize any capture of sediment. Samples obtained directly from springs, and samples collected from the pond and stream for analysis of dissolved metals, stable isotopes (except isotopes of methane and ethane), anions, nutrients, and inorganic/organic carbon, were collected using a peristaltic pump and filtered in-line using a high-capacity (0.45 micron) capsule filter. YSI readings were recorded prior to sampling by inserting the probe unit directly into the surface water body and allowing readings to stabilize, or by directing surface water through the peristaltic pump and the YSI flow cell until stabilization of readings had occurred.

4.4. Water Analysis

4.4.1. Field Parameters

As noted earlier, temperature, specific conductance, pH, ORP, and dissolved oxygen in wells were continuously monitored prior to sample collection using the YSI 556 multi-parameter probe and flow-through cell assembly. YSI electrodes were calibrated each morning prior to sampling. Performance checks were conducted in the morning following calibration, at midday when possible, and at the end of each day. NIST-traceable buffer solutions (4.00, 7.00, and/or 10.01) were used for pH calibration, and YSI 5580 Confidence Solution was used for continuing performance checks. YSI ORP standard was used for calibration of ORP measurements and a conductivity standard (Oakton) was used for calibration of specific conductance measurements. Table A27 (Appendix A) provides the results of the performance checks for these parameters. Performance check criteria were consistently met without exception for these parameters during all three rounds of sampling. Dissolved oxygen sensors were calibrated with water-saturated air according to manufacturer recommendations each morning and checked with zero-oxygen solutions to ensure good performance at low oxygen levels. Prior to field deployment, the electrode assembly and meter were checked to confirm good working order.

Following stabilization of parameters, an approximately 500-mL unfiltered sample was collected and immediately analyzed for field determinations of turbidity, dissolved sulfide, ferrous iron, and alkalinity. Turbidity measurements (EPA Method 180.1) were conducted using a HACH 2100Q Portable Turbidimeter, which was calibrated with a HACH 2100Q StablCal Calibration Set consisting of 20 nephelometric unit (NTU), 100 NTU, and 800 NTU standards, and a 10 NTU calibration verification standard. Iron concentrations were determined using the 1,10-phenanthroline colorimetric method (HACH DR/890 colorimeter, Standard Method 3500-FeB for Wastewater). Dissolved sulfide measurements were made using the methylene blue colorimetric method (HACH DR/890 colorimeter, Standard Method 4500-S^{2-}D for Wastewater). Alkalinity measurements were made by titrating water samples with 1.6N sulfuric acid (H_2SO_4) to the bromcresol green-methyl red endpoint using a HACH Model AL-DT Digital Titrator (EPA Method 310.1).

The HACH DR/890 colorimeter (for ferrous iron and sulfide) and the HACH 2100Q Portable Turbidimeter (for turbidity) were inspected prior to going into the field. The ferrous iron accuracy was checked by making triplicate measurements of a 1-mg Fe/L standard solution (HACH Iron Standard solution, using Ferrover® pillows); the results were between 0.90 - 1.10 mg Fe/L. The accuracy of dissolved sulfide measurements was checked by measuring standard solutions prepared in the laboratory by purging dilute sodium hydroxide solution (0.0001 M) with 1.0% H_2S gas (balance N_2); the results of spectrophotometric measurements were within 20% of expected concentrations. Turbidity was checked following calibration against the 10 NTU StablCal Calibration Set verification standard supplied by HACH. Titrators used for alkalinity measurements were checked using a 100-mg/L standard prepared from sodium bicarbonate ($NaHCO_3$). In the field, ferrous iron and sulfide blanks (distilled water) were measured at the beginning and end of each day to ensure the HACH DR/890 colorimeter remained in working order and was not returning false positives. The turbidimeter was checked against the 20 NTU, 100 NTU, 800 NTU, and/or 10 NTU turbidity calibration standards at the end of each day to ensure it remained in working order. Performance checks of the HACH DR/890 colorimeter and HACH 2100Q Portable Turbidimeter were consistently met throughout the study.

4.4.2. Analytical Methods for Ground Water and Surface Water

Over 2,000 water samples were collected and analyzed over the three rounds of sampling. The laboratories that performed the analyses in each sampling round, and the methods used, are described in Appendix A (Table A1). Anions, nutrients, DIC, and DOC samples from all three sampling events (rounds 1, 2, and 3) were analyzed in-house (GWERD General Parameters Lab, Ada, Oklahoma). Quantitative analyses of the major anions bromide (Br^-), chloride (Cl^-), fluoride (F^-), and sulfate (SO_4^{2-}) were performed by capillary ion electrophoresis (EPA Method 6500) with a Waters Quanta 4000 Capillary Ion Analyzer. Nutrients ($NO_3 + NO_2$, NH_3) were measured by flow injection analysis (EPA Method 350.1 and 353.1) on a Lachat QuickChem 8000 Series flow injection analyzer. The concentration of carbon in DIC and DOC in aqueous samples was determined by acidification and combustion followed by infrared detection (EPA Method 9060A) on a Shimadzu TOC-VCPH Analyzer.

Samples for dissolved gases, low-molecular-weight acids, and stable isotopes of water (δ^2H_{H2O}, $\delta^{18}O_{H2O}$) were analyzed by Shaw Environmental for rounds 1 and 2 and by CB&I for round 3. Dissolved gases were measured by gas chromatography (Agilent Micro 3000 gas chromatograph) using a modification of the method described by Kampbell and Vandegrift (1998). Samples for gas analysis were collected by submerging sample vials in a continuously overflowing bucket filled with water pumped from the sampling location. Concentrations of low-molecular-weight acids were determined using high-performance liquid chromatography (Dionex Ics-3000). Hydrogen and oxygen isotope ratios for aqueous samples collected during round 1 were determined by isotope ratio mass spectrometry (Finnigan TC/EA, Finnigan Delta Plus XP IRMS); cavity ring-down spectrometry was used to measure isotope ratios in samples collected during rounds 2 and 3 (Picarro L2120i CRDS). The oxygen and hydrogen isotope ratio values are reported in terms of permil notation (‰) with respect to the Vienna Standard Mean Ocean Water (VSMOW) standard.

The analysis of DRO, GRO, and SVOCs in water samples collected during rounds 1, 2, and 3 was completed by EPA's Region 8 Laboratory. DRO and GRO were determined using a gas chromatograph equipped with a flame ionization detector (EPA Method 8015B; Agilent 6890N GC). The concentrations of SVOCs were determined by gas chromatography (GC)/mass spectrometry (MS) (EPA Method 8270D; HP 6890 GC and HP 5975 MS).

VOCs were analyzed by Shaw Environmental for samples collected during rounds 1 and 2 using automated headspace GC/MS (EPA Methods 5021A and 8260C; Agilent 6890/5973 Quadrupole GC/MS). In round 3, the samples were analyzed for VOCs by the Southwest Research Institute using purge-and-trap GC/MS (EPA Method 8260B; Agilent 6890N GC/MS).

Glycols (2-butoxyethanol, diethylene glycol, triethylene glycol, and tetraethylene glycol) were measured by EPA's Region 3 Laboratory for samples collected during all three rounds. The samples were analyzed by high-performance liquid chromatography (HPLC) coupled with positive electrospray ionization (ESI+) tandem mass spectrometry (MS/MS; Waters HPLC/MS/MS with a Waters Atlantis dC18 3µm, 2.1 x 150mm column) (Schumacher and Zintek, 2014).

Major cation and trace metals were determined for 0.45 µm filtered (dissolved metals) and unfiltered (total metals) samples by Shaw Environmental in round 1. Major cations were analyzed using inductively coupled plasma–optical emission spectroscopy (ICP–OES; EPA Methods 200.7; Optima 3300 DV ICP-OES). Trace metals were determined by inductively coupled plasma–mass spectroscopy (ICP-MS; EPA Method 6020A; Thermo X Series II ICP–MS). Unfiltered samples were prepared prior to analysis by microwave digestion (EPA Method 3015A). Total and dissolved trace metals were analyzed through EPA's Contract Laboratory Program (CLP) in round 2. The samples were prepared and analyzed following CLP methodology (Method ISM01.3). Total and dissolved metal analyses for samples collected during round 3 were conducted by the Southwest Research Institute in accordance with EPA Methods 6020A (ICP–MS) and 200.7 (ICP–OES). Unfiltered samples were digested prior to analysis (EPA Method 200.7).

In all sampling rounds, selected samples were submitted to Isotech Laboratories, Inc., for analysis of stable isotope ratios of DIC ($\delta^{13}C_{DIC}$), methane ($\delta^{13}C_{CH4}$, δ^2H_{CH4}), and where applicable, ethane ($\delta^{13}C_{C2H6}$). The $\delta^{13}C_{DIC}$ was determined using gas stripping and isotope ratio mass spectrometry (IRMS). Elemental analyses coupled to an isotope ratio mass spectrometer were used to obtain methane and ethane

($\delta^{13}C_{CH4}$, $\delta^{2}H_{CH4}$, $\delta^{13}C_{C2H6}$) isotope ratios. The carbon isotope ratio values are reported in terms of permil notation (‰) with respect to the Vienna Pee Dee Belemnite (VPDB) standard. The hydrogen isotope ratio value ($\delta^{2}H_{CH4}$) is reported in terms of permil notation (‰) with respect to the Vienna Standard Mean Ocean Water (VSMOW) standard.

Strontium isotopes ($^{87}Sr/^{86}Sr$) and rubidium (Rb) and strontium (Sr) concentrations in filtered samples were measured by the USGS for samples collected during all sampling events (rounds 1, 2, and 3). High-precision ($2\sigma = +0.00002$) strontium isotope ratio results were obtained using thermal ionization mass spectrometry (TIMS; Finngan Mat 262) using methods described in Peterman et al. (2012). Gross alpha and gross beta activity concentrations were determined by ALS Environmental using a gas proportional counter following EPA Method 900.0. Isotopes of radium (radium-226 and radium-228) were also determined by ALS Environmental using EPA Methods 903.1 and 904.0.

4.5. QA/QC

Field QC samples included trip blanks, field blanks, equipment blanks, duplicate samples, and field samples with adequate volumes for preparation of matrix spike samples in the laboratory. Field QC sample types, summarized in Appendix A (Table A2), were collected, preserved, and analyzed using identical methodologies as used for the ground water and surface water samples collected in the field. Appendix A presents detailed QA practices and the results for QC samples, including discussions of chain of custody, holding times, blank results, field duplicate results, laboratory QA narratives, QAPP additions and deviations, field QA/QC, application of data qualifiers, tentatively identified compounds (TICs), audits of data quality (ADQ), and the laboratory and field Technical System Audits (TSA). All reported data met project requirements unless otherwise indicated by application of data qualifiers. In rare cases, data not meeting project requirements were rejected as unusable and not reported (see Appendix A).

4.6. Data Handling and Analysis

For each sampling location in this study, geochemical parameters and the water quality data for major ions and other selected inorganic ions collected over the multiple sampling events were averaged. This approach ensures that more frequently sampled locations are given equivalent weight in the overall data analysis; however, a shortcoming of this method is that potential temporal variability in concentration data at a single location is not captured. This issue is addressed in the study by evaluating location-specific, time-dependent concentration trends at selected well locations for selected analytes of interest. For parameters of interest, summary statistics were calculated (mean, median, standard deviation, minimum and maximum values, and 25th, 75th, and 90th percentile values). Non-detect values for parameters, where applicable, were set at half the minimum detection limit; summary statistics determined for parameters that showed mixed results, both greater than the quantitation limit (QL) and less than the QL, were generally determined only when more than 50% of the data were above the QL (US EPA, 2000b). Samples from the two springs sampled as part of this study were combined in the analyses with ground water samples collected from the homeowner wells.

Historical water quality data from the study area were collected online from the USGS National Water Information System (NWIS) database (USGS, 2013) and the USGS National Uranium Resource Evaluation (NURE) database (USGS, 2012c). Data from these sources were considered based upon various evaluation criteria, such as: (1) did the organization that collected the data have a quality system in place; (2) were the data collected under an approved QAPP or other similar planning document; (3) were the analytical methods used comparable to those used for the primary data; (4) did the analytical laboratories have demonstrated competency (such as through accreditation) for the analysis they performed; (5) were the data accuracy and precision control limits similar to the primary data; (6) were the secondary data source MDLs and QLs comparable to those associated with the primary data, or at least adequate to allow for comparisons; and (7) were sampling methods comparable to those used for the primary water quality data collected for this study? In general, the necessary metadata to fully evaluate secondary data by these criteria were unavailable for these secondary water quality data sources; thus, the secondary data are used with the understanding that they are of an indeterminable quality relative to the requirements specified for this study (see QAPP; US EPA, 2013). As with the data collected in this study, historical data from locations with multiple sampling events were averaged and summary statistics were calculated. The EPA STORET (Storage and Retrieval) data warehouse was not used as a source of historical water quality data in this study because these data may have included environmental impact monitoring data that would potentially skew background concentration data. Also, the majority, if not all, of the Bradford County data reported and evaluated by Williams et al. (1998) in their study of ground water quality in Bradford, Tioga, and Potter counties appear to be data common to the NWIS database, thus precluding the need to evaluate their data separately in this study.

The software package AqQA (version 1.1.1) was used to evaluate internal consistency of water compositions by calculating cation/anion balances and by comparing measured and calculated electrical conductivity values. Ion balances were calculated by comparing the summed milliequivalents of major cations (calcium, magnesium, sodium, and potassium), major anions (chloride, sulfate, fluoride, bicarbonate), and minor cations and anions (Sr, Ba, Li, Mn, Fe, and F) using the equation:

$$\text{Charge Balance (\%)} = |(\Sigma\text{cat}-\Sigma\text{an})/(\Sigma\text{cat}+\Sigma\text{an})*100|$$

Bicarbonate concentrations used in the ion balance determinations were calculated (in AqQA) from field-measured alkalinity values. The calculated charge balance error over the three sampling rounds ranged from 0.01 to 15.6% (see Appendix A); 86% of the samples collected for this study had a charge balance error <5%. Only samples with a charge balance $\leq$15% were used for water-type analysis and to construct geochemical plots such as Piper, Durov, or Schoeller diagrams.

Summary statistics for historical data were determined on a countywide basis (Bradford County only) for comparison with the data collected in this study. For the historical datasets, as for the samples from this study, only samples with a charge balance error $\leq$15% were used for water-type analysis and for constructing geochemical plots. Again, the historical data from locations with multiple sampling events were averaged and summary statistics were determined. Charge balance criteria were not used to screen historical data for use in summary statistic calculations or for plotting box-and-whisker diagrams. Various issues relating to data quality and applicability of historical data have been previously discussed (Battelle, 2013; US EPA, 2013), including comparability of analytical methods, comparability of analytes, unknown sample collection methods, and unavailable laboratory QC data and data quality-related qualifiers. While recognizing these limitations, historic data are used as the best points of reference available to compare with the water quality data collected in this study.

All statistical evaluations except post-hoc tests were performed using EPA's ProUCL program, version 5.0. Post-hoc tests were performed, where applicable, using Statistica, version 12. Since comparisons of either two or three datasets were required, a one-way Analysis of Variance (ANOVA), a parametric procedure, and the nonparametric one-way ANOVA (Kruskal-Wallis Test), the nonparametric equivalent, were selected as the most appropriate statistical test procedures. A preliminary review of the data was performed to determine the statistical distributions of the data using ProUCL's goodness-of-fit tests. This was done to determine the most appropriate group-wise comparison tests—parametric or nonparametric. One of the assumptions underlying parametric statistical procedures is that the data are normally distributed or can be transformed to a normally distributed form. Post-hoc tests were performed in cases where analyte-specific significant differences were indicated among three datasets. The post-hoc tests were conducted using parametric Scheffe multiple comparison tests and Kruskal-Wallis nonparametric multiple comparison tests. A p-value <0.05 was, in all cases, interpreted as a significant difference between compared datasets. Because a large number of comparisons were made between the data from this study and the historical water quality data that encompass numerous sampling investigations, multiple locations, and extended periods of time, the problem of multiple comparisons is suggested, that is, the increased likelihood of rejecting the null hypothesis and flagging significant differences among datasets. Given the exploratory nature of this study, p-value adjustments were not incorporated (e.g., Bonferroni or Šidák correction factors) and the traditional significance threshold of 0.05 was applied for the data comparisons.

5. Historic Water Quality Data

5.1. Major Ion Chemistry

Ground water quality in the study area is variable and can range from good to poor depending on location and depth. Many natural exceedances of EPA secondary MCLs and occasionally primary MCLs are known to occur in private wells (Williams et al., 1998; Boyer et al., 2011). Boyer et al. (2011) state that more than 40% of private water wells in Pennsylvania fail to meet federal drinking water standards. Naturally occurring constituents frequently exceeding EPA secondary MCLs in the study area include chloride, TDS, iron, and manganese (Williams et al., 1998). Williams et al. (1998), in their evaluation of over 200 wells in Bradford, Tioga, and Potter counties in northeastern Pennsylvania, indicate about 50% of the wells exceeded secondary MCLs for iron and manganese. Naturally occurring constituents occasionally exceeding EPA primary MCLs in the study area include barium, combined radium-226 and radium-228, and arsenic. According to Williams et al. (1998), higher concentrations of these constituents tend to be associated with the sodium chloride (Na-Cl) type ground water often found in valleys in the study area in zones of more restricted ground water flow.

The USGS NWIS and NURE databases provide historical ground water quality data pre-dating modern-day hydraulic fracturing activities in the study area (i.e., pre-2007). Summary statistics for Bradford County from the NWIS and NURE databases for parameters and constituents of interest in this study are presented in Table 4. Summary statistics were prepared for Bradford County only, since the majority of sampling was conducted in Bradford County and three of the four wells sampled in Susquehanna County were located in the western half of the county, within 15 miles of the Bradford County line (see Figure 4). The pre-2007 NWIS dataset used in this study consists of 129 ground water sampling locations in Bradford County and spans the period from 1935 to 2006. Water quality data in the NWIS database include major cations, anions, general parameters (e.g., pH, specific conductance, and alkalinity), some trace element data, and very limited entries for organic compounds and radiogenic constituents. Data of particular interest to this study (e.g., chloride) were not necessarily collected at all 129 locations, as reflected in the information presented in Table 4. The NURE database provides water quality data for 164 well locations in Bradford County, spanning the very short period from October 6 to October 23, 1977. Summary statistics for major cations (sodium, potassium, calcium, magnesium), major anions (sulfate, chloride), and other constituents (iron, manganese, arsenic, TDS, etc.) from the two datasets are compared in Table 4 to data collected from the 38 ground water sampling locations in this study. Sampling locations associated with the datasets are provided in Figure 11. It is important to note that the historical water quality data are not taken *a priori* as being representative of the background condition in the county, where background is taken to represent the water quality regime in the absence of all human activities, including unconventional oil and gas development. Also, historical water quality data do not provide information on the comprehensive set of analytes evaluated in this study; thus meaningful comparisons between, for example, organic compound data collected for this study and historical data available before unconventional gas development in Bradford County are not possible.

Table 4. Ground water data from this study compared to 1977 NURE and pre-2007 NWIS data.

Parameter	Fraction	Units	Study	Earliest Sample Date	Latest Sample Date	Count of Sample Locations	Count of Total Samples	Mean	Std. Dev.	Minimum	25th	Median 50th	75th	90th	Maximum	NDs/n*
Alkalinity	Total	mg/L	NWIS pre-2007	8/8/35	5/28/03	122	127	157	65.2	20	110	153	203	247	350	0/122
Alkalinity	Total	mg/L	This Study	10/25/11	5/15/13	38	80	166	76.0	22	123	152	215	255	380	0/38
Arsenic	Total	µg/l	NWIS pre-2007	7/21/81	6/15/06	96	100	30.1	104	2.00	2.00	2.50	2.50	24.5	500	78/96
Arsenic	Total	µg/l	This Study	10/25/11	5/15/13	28	45	2.04	2.26	0.06	0.41	1.05	2.85	5.18	9.0	1/28
Arsenic	Dissolved	µg/l	This Study	10/25/11	5/15/13	28	45	1.50	1.73	0.06	0.20	0.71	2.45	3.90	5.75	3/28
Barium	Recoverable	µg/l	NWIS pre-2007	8/2/83	4/29/86	62	62	2151	12573	5.00	30.0	50.0	275	990	98000	34/62
Barium	Total	µg/l	This Study	10/25/11	5/15/13	38	80	707	1176	10.1	151	269	632	1722	5280	0/38
Barium	Dissolved	µg/l	This Study	10/25/11	5/15/13	38	80	680	1154	9.67	148	238	511	1656	5065	0/38
Calcium	Dissolved	mg/L	NWIS pre-2007	8/8/35	7/27/82	60	61	49.9	38.0	2.90	27.5	42.0	62.1	86.1	235	0/60
Calcium	Dissolved	mg/L	This Study	10/25/11	5/15/13	38	80	44.2	54.6	9.21	26.0	34.9	47.0	57.8	357	0/38
Chloride	Dissolved	mg/L	NURE 1977	10/6/77	10/23/77	164	164	14.1	23.7	0.10	5.30	8.05	12.7	25.3	228	1/164
Chloride	Dissolved	mg/L	NWIS pre-2007	8/8/35	4/29/86	116	121	89.4	417	0.50	4.00	10.0	30.0	150	4275	1/116
Chloride	Dissolved	mg/L	This Study	10/25/11	5/15/13	38	80	47.5	114	0.77	3.65	8.59	23.0	82.5	510	0/38
Iron	Recoverable	µg/l	NWIS pre-2007	7/21/81	4/29/86	72	75	1658	6731	10.0	118	335	995	2330	56400	5/72
Iron	Total	µg/l	This Study	10/25/11	5/15/13	38	80	811	1920	11.0	57.9	272	505	1628	10700	4/38
Iron	Dissolved	µg/l	NWIS pre-2007	8/8/35	5/28/03	50	51	1256	2927	10.0	92.5	310	940	2490	15900	0/50
Iron	Dissolved	µg/l	This Study	10/25/11	5/15/13	38	80	204	572	10.0	37.1	48.7	162	353	3533	15/38
Magnesium	Dissolved	mg/L	NWIS pre-2007	8/8/35	7/27/82	60	61	12.4	9.32	0.60	5.45	10.3	16.0	24.3	46.0	0/60
Magnesium	Dissolved	mg/L	This Study	10/25/11	5/15/13	38	80	10.4	20.4	2.01	4.19	6.08	8.83	14.6	130	0/38

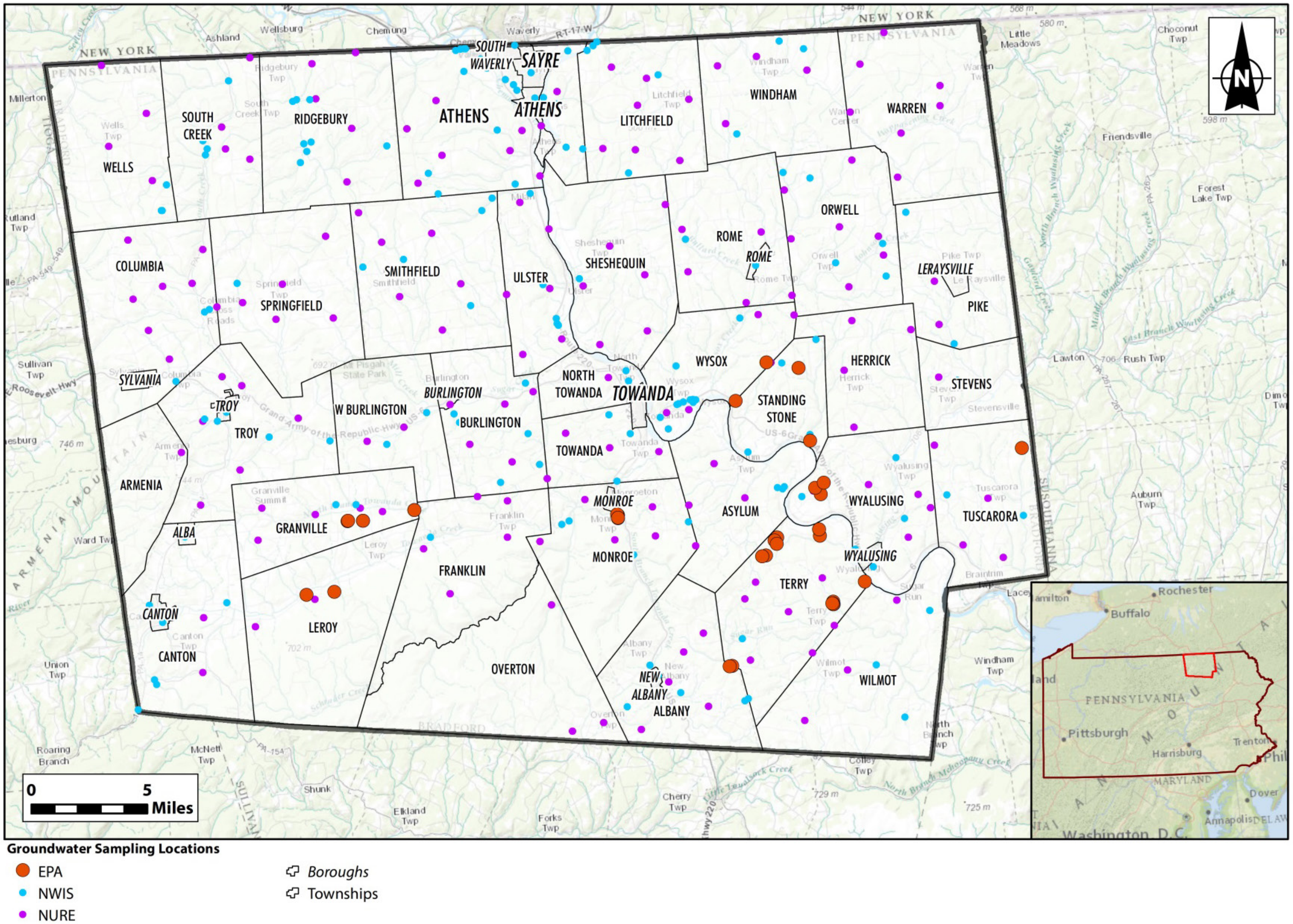
Table 4. Ground water data from this study compared to 1977 NURE and pre-2007 NWIS data.

Parameter	Fraction	Units	Study	Earliest Sample Date	Latest Sample Date	Count of Sample Locations	Count of Total Samples	Mean	Std. Dev.	Minimum	25th	Median 50th	75th	90th	Maximum	NDs/n*
Manganese	Recoverable	µg/l	NWIS pre-2007	7/21/81	4/29/86	71	74	263	878	5.00	25.0	80.0	220	530	7370	19/71
Manganese	Total	µg/l	This Study	10/25/11	5/15/13	38	80	305	642	4.62	15.4	45.4	165	990	2740	4/38
Manganese	Dissolved	µg/l	NURE 1977	10/6/77	10/23/77	161	161	149	117	38.6	85.5	110	154	289	796	0/161
Manganese	Dissolved	µg/l	NWIS pre-2007	1/16/75	5/28/03	37	38	274	557	10.0	30.0	90.0	250	440	2600	0/37
Manganese	Dissolved	µg/l	This Study	10/25/11	5/15/13	38	80	230	505	4.74	7.0	27.8	159	739	2615	7/38
pH	None	std units	NURE 1977	10/6/77	10/23/77	164	164	7.29	0.58	6.0	7.0	7.3	7.6	7.9	9.1	0/164
pH	None	std units	NWIS pre-2007	3/9/70	12/13/06	54	530	7.43	0.64	5.2	7.1	7.4	7.7	8.1	9.1	0/54
pH	None	std units	This Study	10/25/11	5/15/13	38	80	7.46	0.60	5.9	7.1	7.5	7.9	8.1	8.6	0/38
Potassium	Dissolved	mg/L	NWIS pre-2007	8/9/35	7/27/82	45	46	3.28	3.52	0.90	2.00	3.00	3.00	4.00	25.0	0/45
Potassium	Dissolved	mg/L	This Study	10/25/11	5/15/13	38	80	1.67	0.90	0.59	1.02	1.43	1.95	3.18	4.00	0/38
Sodium	Dissolved	mg/L	NURE 1977	10/6/77	10/23/77	163	163	17.5	21.3	1.18	6.58	9.06	18.4	42.8	145	0/163
Sodium	Dissolved	mg/L	NWIS pre-2007	8/9/35	7/27/82	45	46	89.1	300	4.00	11.0	22.0	43.0	131	2000	0/45
Sodium	Dissolved	mg/L	This Study	10/25/11	5/15/13	38	80	48.8	70.9	2.04	13.0	23.2	47.5	104	291	0/38

Table 4. Ground water data from this study compared to 1977 NURE and pre-2007 NWIS data.

Parameter	Fraction	Units	Study	Earliest Sample Date	Latest Sample Date	Count of Sample Locations	Count of Total Samples	Mean	Std. Dev.	Minimum	25th	Median 50th	75th	90th	Maximum	NDs/n*
Specific Conductance	None	µS/cm	NURE 1977	10/6/77	10/23/77	164	164	318	208	5.00	210	280	372	468	1580	0/164
Specific conductance	None	µS/cm	NWIS pre-2007	1/16/75	12/13/06	58	58	634	1022	2.90	331	417	591	738	6000	0/58
Specific conductance	None	µS/cm	This Study	10/25/11	5/15/13	38	80	526	511	90.0	304	348	517	896	2521	0/38
Strontium	Recoverable	µg/l	NWIS pre-2007	8/2/83	4/29/86	62	62	1778	10252	5.00	82.5	160	400	807	80000	4/62
Strontium	Total	µg/l	This Study	10/25/11	5/15/13	38	80	1591	2264	30.0	339	837	1767	3038	10867	0/38
Strontium	Dissolved	µg/l	This Study	10/25/11	5/15/13	38	80	1584	2238	30.0	332	819	1768	3033	10717	0/38
Sulfate	Dissolved	mg/L	NWIS pre-2007	8/8/35	4/29/86	121	125	26.9	32.1	1.00	10.0	20.0	30.0	50.0	250	2/121
Sulfate	Dissolved	mg/L	This Study	10/25/11	5/15/13	38	80	43.9	198	0.03	7.30	11.3	14.7	22.9	1230	3/38
Total dissolved solids**	Dissolved	mg/L	NWIS pre-2007	8/8/35	4/29/86	121	170	361	666	64.0	176	231	344	538	7067	1/121
Total dissolved solids**	Dissolved	mg/L	This Study	10/25/11	5/15/13	38	80	342	332	58.5	198	227	336	582	1639	0/38

* NDs/n = non-detects per total number of locations sampled; ** Calculated from specific conductivity measurements.



Source: *Basemap, ESRI; Sampling Locations, EPA ORD, USGS (NWIS, NURE, Water Resource Report - Williams et al. 1998)*

Figure 11. NURE (1977) and NWIS historical (pre-2007) ground water sampling locations in Bradford County relative to ground water sampling locations in this study.

Williams (2010), in a study of well logs for the neighboring counties of Chemung, Tioga, and Broome in New York (to the immediate north of Bradford and Susquehanna counties), states that the base of freshwater in upland areas tends to be about 800 feet below ground surface, whereas in valley settings, the base of freshwater is only about 200 feet below ground surface. At depths greater than 200 feet in the valley settings, ground water in the Upper Devonian bedrock and in a few areas in the glacial drift tends to be salty. Based on well data reported by Williams et al. (1998) for Bradford County and neighboring Tioga and Potter Counties to the west, median concentrations of TDS, barium, and chloride in restricted flow zones with Na-Cl type ground water are 830 mg/L, 2.0 mg/L, and 349 mg/L, respectively. The authors state that only wells completed in the unconfined stratified drift and the Catskill Formation have median iron and manganese concentrations lower than EPA secondary MCLs of 0.3 mg/L and 0.05 mg/L, respectively.

A good example of the poor quality ground water that can occur naturally in the study area is reflected in the composition of natural spring water found at Salt Spring State Park, in Susquehanna County (Figure 4). Data reported by Warner et al. (2012) for spring water collected from the park show chloride concentrations of 4,014 mg/L, TDS concentrations of 7,067 mg/L, barium concentrations of 84.4 mg/L, and combined radium-226 + radium-228 concentrations of 27.7 pCi/L. The concentrations of barium and combined radium-226 + radium-228 in the spring water far exceed the primary drinking water MCLs of 2.0 mg/L and 5 pCi/L, respectively. A similar example of poor quality ground water is reported in the NWIS database for a valley well location in east-central Bradford County completed in the Lock Haven Formation. The pre-2007 (1982 and 1986) data for this well with a reported depth of 110 ft indicated an average chloride concentration of 4,275 mg/L, average TDS concentrations of 7,650 mg/L, and a recoverable barium concentration in 1986 of 98.0 mg/L. (No barium analysis was conducted in 1982 at this location.) Warner et al. (2012) have suggested that the naturally occurring Na-Cl or Na-Ca-Cl type waters, such as those found at Salt Spring State Park and some valley locations in northeastern Pennsylvania, reflect a mixing of shallow, modern water with water from deeper Appalachian formations. According to Llewellyn (2014), the spring water from Salt Spring State Park represents Appalachian Basin brine that has migrated vertically over geologic time to mix with locally recharged ground water at a concentration of approximately 2 percent.

One of the most important indicators of potential impacts from hydraulic fracturing activities in northeastern Pennsylvania is chloride, which can be found at concentrations greater than 40,000 mg/L in flowback/produced water from the Marcellus Shale (Hayes, 2009; Haluszczak et al., 2013). Chloride is a key indicator of potential impacts on ground water not only because of its high concentrations in Marcellus Shale flowback/produced water but also because of its highly conservative nature (i.e., limited physical, chemical, and biological attenuation in the subsurface). As such, any impact associated with flowback/produced water from the Marcellus Shale should, at a minimum, manifest itself as an increase in chloride concentrations in impacted ground water in the study area. Assuming a chloride concentration of at least 20,000 mg/L in flowback/produced waters from the Marcellus Shale, mixing at a volume-to-volume ratio of only 1%, for example, would still yield a chloride concentration of at least 200 mg/L, while mixing at a volume-to-volume ratio of 0.1% would still yield a concentration of at least 20 mg/L. It is reasonable to assume that locations in this study showing chloride concentrations near or below the median pre-2007 concentrations shown in Table 4 (10.0 mg/L for the NWIS dataset and 8.05 mg/L for the NURE dataset) are locations not likely being impacted by flowback/produced waters associated with hydraulic fracturing activities, at least within the timeframe of this study. Locations showing chloride concentrations above these median concentrations require further evaluation, although high naturally occurring chloride concentrations (e.g., >100 mg/L) are not uncommon in the study area. This is evidenced by the 90th percentile concentration of 150 mg/L for the 116 samples in the Bradford County NWIS dataset for which chloride concentrations are reported (Table 4). Williams et al. (1998) report a median chloride concentration of 350 mg/L for 22 well locations completed in restricted flow zones with Na-Cl type water in their three-county study area of northeastern Pennsylvania (Bradford, Tioga, and Potter counties).

5.2. Gas

Methane occurs naturally in the strata underlying northeastern Pennsylvania at almost all depths down to the Marcellus Shale, often at significant concentrations (Baldassare et al., 2014; Carter and Harper, 2002; Williams 2010). Gas shows (i.e., evidence of gas) during drilling in the Upper Devonian formations (e.g., Lock Haven and Catskill formations) have been regularly observed over the many years preceding modern-day hydraulic fracturing activities (Carter and Harper, 2002; Baldassare et al., 2014). Williams (2010) states the frequency of gas zones generally increases with depth in the Upper Devonian, with pockets of gas locally also present above the base of the freshwater. Baldassare et al. (2014) provide evidence of gas presence in the Middle and Upper Devonian formations above the Marcellus Shale based on analyses of mud log samples collected during drilling of 234 gas wells in a five-county area of northeastern Pennsylvania including Bradford and Susquehanna Counties.

At Salt Spring State Park in Susquehanna County (Figure 4), flammable gas bubbling up from a spring was observed by European settlers in the early 1800s (Inners and Fleeger, 2002). A natural gas well was drilled to a depth of 2,000 feet approximately 800 feet away from the salt spring in 1901-1902. Although the well was ultimately abandoned and plugged, a volume of natural gas sufficient for a single household migrated around the plug for over 20 years thereafter (Inners and Fleeger, 2002). A relatively recent spring water sample collected from Salt Spring State Park showed a methane concentration of 26.0 mg/L (Warner et al., 2012) which is near the solubility limit for methane in water at atmospheric pressure. Methane and ethane isotope data for spring water collected in the park indicate a predominantly thermogenic signature with origins from depths above the Marcellus Formation (Molofsky et al., 2013). Another well known (but more distant) naturally occurring thermogenic gas seep is the Eternal Flame in Chestnut Ridge Park, New York, north of the study area. This natural gas seep reportedly emits approximately 1 kilogram of methane per day and contains approximately 35% (by volume) ethane and propane (Etiope et al., 2013).

Methane occurs naturally as background gas in many homeowner wells in northeastern Pennsylvania and surrounding area. Although no pre-2007 gas data could be found for Bradford County, limited background gas data have been reported from neighboring counties and states where the Marcellus Shale is found. Breen et al. (2007) reported numerous well locations in Tioga County (abutting Bradford County to the west), particularly in the Tioga River valley and along its tributaries, where methane concentrations exceeded 25 mg/L. In a study by White and Mathes (2006) in neighboring West Virginia, methane was detected in 131 of 170 wells sampled between 1997 and 2005, with concentrations greater than 28 mg/L observed in 13 of these wells. The highest methane concentration detected in their study was 68.5 mg/L. Vidic et al. (2013) report background methane concentrations in domestic wells as high as 45 mg/L for 239 sites to the north of the study area, in neighboring New York State. Molofsky et al. (2011, 2013) state that background methane is ubiquitous in ground water in northeastern Pennsylvania, with higher concentrations observed in valleys than in upland areas. They report that of 1,701 post-2006 pre-drill samples evaluated in Susquehanna County, 78% exhibited detectable levels of methane and 3.4% exhibited methane concentrations greater than 7 mg/L. Weston Solutions (2012) report that 1,187 of 3,773 post-2006 pre-drill samples collected in Bradford County (31.4%) showed detectable levels of methane, with 7.9% of the samples exhibiting methane concentrations greater than 3 mg/L, 5.0% exhibiting concentrations greater than 7 mg/L, and 1.75% exhibiting concentrations greater than 20 mg/L. A suggested explanation for the significant presence of natural gas in wells in northeastern Pennsylvania is isostatic rebound following glacial retreat that could have re-opened ancient tectonic fracture systems (Brantley et al., 2013). This, according to the authors, could have resulted in enhanced permeability allowing for gas and fluid migration to be more prevalent than in settings located beyond the front of glacial advance.

The occurrence of methane in homeowner wells has been a highly debated issue in northeastern Pennsylvania (Osborn et al., 2011; Molofsky et al., 2013; Baldasarre et al., 2014). According to Baldassare et al. (2014), the PA DEP investigated 17 statewide reported stray gas incidents in 2009, 35 in 2010, and 37 in 2011, with a majority of these reported incidents occurring in the northeastern counties of the state. Osborn et al. (2011) and Jackson et al. (2013a) have suggested a relationship exists between thermogenic methane concentrations in ground water and proximity to active gas wells in northeastern Pennsylvania. Their claims are based largely on gas isotope data and methane-to-ethane ratios obtained from water wells in active and inactive drilling areas. They claim gas sampled near gas wells tends to be less fractionated (i.e., more ^{13}C-enriched) with a lower methane-to-ethane ratio than gas from inactive areas, consistent with thermogenic gas originating from deeper formations where the Marcellus Shale is found. The claim of increased methane concentrations in proximity to active drilling sites is disputed by others (Schon, 2011; Saba and Orzechowski, 2011; Molofsky et al., 2013; Boyer et al., 2011; Siegel et al., 2015). Molofsky et al. (2013), for example, argue that methane concentrations in the study area are best correlated to topographic and hydrogeologic features, rather than shale-gas extraction. Siegel et al. (2015), using a June 2009 to November 2011 Chesapeake Energy pre-drill dataset comprising over 11,000 methane analyses from domestic wells in Bradford and nearby counties, found no statistically significant relationship between dissolved methane concentrations in ground water from domestic water wells and proximity to pre-existing oil or gas wells. Nevertheless, a number of Notices of Violations (NOVs) related to stray gas migration have been levied against oil and gas operators by the PA DEP in Bradford and Susquehanna counties over the past several years (see Appendix C and Appendix D). Vidic et al. (2013) estimate that up to 3.4% (219 of 6,466) of gas wells in Pennsylvania were cited by the PA DEP for issues related to gas migration, based on data available between 2008 and March 2013. Vidic et al. (2013) further state that the most common cause of stray gas migration is a faulty seal (i.e., inadequate cementing) in the annular space around well casings. Ingraffea et al. (2014) claim that 9.18% of unconventional wells completed in northeastern Pennsylvania since 2009 (2714 wells) have shown a loss of integrity (i.e., cement and/or casing impairment) with unconventional wells having a four-fold higher risk of impairment compared to conventional wells. The authors state cement integrity problems can arise from hydrostatic imbalances caused by inappropriate cement density, inadequately cleaned bore holes, premature gelation of the cement, excessive fluid loss in the cement, high permeability in the cement slurry, cement shrinkage, radial cracking due to pressure fluctuations in the casings, poor interfacial bonding, and normal deterioration with age. Ingraffea et al. (2014) state that casing problems may arise from failed casing joints, casing collapse, and corrosion. Baldassare et al. (2014) state that both ineffective cement bonds and casing thread leaks can be sources of stray gas. Molofsky et al. (2013) acknowledge that instances of stray gas migration resulting from accumulation of gas pressures within and around the sides of the annular spaces of gas well casing have occurred in Pennsylvania, Ohio, and New York, but dispute that stray gas migration is a systemic problem as implied by some researchers (Osborn et al., 2011; Jackson et al., 2013a).

Whether the hydraulic fracturing (stimulation) process itself might be responsible for stray gas is also a highly debated issue. The probability of stray gas migrating upward from induced fractures in the Marcellus Shale as a result of the hydraulic fracturing (stimulation) process itself is claimed to be low given the reported limited vertical extent of induced fractures (Davies et al., 2012; Fisher and Warpinski, 2012) and the relatively low reported permeability of the Mahantango Formation (of the Hamilton Group) that lies immediately above the Marcellus Shale (Flewelling and Sharma, 2014; Molofsky et al., 2013). Davies et al. (2012) report that the maximum height of an upward propagating hydraulic fracture from several thousand fracturing operations in the Marcellus Shale and other shale plays is 588 meters (1,929 feet), with the maximum height in the Marcellus Shale being reported at 536 meters (1,758 feet). This maximum height of 1,758 feet far exceeds the maximum thickness of the Marcellus Shale (<400 feet) in Pennsylvania (Pennsylvania State University n.d.), indicating that vertical fractures in the Marcellus Shale may not necessarily be confined to the Marcellus and may potentially extend into overlying formations. Molofsky et al. (2013) state that the over-pressured Mahantango Formation (of the Hamilton Group) in Susquehanna County—consisting of laminated shale, siltstone, and fine-grained sandstone—overlying the Marcellus Shale acts as a “restrictive barrier” to the upward movement of deep formation fluids and methane from the Marcellus Shale. Flewelling and Sharma (2014) argue that vertical permeabilities are dominated by the least permeable layer and that the stratigraphy above black shales is typically dominated by layers of other shales, siltstones, and mudstones. Many of these layers have inherently low permeability, which is further reduced by high effective stress at depth, cementation, and partial saturation. Warner et al. (2012), however, state that some shallower ground water systems in northeastern Pennsylvania have geochemical signatures similar to produced water from the Marcellus Shale, thereby providing evidence of a pre-existing network of cross-formational pathways that has enhanced hydraulic connectivity to deeper formations. This is supported by the work of others (Llewellyn, 2014; Lautz et al., 2014). Baldassare et al. (2014) evaluated three-dimensional seismic data for Marcellus Shale gas wells, and report that high-angle reverse faults and deep-seated thrust faults cut the Tully Limestone above the Marcellus Shale and that these faults provide evidence of geologic pathways for post-metagenic thermogenic gases to mix with shallow, early thermogenic gases. They suggest that thrust faults may possibly propagate to the surface and cite evidence of two such thrust faults in Bradford County exposed at or near the surface in Towanda (Bridge Street fault) and Wysox (Wysox fault). Myers (2012) claims, through interpretative modeling, that advective transport could require up to tens of thousands of years to move contaminants to the surface but that fracturing the shale could reduce that transport time to tens or hundreds of years. This has been disputed by others (Saiers and Barth, 2012; Cohen et al., 2013).

Baldassare et al. (2014) have compiled an extensive gas isotope dataset from mud log gas samples collected during the completion of 234 gas wells in a five-county area of northeastern Pennsylvania (Tioga, Bradford, Susquehanna, Sullivan, and Wyoming counties). Mean and median values from their study, including standard deviations for $\delta^{13}C$ of methane ($\delta^{13}C_{CH4}$ or $\delta^{13}C_1$), δ^2H of methane (δ^2H_{CH4} or δCD_1), and $\delta^{13}C$ of ethane ($\delta^{13}C_{C2H6}$ or $\delta^{13}C_2$), for more than 1,400 samples collected from the Marcellus Shale and over 500 samples collected from formations above the Marcellus Shale are presented in

Table 5. The data in Table 5 are also presented by depth of collection from 0 to more than 5,000 feet deep—as reported by Baldassare et al. (2014). The authors report that thermogenic gases are predominant in the regional Neogene and Upper Devonian rocks that comprise the upper 1,000 feet of their study area, with average $\delta^{13}C_{CH4}$, $\delta^{13}C_{C2H6}$, and $\delta^{2}H_{CH4}$ values of -43.53‰, -40.95‰, and -232.50‰, respectively. The isotopic signatures are in contrast to observed average isotopic signatures for Marcellus Shale gas, which were more positive (i.e., less fractionated) with values of -32.37‰, -38.48‰, and -162.34‰ for $\delta^{13}C_{CH4}$, $\delta^{13}C_{C2H6}$, and $\delta^{2}H_{CH4}$, respectively. The data presented in Table 5 show not only the variation in isotopic signatures amongst the different formations in the study area but, based on standard deviation values, also reveal the variation in isotopic signatures within the different formations, including the Marcellus Shale. The standard deviation data shown in Table 5 indicate methane and ethane isotopic signatures from the Marcellus Shale may not necessarily be unique and that gas from formations above the Marcellus Shale could exhibit signatures similar to that of the Marcellus Shale.

Molofsky et al. (2013) have suggested that the magnitude of isotope reversals ($\delta^{13}C_{C2H6}$ - $\delta^{13}C_{CH4}$) characteristic of gases from deeper formations such as the Marcellus Shale could possibly be used as a means to differentiate gases from different formations, including the Marcellus Shale. The topic of isotope reversal in deep basin gases in the study area has been extensively addressed by Burruss and Laughrey (2010). Consistent with the pattern of isotope reversal, gas from the Marcellus Shale appears to be generally characterized by an ethane (C_2H_6) fraction that is more fractionated than the methane (CH_4) fraction (i.e., $\delta^{13}C_{CH4} > \delta^{13}C_{C2H6}$). The magnitude of this isotope reversal appears to show some consistency in Marcellus Shale gas within the study area. Molofsky et al. (2013) have reported isotope reversal differences of -5‰ to -7‰ from Marcellus Shale gas wells in the Dimock area of Susquehanna County. Isotope data provided by PA DEP from production casings and tubing from a Marcellus Shale gas well pad location in central Bradford County show isotope reversal differences ranging from -6.66‰ to -6.97‰ (Table 6). The mean isotope reversal difference calculated from the difference of overall $\delta^{13}C_{CH4}$ and $\delta^{13}C_{C2H6}$ means reported by Baldassare et al. (2014) for the Marcellus Shale in their five-county study in northeast Pennsylvania is -6.11‰ (Table 5). In contrast, the mean calculated isotope reversal difference for mud gas samples from the Middle Devonian Hamilton Group above the Marcellus Shale based on the Baldassare et al. (2014) data is -4.49‰ (Table 5). For formations above the Hamilton Group, isotope reversal differences were less, ranging from -4.18‰ to +1.87‰ (Table 6). Thus, it would appear that isotope reversal differences could potentially aid in differentiating between Marcellus Shale gas and gas originating from formations above the Marcellus Shale.

Baldassare et al. (2014) also compiled pre-drill gas isotope data for 67 private wells sampled in their five-county study in northeastern Pennsylvania, including Bradford and Susquehanna counties. The highest (most positive) $\delta^{13}C_{CH4}$ value measured was -34.47‰ for a sample collected in Tioga County. The calculated mean and median $\delta^{13}C_{CH4}$ values for their five-county dataset were -45.33‰ and -43.19‰, respectively, while the calculated mean and median $\delta^{2}H_{CH4}$ values were -212.1‰ and -212.3‰, respectively. Sufficient ethane was available for analysis in 13 of the 67 wells sampled, and the data indicated respective mean and median $\delta^{13}C_{C2H6}$ values of -35.03‰ and -34.60‰. The differences in mean and median isotope values between the gases from the 67 private wells and the Marcellus Shale gas indicate that the gas from the private wells is, on average, considerably more fractionated (i.e., more $\delta^{13}C$-depleted) than Marcellus Shale gas. Also of significance is that none of the 13 gas samples with sufficient ethane present for isotopic analysis was observed to exhibit any isotope reversal.

Table 5. Mud log gas sample data from 234 gas wells drilled in five-county region of northeastern PA, including Bradford and Susquehanna counties (from Baldassare et al. 2014).

Formation or Depth	**Mean $\delta^{13}C_{CH4}$ (‰)**	***n***	**Std Dev $\delta^{13}C_{CH4}$ (‰)**	**Mean $\delta^{13}C_{C2H6}$ (‰)**	***n***	**Std Dev $\delta^{13}C_{C2H6}$ (‰)**	**Mean $\delta^{2}H_{CH4}$ (‰)**	***n***	**Std Dev $\delta^{2}H_{CH4}$ (‰)**	**Mean $\delta^{13}C_{C2H6}$ – Mean $\delta^{13}C_{CH4}$ (‰)**
Marcellus Shale	-32.37	1592	3.75	-38.48	1569	3.15	-162.34	1502	5.69	-6.11
Hamilton Group	-33.33	254	3.44	-37.82	245	3.42	-167.88	214	10.54	-4.49
Tully Limestone	-34.10	51	5.30	-38.28	42	2.91	-173.82	33	20.78	-4.18
Geneseo Shale	-34.59	38	3.33	-38.29	37	2.84	-180.42	24	22.18	-3.70
Brallier Formation	-37.19	101	4.27	-38.58	87	2.98	-208.08	65	33.86	-1.39
Catskill/Lock Haven	-42.12	238	6.29	-40.25	215	2.77	-229.00	129	35.78	1.87
>5000 ft bgs	-32.46	1844	3.84	-38.30	1811	3.21	-163.41	1706	8.54	-5.84
4000 - 5000 ft bgs	-35.94	143	3.56	-39.19	132	2.69	-180.28	95	29.93	-3.25
2000 - 5000 ft bgs	-37.97	269	4.85	-39.60	240	2.69	-195.80	163	36.55	-1.63
1000 - 3000 ft bgs	-41.60	157	5.66	-40.13	139	2.54	-228.91	93	33.93	1.47
0 - 2000 ft bgs	-41.93	161	6.76	-40.38	144	2.58	-226.60	98	37.02	1.55
0 - 1000 ft bgs	-43.53	71	6.84	-40.95	63	2.56	-226.88	40	39.85	2.58

Table 6. Gas isotope data from PA DEP and Molofsky et al. (2013) for gas wells in study area.

Marcellus Gas Wells in Study Area	Location	Date	Source	$\delta^{13}C_{CH4}$ (‰)	$\delta^{13}C_{C2H6}$ (‰)	$\delta^{2}H_{CH4}$ (‰)	$\delta^{13}C_{C2H6}$ - $\delta^{13}C_{CH4}$ (‰)
Strom 2H / Production Casing	Monroe Township, Bradford Co.	8/14/2010	PA DEP	-31.96	-38.93	-158.6	-6.97
Strom 2H / Production Tubing	Monroe Township, Bradford Co.	8/14/2010	PA DEP	-32.44	-39.11	-158.9	-6.67
Strom 1H / Production Casing	Monroe Township, Bradford Co.	8/14/2010	PA DEP	-32.15	-39.05	-158.4	-6.90
Strom 1H / Production Tubing	Monroe Township, Bradford Co.	8/14/2010	PA DEP	-32.60	-39.26	-157.7	-6.66
Vannoy 2H / Production Casing	Granville Township, Bradford Co.	12/10/2010	PA DEP	-37.25	–	-163.2	–
Vargson Production Casing	Granville Township, Bradford Co.	12/10/2010	PA DEP	-36.94	–	-163.5	–
Gas Well 1: 4-1/2" Production Casing	Dimock Township, Susquehanna Co.	1/7/2009	PA DEP*	-29.91	-35.92	-161.1	-6.01
Gas Well 2H: 5-1/2" Production Casing	Dimock Township, Susquehanna Co.	11/4/2011	Operator*	-29.7	-35.6	-160	-5.9
Gas Well 4H: 5-1/2" Production Casing	Dimock Township, Susquehanna Co.	11/4/2011	Operator*	-29.0	-35.2	-160	-6.2
Gas Well 1V: 4-1/2" Production Casing	Dimock Township, Susquehanna Co.	11/4/2011	Operator*	-28.7	-35.3	-157	-6.6
Gas Well 5H: 5-1/2" Production Casing	Dimock Township, Susquehanna Co.	11/4/2011	Operator*	-29.5	-35.3	-161	-5.8

* As reported by Molofsky et al. (2013)

Molofsky et al. (2013) in their study of methane distribution in ground water in Susquehanna County observed that no ground water sampling locations with Ca-HCO_3 type water (n=281) per the criteria of Deutsch (1997) exhibited methane concentrations greater than 1 mg/L. In contrast, 75% of Na-Cl and Na-HCO_3-Cl type ground water samples (n=34), 30% of Na-HCO_3 type ground water samples (n=20), and 11% of Ca-Na-HCO_3 type ground water samples (n=46) in their study exhibited methane concentrations greater than 1 mg/L. A similar observation was made by McPhillips et al. (2014) for a study conducted in central New York State to the north of the study area. They found only one of 81 samples with Ca-HCO_3 type water exhibited a methane concentration greater than 1 mg/L (per the criteria of Deutsch, 1997) whereas 58% (n=19) of Na-Cl, Na-HCO_3-Cl, and Na-HCO_3 type ground water samples exhibited methane concentrations greater than 1 mg/L. The one Ca-HCO_3 type water sample exhibiting a methane concentration greater than 1 mg/L (reportedly between 1 and 5 mg/L) in the McPhillips et al. (2014) study was a borderline Ca-HCO_3 type water very close to being classified as a Ca-Na-HCO_3 type water.

Methane, regardless of its source, can be a concern because it can accumulate to cause an explosive environment in which an ignition source or even a well pump can trigger an explosion (Mathes and White, 2006). Reported incidents of stray gas migration specific to Bradford and Susquehanna counties—as previously noted—are provided in Appendices C and D. However, it is important to note that stray gas migration from oil and gas exploration activities is not a new phenomenon and has been an on-going issue in northeastern Pennsylvania for many years preceding modern-day hydraulic fracturing. Harrison (1983, 1985), for example, discussed stray gas migration associated with historical oil and gas drilling activities in northeastern Pennsylvania and proposed possible mechanisms for the occurrence of the stray gas. One mechanism postulated was lateral migration of gas through highly permeable strata into the open (non-cemented) annuli of gas wells followed by upward movement of the gas into shallower zones.

In Pennsylvania, an action level of 7 mg/L for dissolved methane in ground water has been established (Pennsylvania Code, 2011). In cases where sustained concentrations in domestic wells are equal to or greater than 7 mg/L and operators are deemed responsible for the methane presence, operators—in conjunction with the PA DEP—are required to "take measures necessary to ensure public health and safety." The action level of 7 mg/L represents 25% of the approximate 28 mg/L solubility limit for methane in water at atmospheric pressure. Dissolved methane concentrations at depth can be much greater than 28 mg/L (due to the effects of hydrostatic pressure) such that dissolved methane in water pumped from depth may undergo significant exsolvation (outgassing) to yield free methane once at the surface. The US Department of Interior, Office of Surface Mining (Eltschlager et al., 2001) has proposed an action level for dissolved methane in water of 10 mg/L with the recommendations that at concentrations between 10 mg/L and 28 mg/L, "remediation may be prudent to reduce the methane concentration to less than 10 mg/L" and "ignition sources be removed from the immediate area." The Office of Surface Mining publication further states concentrations greater than 28 mg/L indicate "potentially explosive or flammable quantities of gas are being liberated in the well and/or may be liberated in confined areas of the home."

6. Water Quality Data from This Study

6.1. Geochemical Parameters

Water temperature, specific conductance, pH, dissolved oxygen, and ORP were measured in the field prior to collection of all samples from the 36 homeowner wells, two springs, one pond, and one stream. The temperatures of water collected from wells and springs over the three rounds of sampling ranged from 9.22^{o}C to 15.8^{o}C, with a median temperature of 11.0^{o}C. pH measurements ranged from 5.85 at spring location NEPASW02 to 8.72 at homeowner well location NEPAGW11, with a median value of 7.47. Dissolved oxygen concentrations ranged from 0.02 mg/L at NEPAGW01 to 8.8 mg/L at NEPAGW14, with a median value for the three rounds of 0.28 mg/L. The low median value for dissolved oxygen indicates samples from more than half of the ground water sampling locations were likely in an anoxic or significantly reduced state, reflecting conditions more conducive to the reductive dissolution of iron and manganese. Ferrous (reduced) iron was detected at or above 0.03 mg/L at 19 of the 38 well and spring locations, with a maximum concentration of 0.95 mg/L detected in NEPAGW03 in the third round of sampling. Sulfide concentrations were detected at or above 0.02 mg/L at 14 of the 38 well and spring sampling locations, with a measured high concentration of 0.80 mg/L at homeowner well location NEPAGW31. Alkalinity ranged from 22.0 mg/L (as $CaCO_3$) at spring location NEPASW02 to 382 mg/L (as $CaCO_3$) at homeowner well location NEPAGW03, with a median value of 152 mg/L. Similarly, total dissolved solids (calculated from specific conductance measurements) ranged from a low of 58.5 mg/L at spring location NEPASW02 to a high of 1,673 mg/L at homeowner well NEPAGW03, with an overall median concentration of 227 mg/L. All median concentrations/values reported above are derived from averaged data for those locations sampled in more than one round.

Turbidity in samples collected over the three rounds ranged from <1.0 NTU to 78 NTU, with a median value of 1.7 NTU. This excludes the results for two well locations (NEPAGW24 and NEPAGW31) sampled in the first round only that exhibited turbidity values greater than 800 NTU. Excessive turbidity in one well (>800 NTU in NEPAGW31) is attributed to the well having been in disuse for an extended period of time coupled with difficulty in controlling water flow rates during sampling with the existing homeowner well pump assembly. Excessive turbidity in the other well (NEPAGW24) may have been due to the well having been stressed far beyond its normal use due to the approximately one hour of pre-sampling purge time applied to all wells in the study. No significant turbidity was observed in this well when purging began; however, as purging proceeded, turbidity gradually increased until becoming excessive (more than 800 NTU). Both homeowner wells exhibiting excessive turbidity were coincidentally also wells sampled in this study located more than 1 mile from a well pad where hydraulic fracturing had occurred at the time of sampling. In fact, both homeowner wells were located more than 2 miles from the nearest well pad with fractured wells and areally more than 2 miles from the nearest fractured lateral at the time of sampling. It is conceivable that the turbidity in these homeowner wells may have been influenced by activities at one or more nearer well pads where drilling only had occurred at the time of sampling. A well pad with drilled but not yet fractured wells was located within approximately 2500 feet of NEPAGW31—although drilling at the well pad had been completed more than six months prior to the sampling event in this study. In the case of NEPAGW24, a well pad with drilled but not yet fractured wells at the time of sampling was approximately 6200 feet to the west. Neither NEPAGW24 nor NEPAGW31 were sampled after the first round. In the case of NEPAGW24, although the turbidity problem arising from the sampling event eventually resolved itself the following day, there was concern that future sampling rounds at this location—using the methodology employed in this study—might cause a similar and potentially more sustained turbidity problem. In the case of NEPAGW31, the homeowner pump seized up during purging raising concerns of potential damage to the homeowner pump if future sampling events were conducted at this location.

The calculated charge balance error for water samples collected during the three sampling rounds in this study ranged from 0.01% to 15.6%, with 86% of samples showing a charge balance of <5%. Only one sample (NEPAGW22), with a charge balance error of 15.6%, did not meet the 15% criteria required for inclusion in water typing and development of Piper, Durov, and Schoeller diagrams. The Piper diagram in Figure 12 shows the variation in ground water chemistry of samples collected in the study with respect to major ion distribution. A majority of ground water samples are observed to plot to the left within the diamond as Ca-HCO_3 type water. However, seven samples (NEPAGW01, NEPAGW02, NEPAGW11, NEPAGW16, NEPAGW25, NEPAGW27, and NEPAGW33) plot as Na-HCO_3 type water, three samples (NEPAGW04, NEPAGW08, and NEPAGW17) plot as Na-Cl type water, and one sample (NEPAGW03) distinctly plots as Ca-SO_4 type water. The Durov diagram in Figure 13 shows the correlation of the cation-anion distribution with sample pH and TDS indicating that Na-Cl and Na-HCO_3 type water samples generally exhibit more elevated pH values and TDS concentrations than other samples in the study.

Figure 14 shows the frequency distribution of water types for wells and springs sampled in this study. Also shown in Figure 14 are associated frequencies of methane detections greater than 1 mg/L per water type. The data indicate Na-HCO_3 and Na-Cl type waters exhibited the greatest frequency of methane detections >1 mg/L in this study. This correlation between water types and methane concentrations is consistent with the observations of Molofsky et al. (2013) for their study in Susquehanna County and McPhillips et al. (2014) for their study in neighboring New York State. The water type distribution shown in Figure 14 for this study is based on AqQA criteria whereas Molofsky et al. (2013) and McPhillips et al. (2014) used the more detailed criteria of Deutsch (1997). Direct comparison of the water types with methane concentrations greater than 1 mg/L from this study with those of Molofsky et al. (2013) using the criteria of Deutsch (1997) is provided in Appendix E. Four homeowner well locations in this study with Ca-HCO_3 type water per the criteria of Deutsch (NEPAGW13, NEPAGW23, NEPAGW32, and NEPAGW37) exhibited methane concentrations greater than 1 mg/L. This represents 23.5% of homeowners with Ca-HCO_3 type water in this study (per the criteria of Deutsch) and contrasts with the findings of Molofsky et al. (2013) where zero (0%) of 281 ground water sampling locations with Ca-HCO_3 type water exhibited methane concentrations >1 mg/L, and the McPhillips et al. (2014) study where one (1.2%) of 81 ground water sampling locations with Ca-HCO_3 type water exhibited methane concentrations >1 mg/L. As shown in Figure 14, 26 ground water sampling locations in this study exhibited Ca-HCO_3 type water per the broader criteria of AqQA with eight (30.8%) of these locations exhibiting methane concentrations >1 mg/L.

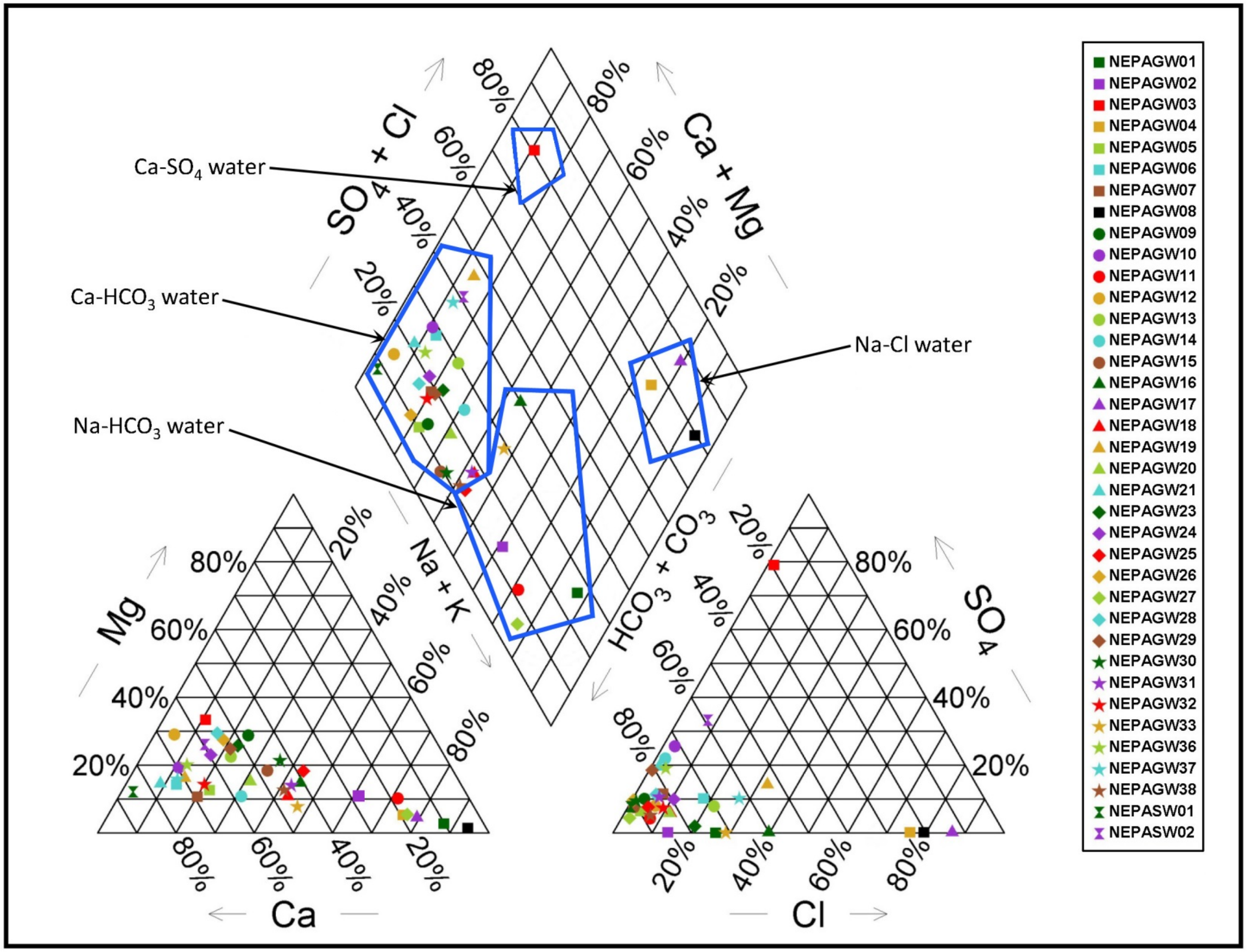


Figure 12. Piper diagram showing water-type distribution (based on AqQA) for homeowner wells and springs sampled in this study. (Data for NEPAGW22 not included due to ion balance not meeting ≤15% criteria.)

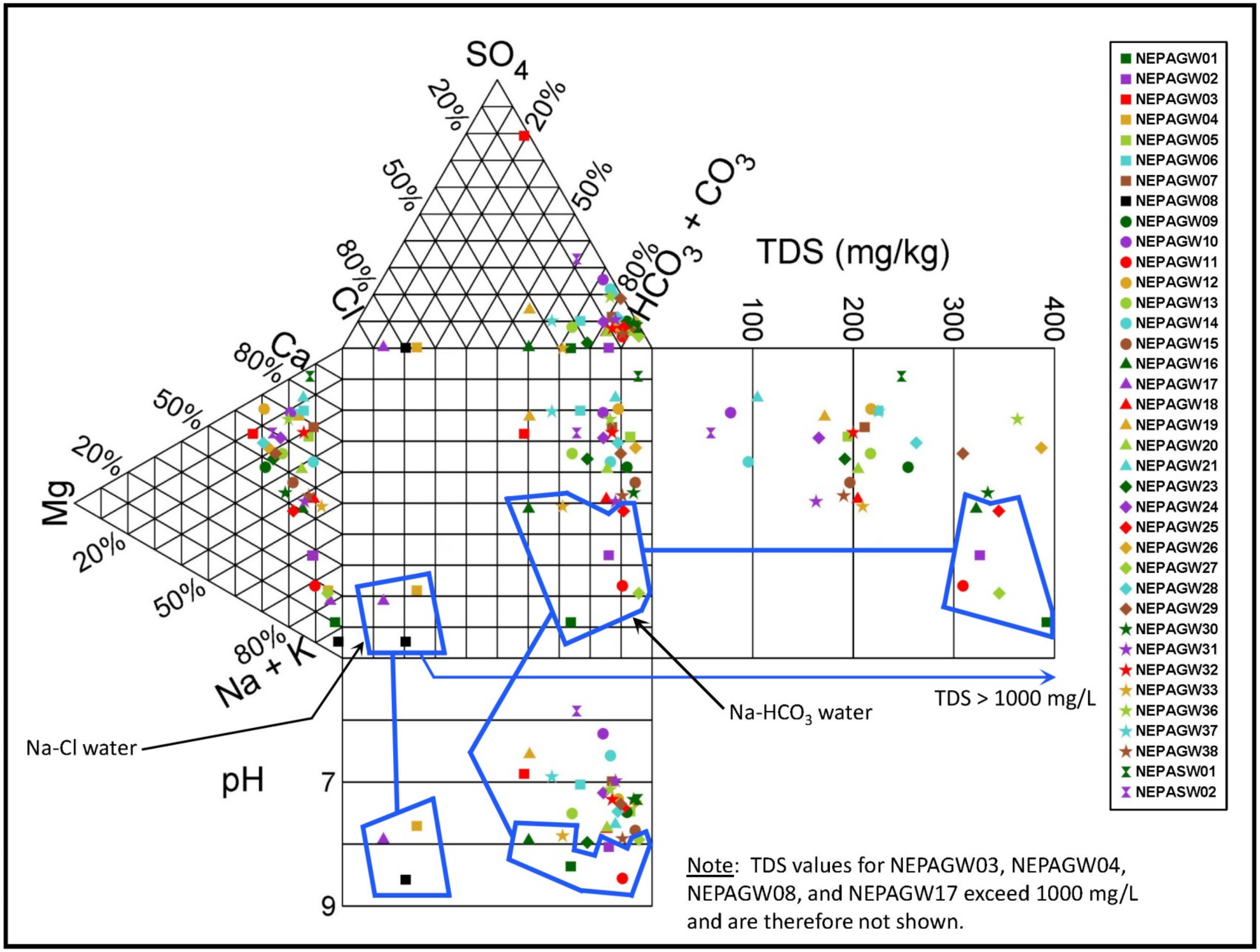


Figure 13. Durov diagram showing the generally higher pH and TDS levels associated with Na-Cl and Na-HCO_3 type waters sampled from homeowner wells in this study.

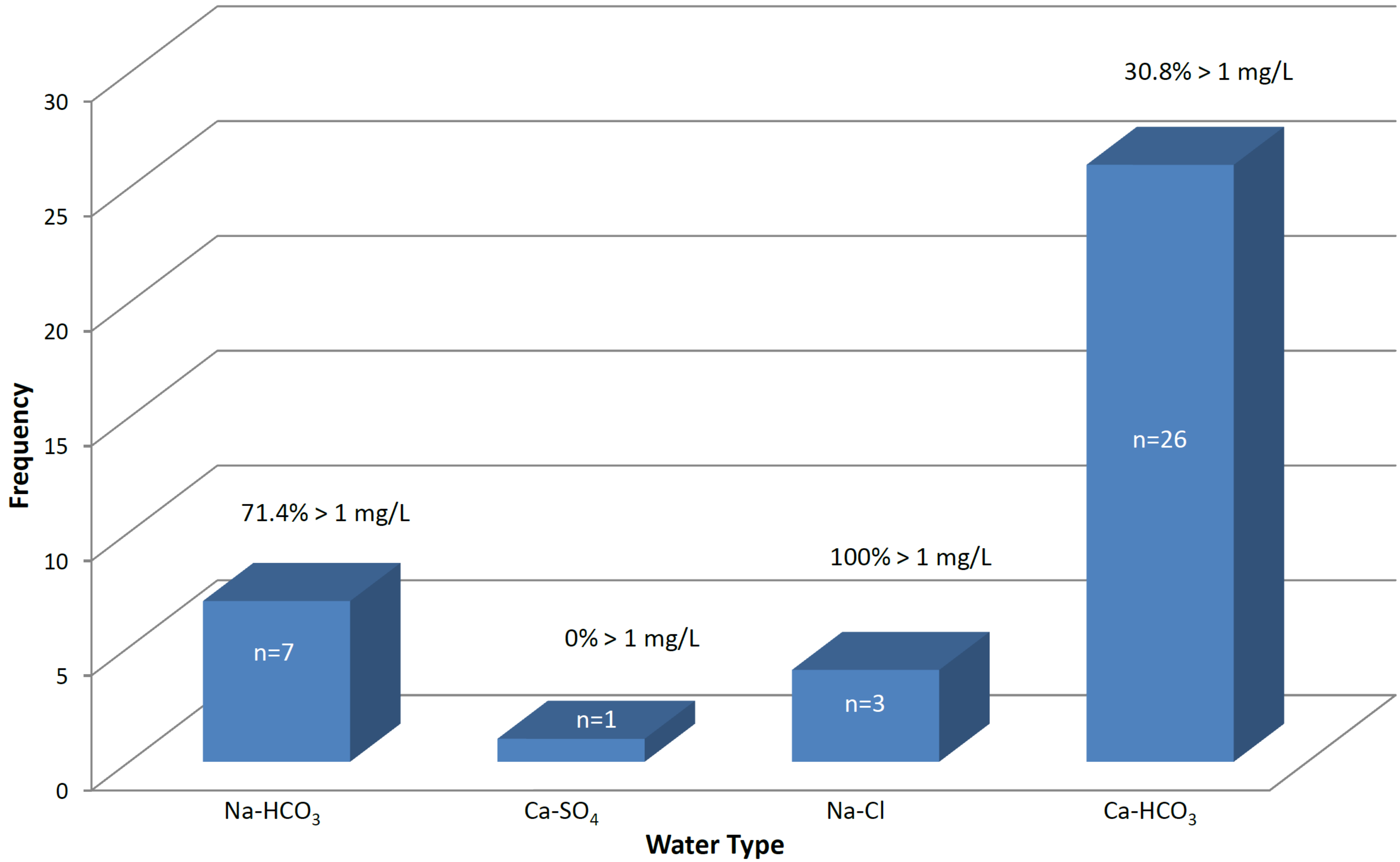


Figure 14. Breakdown of water types from this study (based on AqQA criteria) and percentage of methane detections >1mg/L per water type. (8 of 10 locations with Na-HCO_3 or Na-Cl type water exhibited methane concentrations >1 mg/L.)

6.2. Inorganics

6.2.1. Iron and Manganese

Box-and-whisker plots presented in Figure 15 show the dissolved iron distribution in this study relative to that of the NWIS dataset, and the dissolved manganese distribution relative to both the NWIS and NURE datasets. (Iron data are not available in the NURE database.) The plots in Figure 15 and data presented in Table 4 show that the median, mean, 25th, and 75th percentile dissolved iron and manganese concentrations from this study are less than those of the NWIS dataset. However, the plots also indicate the mean and maximum dissolved manganese concentrations from this study and the NWIS dataset are higher than those of the NURE dataset.

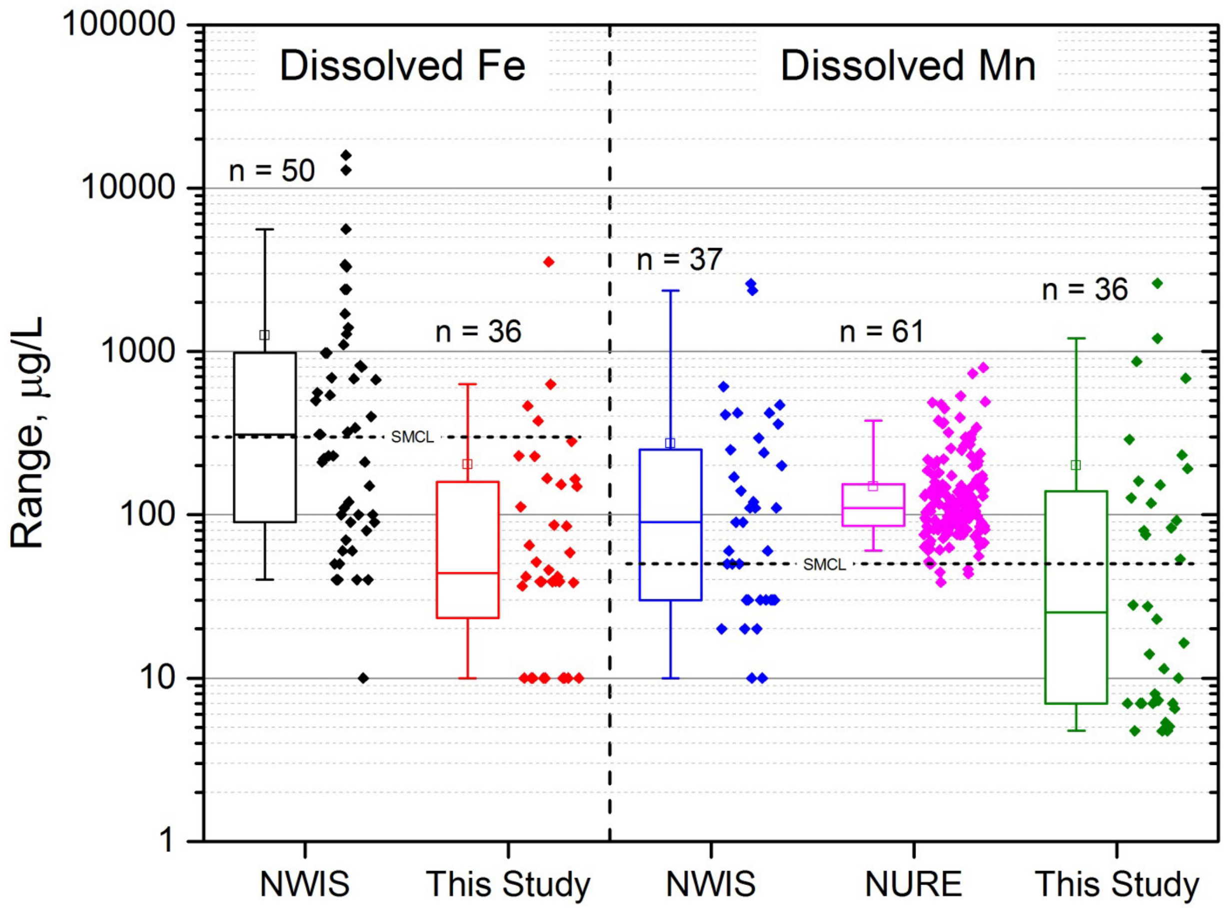


Figure 15. Box and whisker plots showing the dissolved iron and manganese distribution (5th, 25th, median, 75th, and 95th percentiles) for wells and springs sampled in this study relative to pre-2007 NWIS and NURE 1977 ground water data. Small open squares on plots represent mean values. (No NURE data available for dissolved Fe; Data for NEPAGW24 and NEPAGW31 are not shown due to excessive turbidity [>800 NTU] measured in samples; Data for locations sampled in more than one round are averaged.)

Goodness-of-fit testing at the 0.05 significance level indicates the dissolved iron data from this study is not normally, log-normally, or gamma-normally distributed. Nonparametric (Kruskal-Wallis) analysis of variance conducted on the dissolved iron NWIS dataset and the dataset from this study indicate significant differences between the two datasets, with a calculated p-value of 6.75E-06 (Appendix F). The p-value of <0.05 is reflective of the dissolved iron data from this study representing a population of samples with significantly lower dissolved iron concentrations than the population represented by the NWIS dataset.

Goodness-of-fit testing at the 0.05 significance level for dissolved manganese for the three datasets indicate the dissolved manganese data from this study and the NWIS dataset are log-normally distributed, while the NURE dataset is not normally, log-normally, or gamma-normally distributed. Nonparametric (Kruskal-Wallis) analysis indicated significant differences amongst the three datasets for dissolved manganese (Appendix F). A subsequent post-hoc Kruskal-Wallis nonparametric multiple comparison analysis indicated a significant difference between the NURE dataset and the data from this study but not between the NURE dataset and the NWIS dataset. A post-hoc parametric (Scheffe) multiple comparison analysis on the data from this study and the NWIS dataset—since these datasets are both log-normally distributed—also indicated a significant difference (Appendix F). The results indicate the dissolved manganese data from this study represent a population of samples with significantly lower dissolved manganese concentrations than the populations represented by the NURE and NWIS datasets.

Box-and-whisker plots in Figure 16 compare dissolved iron and manganese concentrations with total concentrations of these metals in this study. Figure 16 also shows the distribution of turbidity in this study since turbidity can have a significant influence on measured concentrations of total metals. Figure 16 and Table 4 show, as might be expected, that median total concentrations of iron and manganese are higher than median dissolved concentrations, although more so for iron than for manganese. Figure 16 further shows that many locations sampled in this study (more than 40%) exceeded the secondary MCLs for manganese (50 µg/L) and/or iron (300 µg/L). Total iron MCL exceedances—as inferred from Figure 16—appear to be primarily linked to turbidity in wells whereas manganese exceedances appear to be largely independent of turbidity.

6.2.2. Chloride, Sodium, TDS, and Bromide

Concentrations of chloride, a key indicator of potential impacts, were measured above 15 mg/L at 14 of the 38 ground water sampling locations in this study, above 25 mg/L at 9 locations, above 50 mg/L at 6 locations, and above 100 mg/L at 4 locations. The highest average chloride concentration detected was 509.8 mg/L at NEPAGW17. Summary statistics for chloride concentrations in this study relative to the NWIS and NURE pre-2007 datasets are provided in Table 4 and are presented graphically in Figure 17 using box-and-whisker plots. The data indicate the median, mean, and maximum chloride concentrations for this study are below those of the NWIS dataset but higher than those of the NURE dataset.

Goodness-of-fit testing at the 0.05 significance level for dissolved chloride for the three datasets indicate the chloride data from this study are log-normally distributed, while the NURE and NWIS datasets are not normally, log-normally, or gamma-normally distributed. Nonparametric (Kruskal-Wallis) analysis of variance conducted on the three datasets for chloride (Appendix F) indicated no significant differences amongst the three datasets (p-values >0.05). A histogram comparing the chloride data from this study with those of the NWIS and NURE datasets is presented in Figure 18. Nineteen of 116 samples (16.4%) from the NWIS dataset and 7 of 164 samples (4.3%) from the NURE dataset exhibited chloride concentrations >100 mg/L, compared to the 4 of 38 samples (10.5%) from this study. The pre-2007 NWIS dataset, in particular, confirms that elevated chloride concentrations >100 mg/L are not uncommon in the study area.

Time trend data presented in Figure 19 for locations with chloride concentrations greater than 8 mg/L indicate that chloride concentrations generally remain relatively constant over the 1.5-year span of the study. This observation would be more consistent with aquifer equilibrium conditions than a transient chloride plume migration scenario, where an increasing or decreasing concentration trend would be more likely. One exception is NEPAGW08, where chloride concentrations were observed to increase 31% over the course of three sampling rounds, from 335 mg/L to 440 mg/L. However, an earlier pre-drill sample collected by the operator at this location on April 29, 2011, approximately six months prior to commencement of this study, showed a chloride concentration of 413 mg/L—thus bringing into question the presence of an actual increasing concentration trend. The observed increases over the three rounds of sampling in this study may well be within the margin of variability for high TDS Na-Cl type waters in valley settings in the study area. The average lithium to chloride (Li/Cl) ratios of less than 0.002 and boron to chloride (B/Cl) ratios of less than 0.001 observed at NEPAGW08 would not be consistent with impacts from Marcellus Shale flowback or produced water in accordance with Warner et al. (2014).

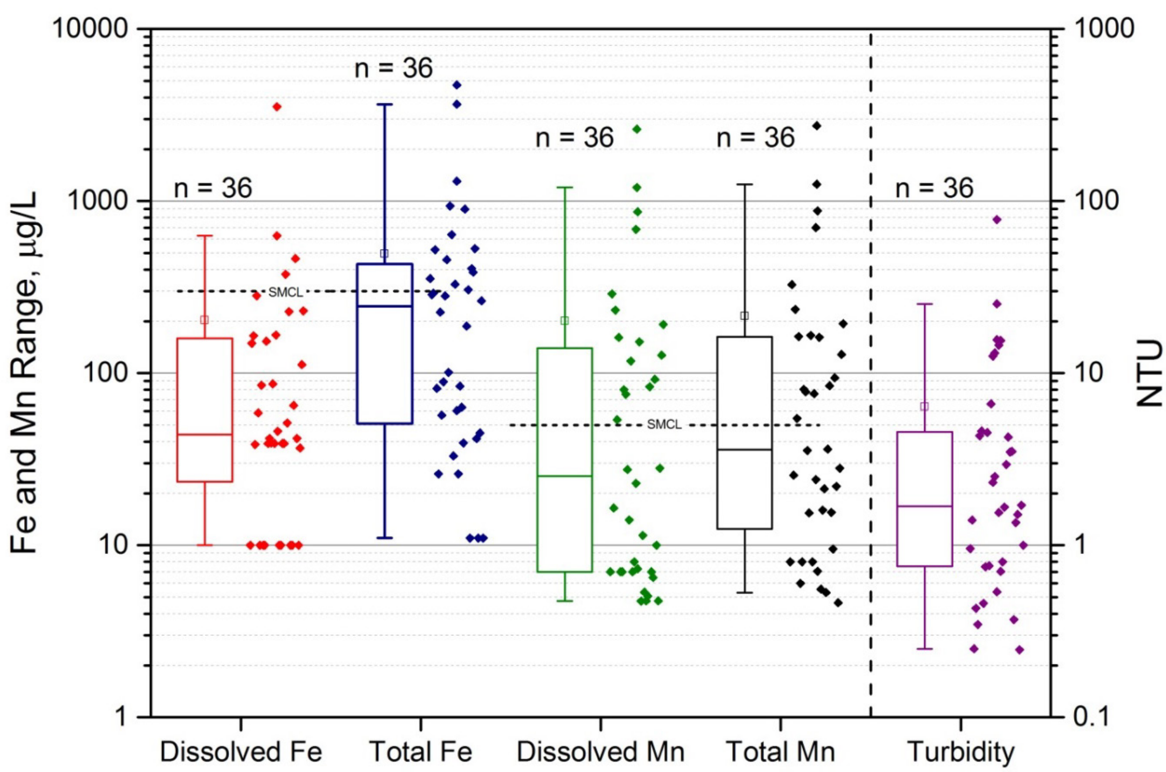


Figure 16. Box and whisker plots comparing dissolved iron and manganese distributions with total iron and manganese distributions for this study (5th, 25th, median, 75th, and 95th percentiles). Also shown is a plot of turbidity from this study. (Data for NEPAGW24 and NEPAGW31 not shown due to excessive turbidity [>800 NTU] measured in samples. Data for locations sampled in more than one round are averaged.)

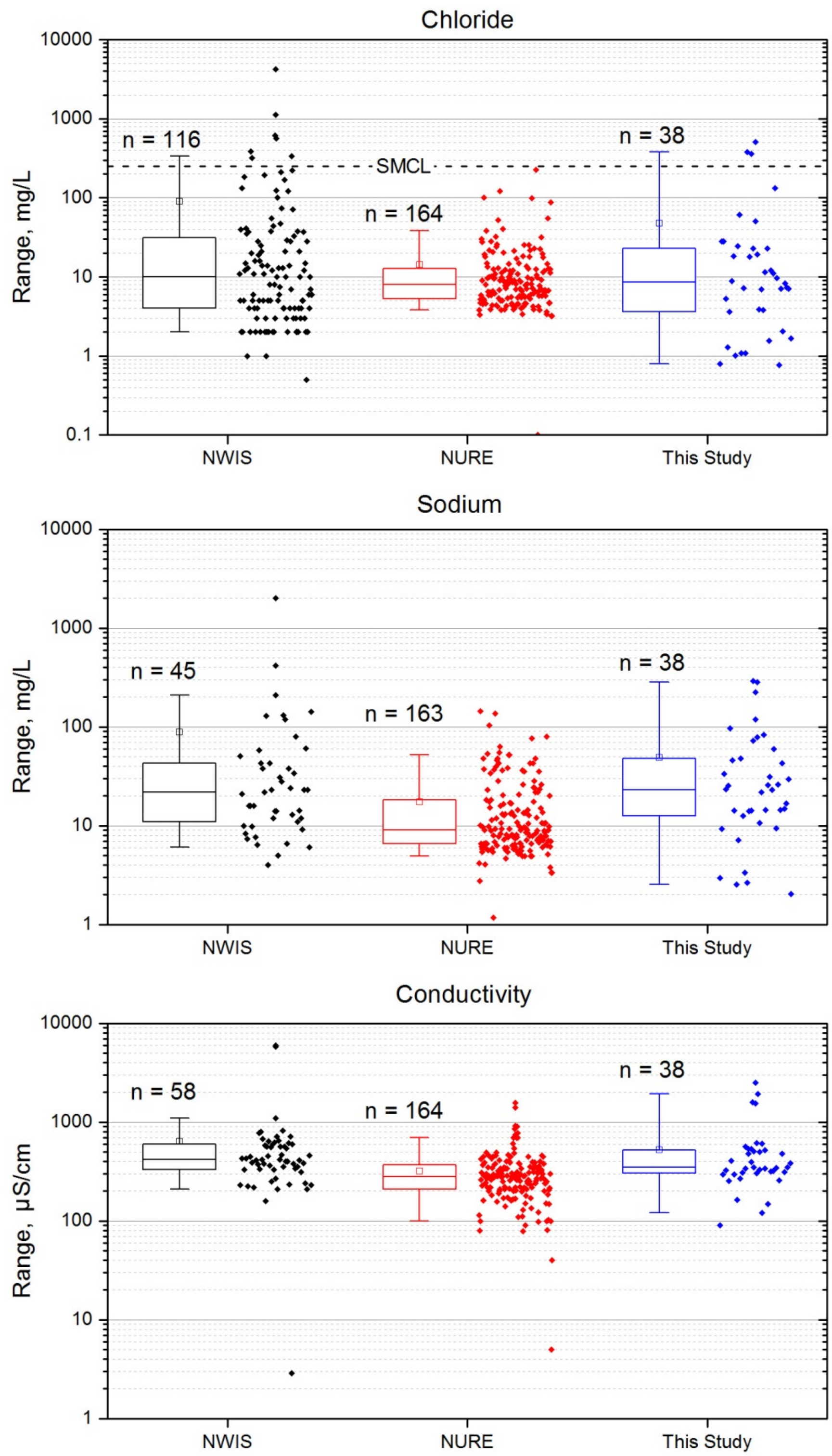


Figure 17. Box and whisker plots showing chloride, sodium, and specific conductance distribution (5th, 25th, median, 75th, and 95th percentiles) for ground water locations sampled in this study relative to pre-2007 NWIS and NURE 1977 ground water data. (Data for locations sampled in more than one round are averaged.)

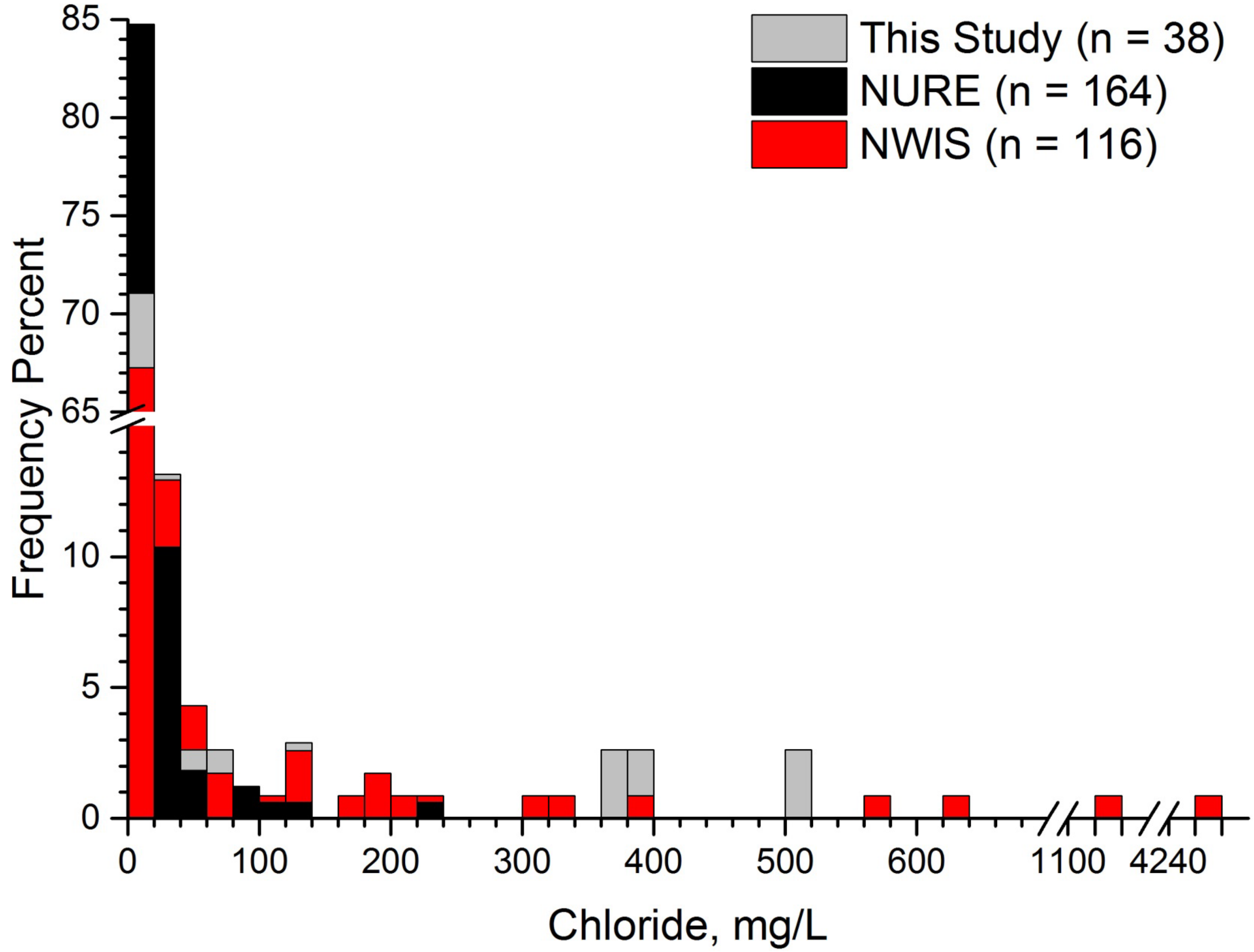


Figure 18. Chloride concentration histogram comparing data from ground water locations in this study with pre-2007 NWIS and NURE 1977 ground water data**.** (Data for locations sampled in more than one round are averaged.)

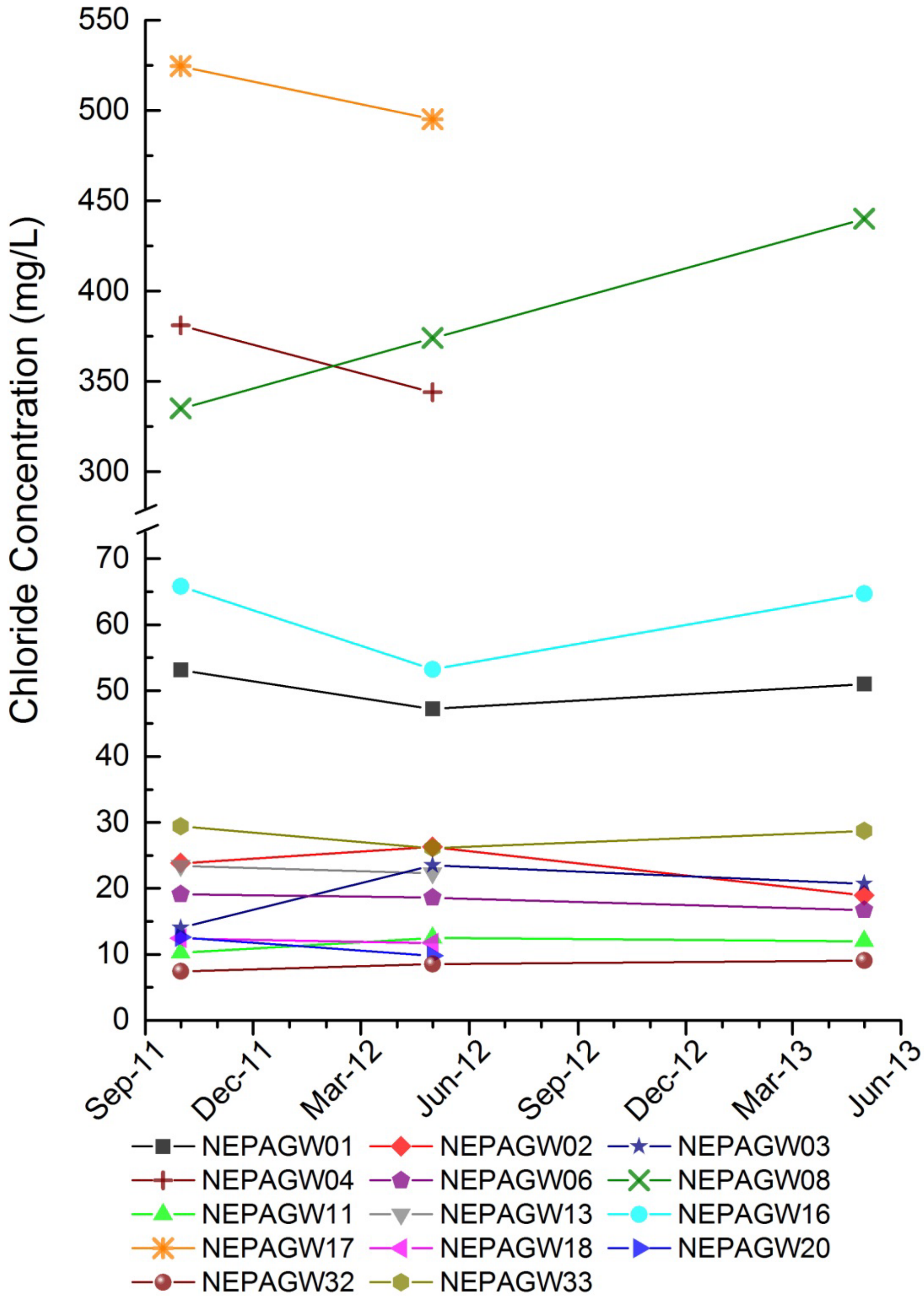


Figure 19. Time trends for chloride in homeowner wells from this study with concentrations >8 mg/L measured in one or more sampling rounds. Not shown are data for NEPAGW19, NEPAGW22, NEPAGW23, and NEPAGW37, which were sampled only once with measured concentrations of 24.7 mg/L, 132 mg/L, 18.2 mg/L, and 28.1 mg/L, respectively. All other locations not shown exhibited chloride concentrations <8 mg/L.

A comparison of the summary statistics for dissolved sodium from this study to the NWIS and NURE pre-2007 datasets is provided in Table 4 and presented graphically in Figure 17 using box-and-whisker plots. Goodness-of-fit testing at the 0.05 significance level for the three datasets indicate the dissolved sodium from this study and the NWIS dataset are log-normally distributed, while the NURE dataset is not normally, log-normally, or gamma-normally distributed (Appendix F). Nonparametric Kruskal-Wallis analysis of variance conducted on the three datasets indicated significant differences amongst the three datasets for dissolved sodium (p-value <0.05). Subsequent post-hoc nonparametric Kruskal-Wallis multiple comparison analysis indicated a significant difference between the NURE dataset and the data from this study, but also, between the NURE dataset and the NWIS dataset. Post-hoc parametric Scheffe multiple comparison analysis conducted on the log-transformed data from this study and the NWIS dataset—since these two dissolved sodium datasets are log-normally distributed—indicated no significant difference between the two datasets (p-value of 0.821). The results indicate the dissolved sodium data from this study represent a population of samples with significantly higher dissolved sodium concentrations than the population represented by the NURE dataset, but not the NWIS dataset.

A comparison of the summary statistics for specific conductance measurements from this study with the NWIS and NURE pre-2007 datasets is provided in Table 4 and presented graphically in Figure 17 using box-and-whisker plots. Goodness-of-fit testing at the 0.05 significance level for specific conductance indicated none of the three datasets was normally, log-normally, or gamma-normally distributed. Nonparametric Kruskal-Wallis analysis of variance conducted on the three datasets indicated significant differences amongst the three datasets (p-value <0.05). Subsequent post-hoc nonparametric Kruskal-Wallis multiple comparison tests indicated significant differences between the NURE dataset and the data from this study, but also, between the NURE dataset and the NWIS dataset (Appendix F). No significant difference was indicated between the NWIS dataset and the data from this study (p-value of 0.977). A histogram comparing specific conductance data from this study with the NWIS and NURE datasets are shown in Figure 20.

Time trend data for TDS (Figure 21) for the same locations shown in Figure 19 for chloride indicate TDS concentrations remained relatively constant over the three sampling rounds, with the exception, again, of NEPAGW08. Increased TDS concentrations (calculated from specific conductance values) were measured at NEPAGW08 with each sampling round in this study with estimated concentrations ranging from 956 mg/L in the first round to 1126 mg/L in the third round. In contrast to the chloride data, pre-drill TDS data reported by the operator for April 29, 2011 indicated a lower value of 842 mg/L at this location than measured in the three rounds of sampling conducted in this study, thus appearing to more strongly suggest evidence of a potential impact at this well location. However, the operator pre-drill sodium, barium, and specific conductance data, relative to the sodium, barium, and specific conductance data from this study, also showed a pattern similar to that of chloride. That is, the operator-reported pre-drill concentrations/values for sodium, barium, and specific conductance were higher than concentrations/values measured in the first two rounds of sampling in this study. This suggests a discrepancy in TDS measurement/calculation methodologies between the operator and this study as apparently reflected in specific conductance and TDS values reported for split samples collected at NEPAGW08 during the first round of sampling in this study. Specific conductance and TDS values for this study in the first round of sampling were 1471 µS/cm and 956 mg/L, respectively, while operator reported data for a split sample were 1270 µS/cm and 726 mg/L, respectively (Weston Solutions, 2012).

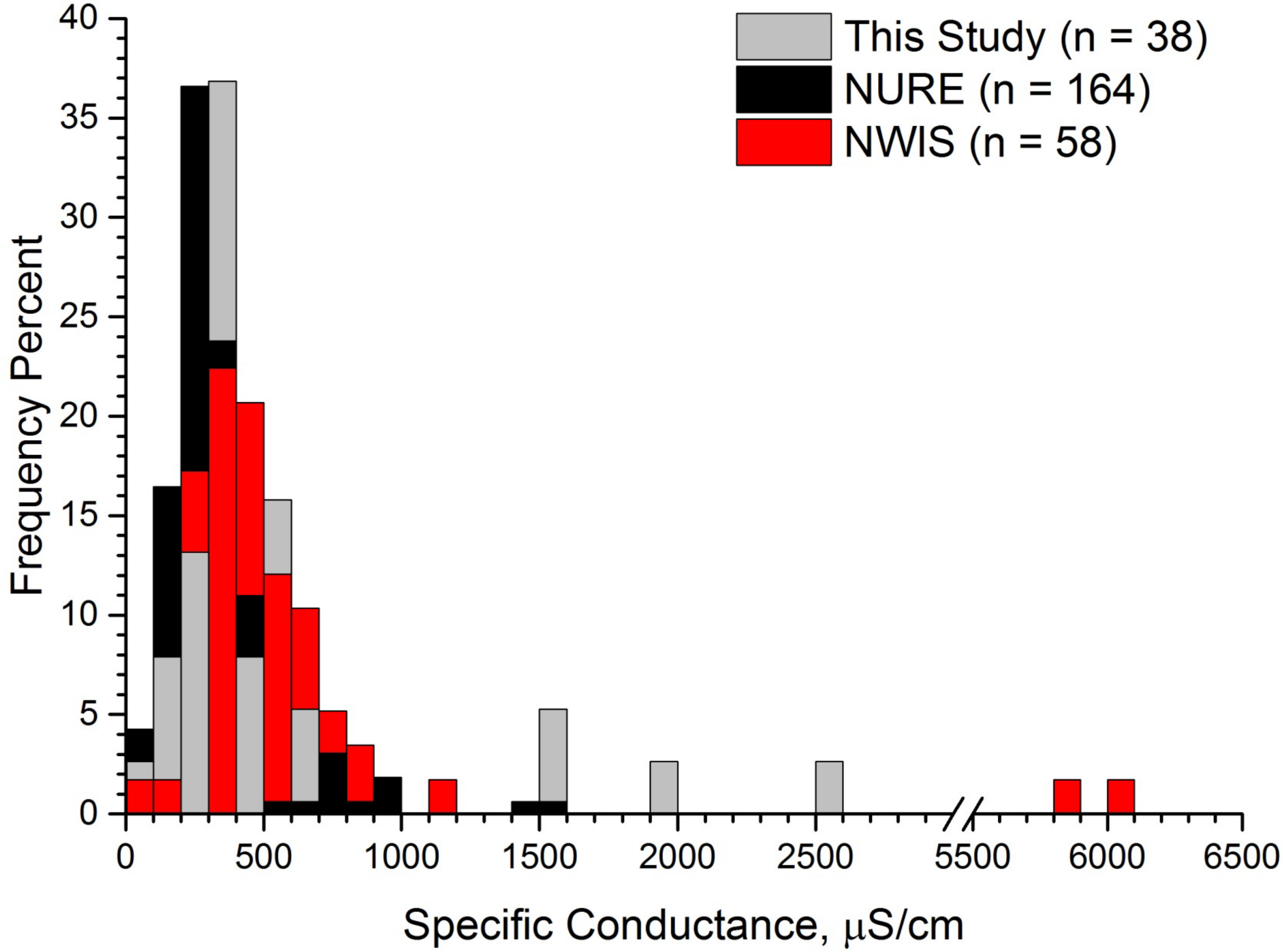


Figure 20. Specific conductance histogram comparing data from ground water locations in this study with pre-2007 NWIS and NURE 1977 ground water data**.** (Data for locations sampled in more than one round are averaged.)

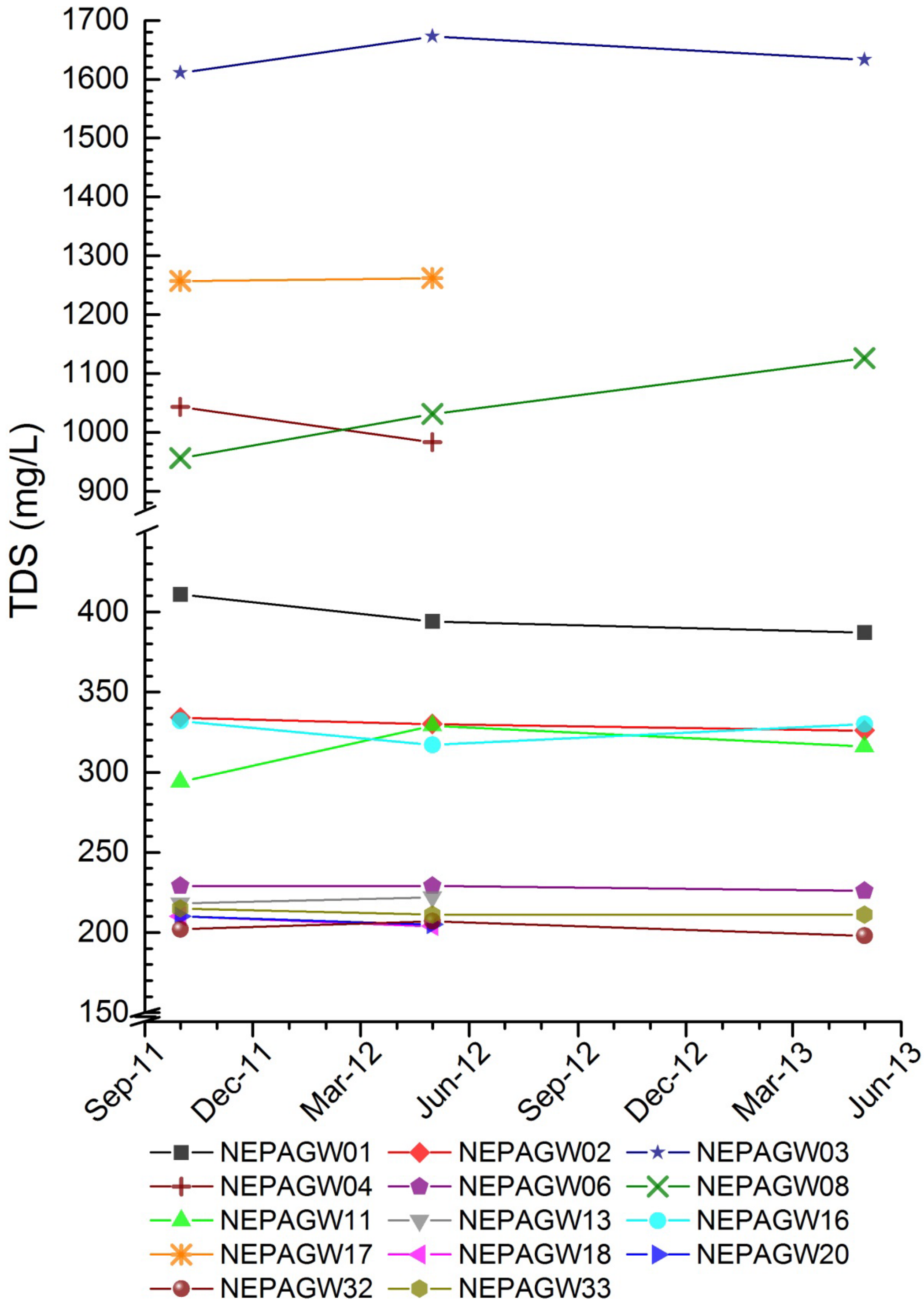


Figure 21. Time trends for total dissolved solids (TDS) in homeowner wells shown in Figure 19 over the course of this study. (TDS values are calculated from specific conductance values measured in the field.)

The operator specific conductance and TDS values were also lower than their reported pre-drill (April 29, 2011) values of 1780 µS/cm and 842 mg/L. Appendix A (Table A-27) of this report indicates that performance checks conducted in this study for specific conductance at the beginning of the day, mid-day, and at the end of the day on October 27, 2011—when split samples were collected from NEPAGW08—consistently met performance check criteria.

Bromide, another potential indicator of hydraulic fracturing activity impacts, was detected above the method quantitation limit (1.0 mg/L) at three of the 38 ground water locations sampled in this study and at none of the surface water locations. These three ground water locations (NEPAGW04, NEPAGW08, and NEPAGW17) were also the only locations in the study that exhibited Na-Cl type water. Bromide concentrations in these three wells ranged from 1.88 mg/L in NEPAGW04 to 4.70 mg/L in NEPAGW17. The NWIS database provides no data for bromide while the NURE database provides data for total bromine only (based on neutron activation analysis). Davis et al. (1998) report that total bromine concentrations in ground water (as measured by neutron activation analysis) can essentially be considered equivalent to bromide concentrations—since virtually all bromine in ground water can be expected to exist as the monovalent anion (i.e., bromide). A theoretical mixing curve with one end member based on the median chloride and bromine (bromide) concentrations from the Bradford County NURE dataset and the other end member based on the median chloride and bromide concentrations for Marcellus Shale flowback water from Haluszczak et al. (2013) is provided in Figure 22. NEPAGW04, NEPAGW08, and NEPAGW17 all fall near the mixing curve but, as can be observed, so does the naturally occurring spring water from Salt Spring State Park. This indicates—consistent with the findings of Llewellyn (2014) and Lautz et al. (2014)—that use of Cl/Br ratio data to evaluate potential impacts on ground water has limitations in this particular study area since it cannot alone be used to distinguish between naturally occurring water and potentially impacted water.

6.2.3. Barium and Strontium

Hayes (2009) reports median barium and strontium concentrations of 686 mg/L and 1,080 mg/L, respectively, for 5-day flowback water from 19 Marcellus Shale gas wells in Pennsylvania and West Virginia. This compares to median recoverable barium and strontium concentrations of 0.050 mg/L and 0.160 mg/L, respectively, reported for 62 Bradford County ground water locations in the NWIS database (see Table 4). Barbot et al. (2013) report mean barium and strontium concentrations of 2,224 mg/L and 1,695 mg/L, respectively for over 150 Marcellus Shale produced water samples in Pennsylvania. This compares to calculated mean recoverable barium and strontium concentrations for the Bradford County NWIS dataset of 2.15 mg/L and 1.78 mg/L, respectively (Table 4). Figure 23 shows box-and-whisker plots comparing the distribution of barium (total and dissolved) and strontium (total and dissolved) from this study with the distribution of recoverable barium and strontium from the NWIS dataset. (The NWIS database does not contain dissolved or total barium and strontium data for Bradford County.) The plots (and Table 4) indicate the 25th percentile, median, and 75th percentile dissolved and total barium and strontium concentrations from this study are higher than those for recoverable barium and recoverable strontium concentrations from the NWIS dataset. In contrast, the mean dissolved and total barium and strontium concentrations from this study are lower than those of the NWIS dataset, although for strontium, only slightly lower. The contrasting differences between the medians and means for the datasets are attributed to very high strontium and barium concentrations reported at two Bradford County locations in the NWIS dataset.

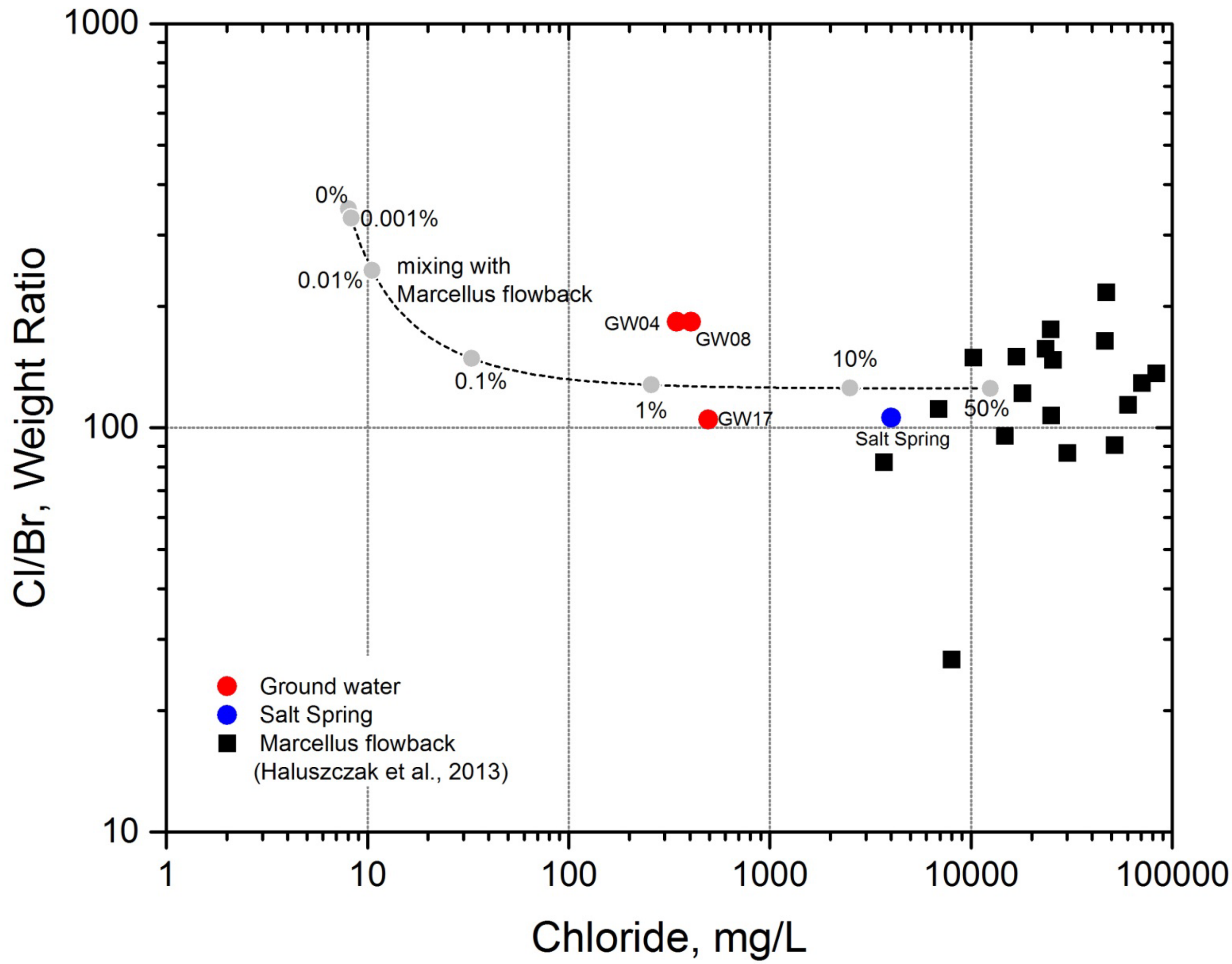
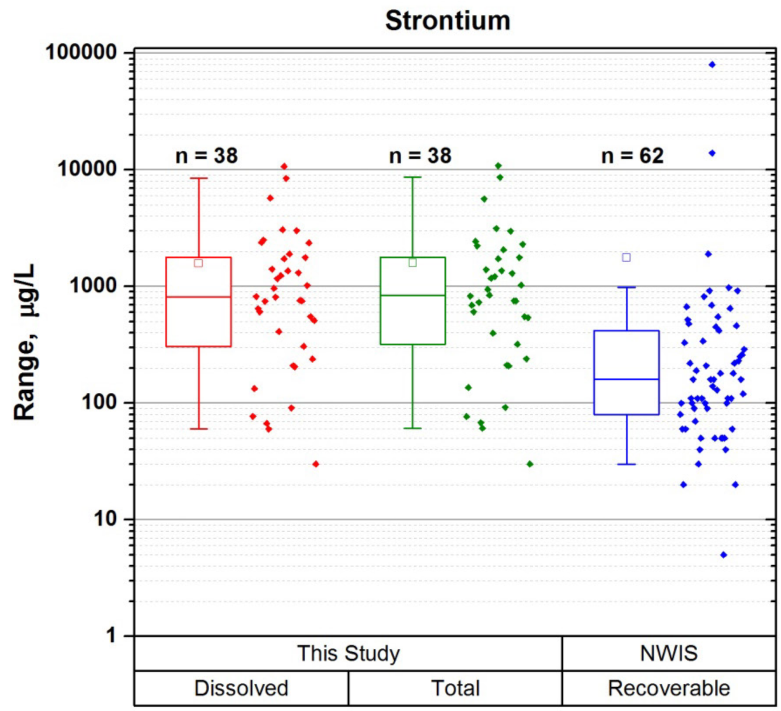


Figure 22. Theoretical mixing curve with end members based on NURE (1977) and Haluszczak et al. (2013) flowback median Cl and Br concentrations. Bradford County NURE Cl and Br medians are 8.05 mg/L (n=164) and 0.0231 mg/L (n=112), respectively. (NURE Br data are for bromine analyzed by neutron activation analysis.) Sample locations shown from this study are only those with bromide concentrations detected above the quantitation limit.



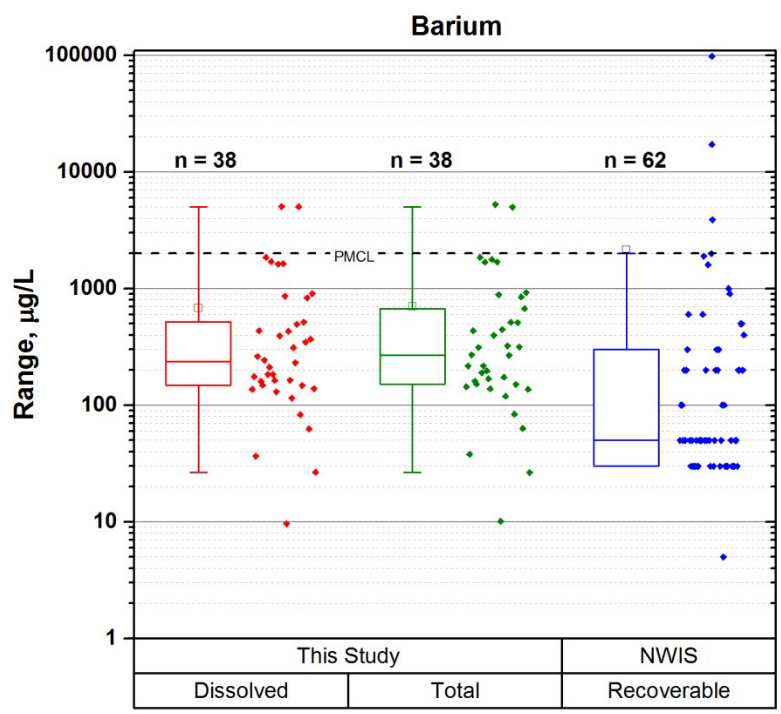


Figure 23. Box and whisker plots comparing total and dissolved barium and strontium distributions (5th, 25th, median, 75th, and 95th percentiles) from this study with recoverable barium and strontium distributions from the pre-2007 NWIS dataset for Bradford County**.** (Note: No dissolved or total barium or strontium data are reported in the NWIS database; data for locations sampled in more than one round are averaged.)

Goodness-of-fit testing at the 0.05 significance level for recoverable barium from the NWIS dataset and total barium from this study indicate data from this study are log normally distributed, while the data from the NWIS dataset are not normally, log-normally, or gamma-normally distributed. Nonparametric Kruskal-Wallis analysis of variance conducted on the data from this study and the NWIS dataset indicated a significant difference (p-value of 5.53E-04) between the datasets (Appendix F). The results indicate the total barium data from locations sampled in this study represent a population of samples with significantly higher total barium concentrations than that of the recoverable barium sample population represented by the NWIS dataset.

Since Na-Cl and Na-HCO_3 water types in this study were generally observed to exhibit the higher barium and strontium concentrations relative to the other water types, and since there was a larger proportion of Na-Cl and Na-HCO_3 water types in this study (10/38) than in the NWIS dataset (12/62), it was possible that uneven representation of these water types in the two datasets could have accounted for the observed difference. To test this possibility, barium concentrations in only the Na-Cl and Na-HCO_3 water types for the two datasets were compared. Goodness-of-fit testing at the 0.05 significance level for recoverable barium from Na-Cl and Na-HCO_3 water types in the NWIS dataset and total barium from Na-Cl and Na-HCO_3 water types in this study indicated the log-transformed data from both reduced datasets were normally distributed. Subsequent parametric analysis of variance returned a p-value of 0.358 (Appendix F), indicating no significant difference between the datasets when evaluated on the basis of the two water types.

Goodness-of-fit testing at the 0.05 significance level for recoverable strontium from the NWIS dataset and total strontium from this study indicated both the log-transformed NWIS dataset and the log-transformed data from this study are normally distributed. Parametric analysis of variance on the log-transformed data indicated significant differences (p-value of 7.32E-06) between the two datasets. The results indicate the total strontium data from this study represent a population of samples with significantly higher total strontium concentrations than that of the recoverable strontium sample population represented by the NWIS dataset.

As in the case of barium, Na-Cl and Na-HCO_3 water types in this study were observed to exhibit generally higher strontium concentrations than the other water types, and it was possible that uneven representation of these water types in the two datasets could have accounted for the observed difference. To test this possibility, strontium concentrations in only the Na-Cl and Na-HCO_3 water types for the two datasets were compared. Goodness-of-fit testing at the 0.05 significance level for recoverable strontium from Na-Cl and Na-HCO_3 water types in the NWIS dataset and total strontium from Na-Cl and Na-HCO_3 water types in this study indicated the log-transformed data from both reduced datasets were normally distributed. Subsequent parametric analysis of variance on the log-transformed data returned a p-value of 0.063 indicating no significant difference at the 0.05 significance level (Appendix F).

Increases in strontium and barium concentrations in ground water impacted by hydraulic fracturing fluids (e.g., flowback or produced waters) should coincide with increases in chloride, sodium, and TDS concentrations, since strontium and barium concentrations tend to be positively correlated with salinity in Marcellus wastewaters (Vengosh et al., 2014). There is no basis for barium and strontium preferentially reaching a homeowner well relative to more mobile constituents such as chloride and sodium which are also present at much higher concentrations in hydraulic fracturing wastewaters. As noted earlier, statistical analyses did not indicate any significant differences between the data from this study and the NWIS dataset with respect to chloride, sodium, and specific conductance. The very high concentrations of barium and strontium that can occur naturally in the study area are evidenced in Table 7. Table 7 shows data from a domestic well in a valley setting located within 1500 ft of NEPAGW08 (see Appendix E, Figure E-2) with reported pre-2007 barium and strontium concentrations of 98.0 mg/L and 80.0 mg/L, respectively and spring water from Salt Spring State Park exhibiting barium and strontium concentrations of 84.4 mg/L and 48.5 mg/L, respectively. These concentrations are much higher than any barium and strontium concentrations detected in this study. Dissolved barium and strontium concentrations in ground water in the study area are likely controlled by minerals including barite ($BaSO_4$) and celestite [$SrSO_4$] (Williams et al., 1998).

6.2.4. Radionuclides

Concentrations of radionuclides, including radium-226 and radium-228, can be high in Marcellus wastewaters and have been reported as high as 6,540 pCi/L for combined radium-226 and radium-228 in Marcellus Shale flowback water (Haluszczak et al., 2013). Barbot et al. (2013) report mean radium-226 and radium-228 concentrations for 46 Marcellus Shale-produced water samples in Pennsylvania of 623 pCi/L and 120 pCi/L, respectively with a maximum reported radium-226 concentration of 9,280 pCi/L and maximum reported radium-228 concentration of 1,360 pCi/L. Water samples collected in this study were analyzed for radium-226, radium-228, gross alpha activity, and gross beta activity in the second and third rounds of sampling. The results indicated radium-226, radium-228, gross alpha activity, and/or gross beta activity were detected above the study reporting limits at 7 of the 27 locations sampled for these parameters. The highest radium-226 and radium-228 concentrations were detected at NEPAGW04 at concentrations of 4.40 ± 1.3 pCi/L and 2.88 ± 0.73 pCi/L, respectively (combined = 7.28 pCi/L). For comparison, the combined radium-226 and radium-228 concentration in spring water from Salt Spring State Park (Table 7) has been measured at 27.7 pCi/L (Warner et al., 2012). Williams et al. (1998) reported radium-226 and radium-228 concentrations of 17 pCi/L and 13 pCi/L (combined = 30 pCi/L) measured in a domestic well sampled in neighboring Tioga County in 1986. The highest gross alpha activity in this study was also measured at NEPAGW04 at a concentration of 6.1 ± 2.2 pCi/L, while the highest gross beta activity was detected at NEPAGW17 at a concentration of 7.4 ± 2.8 pCi/L. Barbot et al. (2013) report mean gross alpha and gross beta concentrations for 32 Marcellus Shale-produced water samples from northeastern Pennsylvania of 1,509 pCi/L and 43,415 pCi/L, respectively.

The results from this study indicate primary MCLs were exceeded at two locations—NEPAGW04 and NEPAGW17—where combined radium-226 and radium-228 exceeded the primary MCL of 5 pCi/L (see Table 7). As in the case of Salt Spring State Park, both of these wells are located in valley settings characterized by Na-Cl type water and high TDS. Also, as in the case of strontium and barium, radium concentrations are known to correlate positively with salinity in ground water in the study area (Williams et al., 1998). Spring water collected at Salt Spring State Park (Table 7), for example, showed chloride and sodium concentrations of 4,014 mg/L and 1,800 mg/L, respectively while the well in neighboring Tioga County with the combined radium-226 and radium-228 concentration of 30 pCi/L showed dissolved chloride and sodium concentrations of 4,600 mg/L and 2,500 mg/L, respectively (Williams et al., 1998). The highest radium-226 concentration detected in a non-Na-Cl type water in this study was 2.70 ± 0.89 pCi/L at NEPAGW26 which exhibits Ca-HCO_3 type water. Radium-226 was also

Table 7. Valley locations with Na-Cl type water from this study compared to nearby valley locations from NWIS database exhibiting Na-Cl type water. The two USGS wells shown are reported to be completed at depths of 110 feet and 117 feet (http://nwis.waterdata.usgs.gov).

	TDS (mg/L)	Cl (mg/L)	Br (mg/L)	Cl/Br (w/w)	Na (mg/L)	Sr (mg/L)	Ba (mg/L)	Li (mg/L)	B (mg/L)	$^{226}Ra + ^{228}Ra$ (pCi/L)
NEPAGW08	1037	383	2.20	174	286	1.90	1.62	0.440	0.319	<2.00
USGS-414451076182001* *(1,464 ft from NEPAGW08)*	7650	4275	–	–	2255	80.0	98.0	–	–	–
NEPAGW17	1259	510	4.70	108	289	5.74	5.03	0.444	0.242	6.38
USGS-414330076280501* *(7,885 ft from NEPAGW17)*	580	168	–	–	210	–	–	–	–	–
NEPAGW04	1013	362	1.88	192	227	8.46	5.06	0.557	0.257	7.28
Williams et al. (1998) identified Na-Cl wells in Bradford County [median/mean]	803/1,555 (n=9)	348/714 (n=10)	–	–	249/431 (n=10)	1.10/12.6 (n=8)	1.32/15.0 (n=7)	–	–	–
Salt Spring State Park (Warner et al. 2012)	6418	4014	37.9	106	1800	48.5	84.4	4.34	–	27.7

* For sample location, see Figure E-2, Appendix E. Values are averaged for locations sampled more than once.

detected above the study reporting limit of 1 pCi/L at NEPAGW16 (high of 1.31 ± 0.50 pCi/L) and at NEPAGW33 (high of 2.07 ± 0.66 pCi/L), both of which exhibit Na-HCO_3type water. Radium-228 was not detected above the study reporting limit of 1 pCi/L at any non-Na-Cl well location. There is no evidence to indicate that radium-226, radium-228, and/or alpha and beta activity detected at locations in the study are inconsistent with location-specific natural background conditions.

6.2.5. Strontium Isotopes

Strontium (Sr) isotope analyses were also conducted on all samples collected in the study. $^{87}Sr/^{86}Sr$ ratios fall within a unique range in Marcellus Shale flowback and produced water and thus can be sensitive indicators of potential impacts (Chapman et al., 2012). Chapman et al. (2012) indicate mixing of as little as 1% Marcellus Shale-produced water with a receiving water would result in a $^{87}Sr/^{86}Sr$ signature dominated by the produced water. $^{87}Sr/^{86}Sr$ ratios for Marcellus Shale-produced water are reported to fall between 0.71000 and 0.71212, in contrast to the higher $^{87}Sr/^{86}Sr$ ratios associated with water produced from formations above the Marcellus Shale (Warner et al., 2012). Chapman et al. (2012) evaluated five Marcellus Shale-produced waters from Bradford County and observed they exhibited $^{87}Sr/^{86}Sr$ ratios in a narrower range between 0.71000 and 0.71080. Samples from five homeowner wells (NEPAGW01, NEPAGW02, NEPAGW03, NEPAGW08, and NEPAGW30) and one spring (NEPASW01) in the study exhibited $^{87}Sr/^{86}Sr$ ratios within the 0.71000 to 0.71212 range identified by Warner et al. (2012) and three homeowner wells (NEPAGW01, NEPAGW02, and NEPAGW03) exhibited $^{87}Sr/^{86}Sr$ ratios within the more narrow 0.71000 to 0.71080 range reported by Chapman et al. (2012) for Marcellus Shale-produced water in Bradford County (see Figure 24). Each of the samples, with the exception of spring sample NEPASW01, also exhibited Sr/Ca ratios above 0.03, which Warner et al. (2012) have indicated is also characteristic of Marcellus Shale-produced water. However, Warner et al. (2012) also show that background shallow ground water in northeastern Pennsylvania (designated in their study as “Type D” water) at locations far removed from hydraulic fracturing activities can, in certain settings (e.g., valley settings), also exhibit the same low $^{87}Sr/^{86}Sr$ ratios with Sr/Ca ratios above 0.03. Data reported by Warner et al. (2012) for spring water collected from Salt Spring State Park, for example, indicated a $^{87}Sr/^{86}Sr$ ratio of 0.71115 (Figure 24) and Sr/Ca ratio of 0.13. $^{87}Sr/^{86}Sr$ ratio data provided by Warner et al. (2012) for over 100 drinking water wells in northeastern Pennsylvania also show some wells with $^{87}Sr/^{86}Sr$ ratios in the more narrow range (0.71000 to 0.71080) reported by Chapman et al. (2012) for Bradford County produced water. Thus, the usefulness of $^{87}Sr/^{86}Sr$ ratios for evaluating potential impacts on ground water in this particular study area appears to be somewhat limited. However, as will be noted in a later section of this report, $^{87}Sr/^{86}Sr$ ratios (for surface water samples NEPASW03 and NEPASW04) were used as a potential line of evidence for evaluating impacts to the homeowner pond investigated in this study.

Well locations NEPAGW01, NEPAGW02, and NEPAGW03 that fall within the $^{87}Sr/^{86}Sr$ range reported by Chapman et al. (2012) for the five Marcellus Shale-produced waters in Bradford County also exhibited chloride concentrations above the median values for the NURE dataset (8.05 mg/L), the NWIS dataset (10.0 mg/L), and this study (8.59 mg/L) at concentrations ranging from 14.0 mg/L to 53.1 mg/L. Although these chloride concentrations coupled with the $^{87}Sr/^{86}Sr$ ratios might suggest impacts to the homeowner wells, the chloride and TDS trend plots shown in Figures 19 and 21 for these well locations indicate chloride and TDS concentrations were relatively stable over the 1.5 year span of the study—a pattern that would generally be more consistent with a natural background condition. Both NEPAGW01 and NEPAGW02 are Na-HCO_3 type waters and exhibited average chloride concentrations over the three

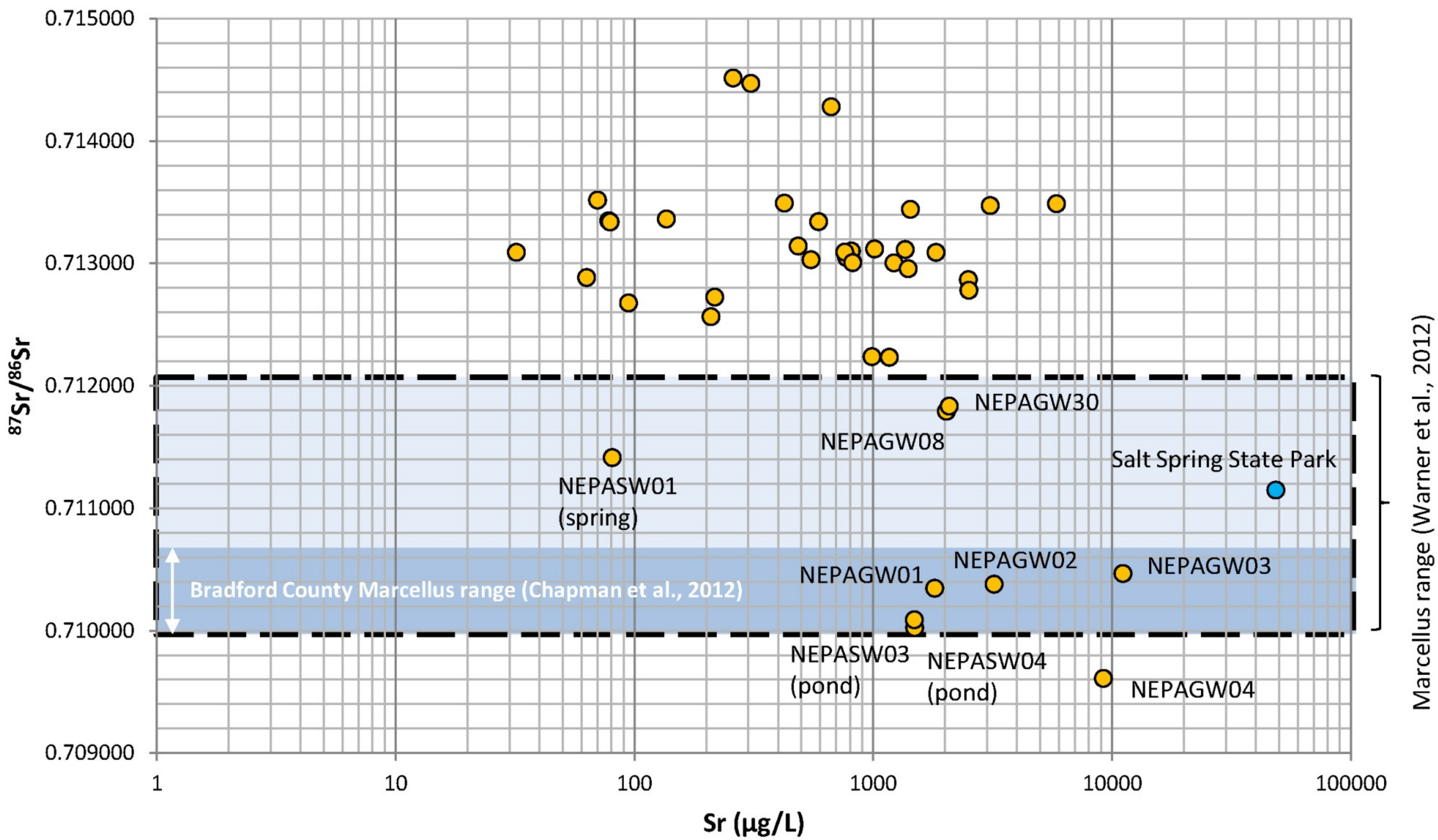


Figure 24. Strontium isotope data versus strontium concentrations for locations sampled in this study. Data for locations sampled in more than one round are averaged. (Salt Spring State Park data from Warner et al., 2012)

sampling rounds of 50.4 mg/L and 23.0 mg/L, respectively. An operator sample collected from NEPAGW01 approximately 7 months prior to initiation of this study indicated a chloride concentration of 45 mg/L. The median and 75th percentile values for chloride for the 15 Na-HCO_3 type ground water locations in the pre-2007 NWIS Bradford County dataset are 28.0 mg/L and 42.5 mg/L, respectively with two of the Na-HCO_3 locations in the dataset showing chloride concentrations above 120 mg/L. Thus, elevated chloride concentrations in Na-HCO_3 type waters would not be anomalous for the study area. NEPAGW16 and NEPAGW33, two other homeowner wells with Na-HCO_3 type water in this study, were observed to exhibit average chloride concentrations of 61.2 mg/L and 28.1 mg/L, respectively over the three rounds of sampling. It is also noteworthy that radium-226 and radium-228 were not detected above the study reporting limits of 1 pCi/L in any of the three wells nor were any indicator organic compounds associated with hydraulic fracturing detected. The $^{87}Sr/^{86}Sr$ ratios at each of the three well locations also did not vary significantly over the three rounds of sampling with values ranging from 0.710334 (in round 2) to 0.710362 (in round 1) at NEPAGW01; from 0.710364 (in round 1) to 0.710394 (in round 2) at NEPAGW02; and from 0.710451 (in round 3) to 0.710498 (in round 2) at NEPAGW03. Given the aforementioned observations, there is no basis for concluding that NEPAGW01 or NEPAGW02 have been impacted by Marcellus Shale flowback/produced water. The third location—NEPAGW03—the only Ca-SO_4 type ground water location in this study, showed an average chloride concentration of 19.4 mg/L over the three rounds of sampling. Only two of the more than 100 water locations in the NWIS dataset for Bradford County exhibited Ca-SO_4 type water with chloride concentrations at these two locations ranging from 4 mg/L to 8 mg/L. NEPAGW03 is further addressed in a subsequent section of this report.

There was no observed relationship between low $^{87}Sr/^{86}Sr$ ratios and water type in this study. Two of the wells with $^{87}Sr/^{86}Sr$ <0.71212 and Sr/Ca >0.03 exhibited Na-HCO_3 type water (NEPAGW01, NEPAGW02), one well exhibited Ca-SO_4 type water (NEPAGW03), one well exhibited Ca-HCO_3 type water (NEPAGW30), and one well exhibited Na-Cl type water (NEPAGW08).

6.2.6. Evaluation of Homeowner Wells with Na-Cl Type Water

Homeowner wells with Na-Cl type water in this study were of interest since any well significantly impacted by flowback/produced water, if not already exhibiting naturally occurring Na-Cl type water, could acquire a Na-Cl type water signature due to the very high Na and Cl content of Marcellus flowback/produced waters. Thus, homeowner wells exhibiting Na-Cl type water could potentially signify impacts from hydraulic fracturing activities. The homeowner wells in this study exhibiting Na-Cl type water (NEPAGW04, NEPAGW08, and NEPAGW17) were each located in stream/river valleys, consistent with the observations of Williams et al. (1998) for locations where Na-Cl type ground water tends to be naturally found in the study area. Chloride and TDS concentrations in the three wells were measured at greater than 300 mg/L and 1,000 mg/L, respectively. A plot of NWIS locations exhibiting Na-Cl-type water, as well as the naturally occurring spring water from Salt Spring State Park, on the Piper diagram in Figure 25 shows the overlap with the three Na-Cl type water locations identified in this study. This is consistent with the Na-Cl type waters observed at the three homeowner locations (NEPAGW04, NEPAGW08, and NEPAGW17) not being anomalous for the study area. Comparison of the cation-anion distribution of the Na-Cl type water locations in this study with Na-Cl type water locations from the NWIS dataset—and the spring water from Salt Spring State Park—in the Shoeller diagram in Figure 26, also does not provide any indication that the geochemistry in wells NEPAGW04, NEPAGW08, and NEPAGW17 is anomalous for the study area.

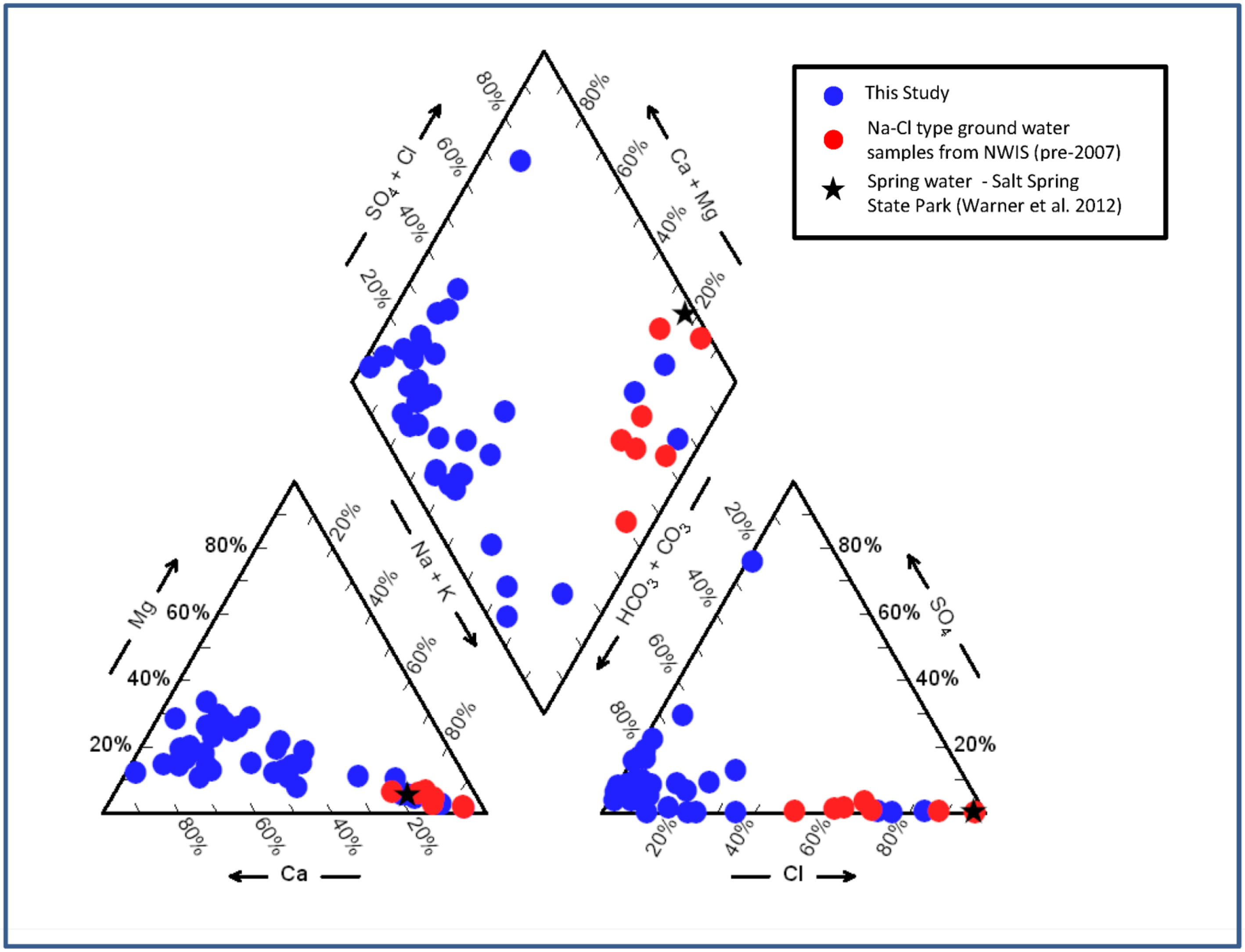


Figure 25. Piper diagram showing overlap of ground water locations with Na-Cl type water from this study with ground water locations with Na-Cl type water from the pre-2007 NWIS dataset for Bradford County. Data is also shown for natural spring water collected at Salt Spring State Park in Susquehanna County (Warner et al., 2012).

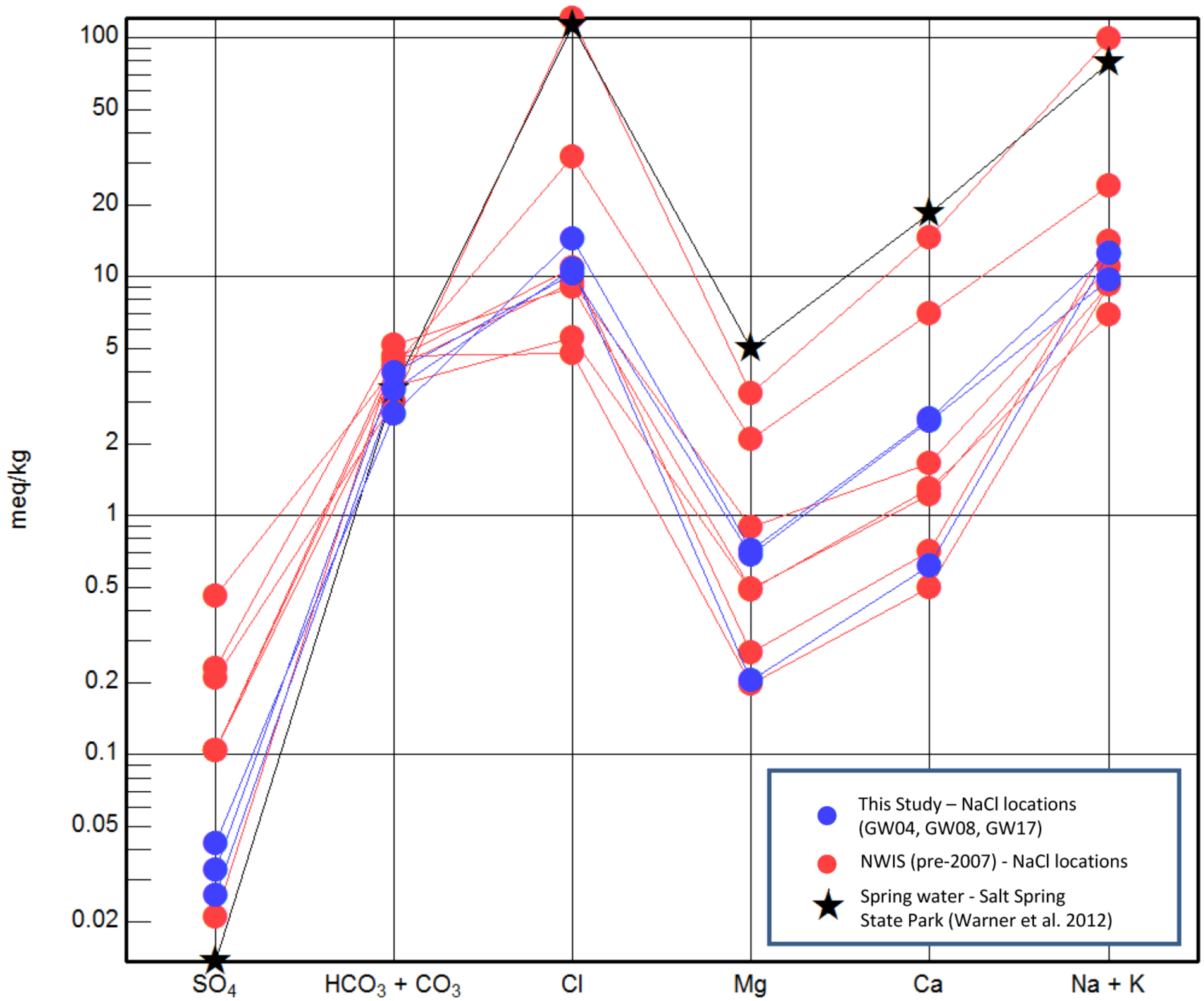


Figure 26. Schoeller diagram showing the chemical composition of ground water locations with Na-Cl type water in this study relative to pre-2007 NWIS locations with Na-Cl type water and spring water from Salt Spring State Park in Susquehanna County (Warner et al., 2012).

At homeowner well locations NEPAGW04 and NEPAGW17, barium and combined radium-226 and radium-228 concentrations exceeded EPA's primary MCL drinking water criteria of 2.0 mg/L and 5 pCi/L, respectively. At homeowner well location NEPAGW08, the mean barium concentration (1.78 mg/L) was slightly below the MCL of 2.0 mg/L, while combined radium-226 and radium-228 concentrations were below the study reporting limits of 1 pCi/L. These three wells also exhibited more elevated methane concentrations (ranging from 14.8 mg/L to 27.6 mg/L) relative to most other sampling locations in this study, as well as reducing conditions as indicated by low ORP values, low DO concentrations, and detectable ferrous iron and/or hydrogen sulfide concentrations. Table 7 provides data for two pre-2007 NWIS database sampling locations with elevated TDS and chloride concentrations that are located in close proximity to NEPAGW08 and NEPAGW17. (The locations of these two wells are shown in Appendix E, Figure E-2.) Also shown in Table 7 are data for Na-Cl type ground water locations in Bradford County as reported by Williams et al. (1998) and data for Salt Spring State Park spring water as reported by Warner et al. (2012). As noted earlier, it has been hypothesized that stream valleys represent zones of weakness, or increased bedrock fracturing, that allowed glacial and weathering processes to down cut preferentially into the bedrock (Breen et al., 2007). The increased fracture density in the stream valleys could thus result in a greater abundance of preferential pathways for the flow of natural gas from depth to the surface. Warner et al. (2012) have speculated that some shallow ground water systems near valley centers in northeastern Pennsylvania with geochemical signatures similar to produced water from the Marcellus Formation (Cl >20 mg/L, Cl/Br <1000, Cl/Na >0.2) are indicative of a pre-existing network of cross-formational pathways that has enhanced hydraulic connectivity to deeper formations. The three homeowner wells in Bradford County with Na-Cl type water in this study (NEPAGW04, NEPAGW08, and NEPAGW17) exhibit these geochemical signatures with respect to Cl, Cl/Br, and Cl/Na. Cl/Br ratios in the three wells ranged from 105 to 182, Cl/Na ratios from 1.38 to 1.71, and chloride concentrations from 335 mg/L to 525 mg/L. The lower Cl/Br ratios relative to the Cl/Br ratios of >1000 (generally characteristic of road salt [halite] impacts) are consistent with the Na-Cl in the three homeowner wells having originated from highly evaporated seawater beyond the point of halite precipitation, as has been postulated for formation brines in Pennsylvania, including those originating from the Marcellus Formation (Haluszczak et al., 2013). For comparison, the median Cl/Br ratio of flowback water reported by Haluszczak et al. (2013) for Marcellus Formation gas wells in the Dimock area of Susquehanna County was 125.2 and the Cl/Br ratio for the naturally occurring spring water at Salt Spring State Park (Susquehanna County) is reported to be 106 (Warner et. al., 2012). The low Cl/Br ratio (<1000) as observed in the naturally occurring spring water at Salt Spring State Park indicate Cl/Br ratios need to be used with caution as potential indicators of hydraulic fracturing impacts in the study area—as supported by the findings of others (Llewellyn, 2014; Lautz et al., 2014).

In the case of NEPAGW17, hydraulic fracturing had been conducted on a well pad within approximately 4,000 feet of the homeowner well about 20 months prior to the first round of sampling, and three gas wells had also been drilled (but not yet fractured) on another pad located within approximately 3,500 feet of the homeowner well 14 to 16 months prior to the first round of sampling (see Figure 27). Although the elevated concentrations of barium, chloride, TDS, and radium in NEPAGW17 could suggest an impact, gas isotope data and methane-to-ethane ratio data from this well are not consistent with that of Marcellus Shale gas, as will be addressed later in this report. This is of significance because if a pathway for hydraulic fracturing fluids and produced water to the homeowner well had, in fact, been

NEPAGW17 (Spring 2012)	
Cl	495
Na	290
Ba	4.90
TDS	1262
Ra-226/228	6.38 pCi/L
Li	0.444
Br	4.70
methane (CH_4)	24.6
CH_4/C_2H_6	845
$\delta^{13}C_{CH4}$	-46.46 ‰
$\delta^{2}H_{CH4}$	-202.3 ‰
$\delta^{13}C_{C2H6}$	-38.2 ‰

NEPAGW16 (Spring 2012)	
Cl	53.2
Na	40.4
Ba	1.61
TDS	317
Ra-226/228	1.09 pCi/L
Li	0.073
Br	0.40
methane (CH_4)	8.19
CH_4/C_2H_6	75.1
$\delta^{13}C_{CH4}$	-39.41 ‰
$\delta^{2}H_{CH4}$	-170.4 ‰
$\delta^{13}C_{C2H6}$	-37.7 ‰

Units mg/L unless otherwise noted; CH_4/C_2H_6 no units

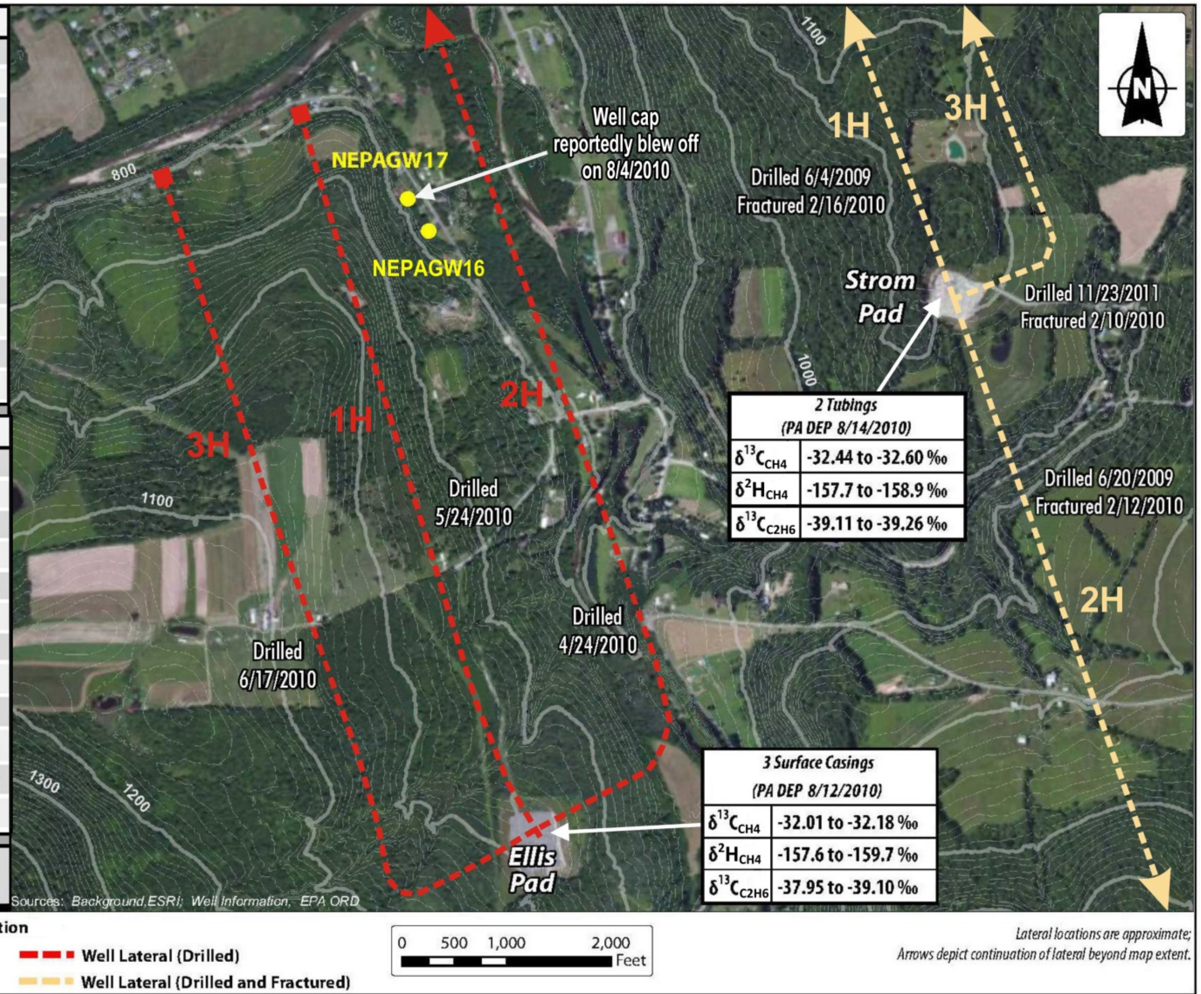


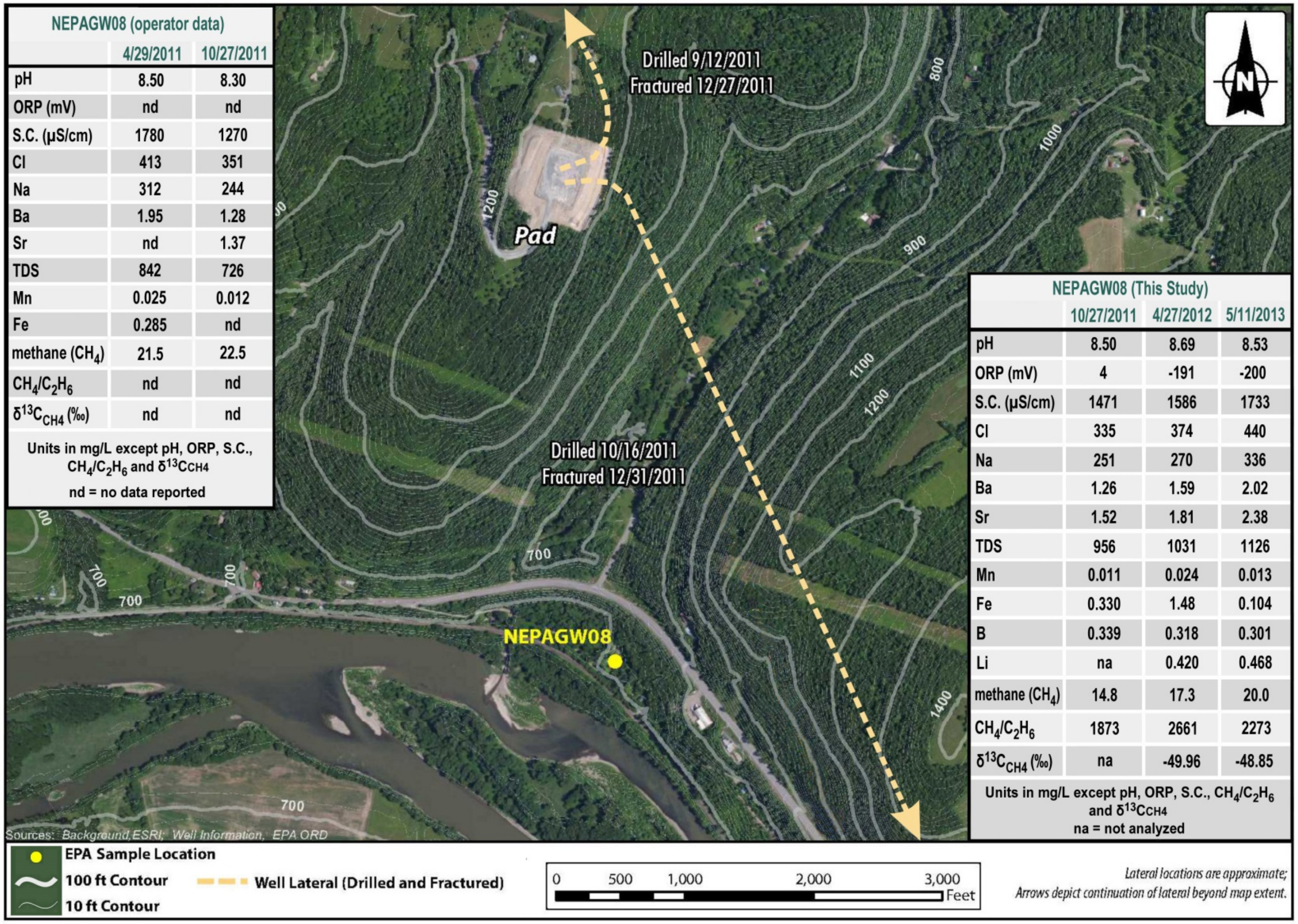
Figure 27. Location of Bradford County homeowner well NEPAGW17 where reported gas intrusion occurred on August 4, 2010. Data show PA DEP gas isotope signatures for surface casings and production tubings on well pads near homeowner wells NEPAGW17 and NEPAGW16 relative to signatures observed in homeowner wells. Data also show differences in water chemistry between the two homeowner wells reportedly completed at similar depths (85 ft vs 100 ft) and located only a few hundred feet from one another. Drill/fracture dates from Chesapeake Energy (2/12/2012).

created as a result of the hydraulic fracturing (stimulation) process, then this pathway would likely also have readily allowed for the migration of methane from the Marcellus Shale into the homeowner well.

Another homeowner well sampled in the study (NEPAGW16) is located within 300 feet of NEPAGW17 (see Figure 27) and, according to the homeowner, differs in depth by only 14 feet (100 ft depth for NEPAGW17 versus 86 ft depth for NEPAGW16). However, data obtained from these two wells show significant differences in water chemistry. NEPAGW16 exhibits significantly lower average concentrations of TDS (326 mg/L vs. 1,260 mg/L for NEPAGW17) and chloride (61.2 mg/L vs. 510 mg/L for NEPAGW17) and no primary MCL exceedances for barium and combined radium. In addition, NEPAGW16 plots as a Na-HCO_3 type water rather than a Na-Cl type water (see Figure 12). This would appear to attest to the significant differences in water quality that can occur over short increments of distance and depth within the study area. It is possible that NEPAGW17, with its reported greater depth, accesses shallow saline waters to a greater extent in this valley setting than does NEPAGW16. The significant differences in geochemistry between the two locations were observed in the two rounds they were both sampled (see Figures 19 and 21).

Gas wells on well pads located within 1 mile of homeowner locations NEPAGW04 and NEPAGW08 had only been drilled but not yet hydraulically fractured when the first round of sampling was conducted in fall 2011. Thus, the saline conditions observed in these two homeowner wells cannot be attributed to the hydraulic fracturing (stimulation) process. Operator data collected from NEPAGW08 prior to initiation of drilling on the nearby well pad indicated that ground water in this homeowner well was already in a saline condition—thus also precluding drilling as the cause of the saline conditions at this particular well location (see Figure 28). Pre-drill data were not available for NEPAGW04.

Approximately two months after the first round of sampling, hydraulic fracturing (stimulation) was conducted on a well pad located approximately 4,000 feet from homeowner well NEPAGW08 (Figure 28). The lateral from this gas well passes areally within a radius of approximately 1,200 feet from the homeowner well. NEPAGW08, with a homeowner-reported depth of 260 feet, would thus appear to serve as a well-specific case study for pre- and post-hydraulic fracturing effects on ground water in this river valley location. Data collected from NEPAGW08 over the three rounds of sampling do appear to show a potentially increasing trend with respect to concentrations of some selected inorganic constituents following hydraulic fracturing (see Figure 28). However, when this location was sampled by the operator in April 2011 (i.e., approximately six months prior to the first round of sampling conducted in this study), chloride, sodium, and barium concentrations were measured at concentrations between those observed in the second and third rounds of this study (see Figure 28). As noted earlier, this calls into question the presence of actual increasing trends at this location and suggests the data may fall within the range of variability for high TDS waters in the study area. Warner et al. (2014) report that lithium to chloride (Li/Cl) ratios <0.002 and boron to chloride (B/Cl) ratios <0.001—as observed for samples collected from NEPAGW08 in the second and third rounds of this study (see data table in Figure 28)—would be inconsistent with impacts from Marcellus Shale flowback/produced water. As discussed in a subsequent section of this report, methane isotope signatures ($\delta^{13}C_{CH4}$) and methane-to-ethane ratios for this homeowner well (as in the case of NEPAGW17) are also not consistent with a pathway for migration of Marcellus Shale gas and fluids to the well having been created.



NEPAGW08 (operator data)

	4/29/2011	10/27/2011
pH	8.50	8.30
ORP (mV)	nd	nd
S.C. (µS/cm)	1780	1270
Cl	413	351
Na	312	244
Ba	1.95	1.28
Sr	nd	1.37
TDS	842	726
Mn	0.025	0.012
Fe	0.285	nd
methane (CH_4)	21.5	22.5
CH_4/C_2H_6	nd	nd
$\delta^{13}C_{CH4}$ (‰)	nd	nd

Units in mg/L except pH, ORP, S.C., CH_4/C_2H_6 and $\delta^{13}C_{CH4}$
nd = no data reported

NEPAGW08 (This Study)

	10/27/2011	4/27/2012	5/11/2013
pH	8.50	8.69	8.53
ORP (mV)	4	-191	-200
S.C. (µS/cm)	1471	1586	1733
Cl	335	374	440
Na	251	270	336
Ba	1.26	1.59	2.02
Sr	1.52	1.81	2.38
TDS	956	1031	1126
Mn	0.011	0.024	0.013
Fe	0.330	1.48	0.104
B	0.339	0.318	0.301
Li	na	0.420	0.468
methane (CH_4)	14.8	17.3	20.0
CH_4/C_2H_6	1873	2661	2273
$\delta^{13}C_{CH4}$ (‰)	na	-49.96	-48.85

Units in mg/L except pH, ORP, S.C., CH_4/C_2H_6 and $\delta^{13}C_{CH4}$
na = not analyzed

Figure 28. Bradford County homeowner well located in valley setting with pre- and post-hydraulic fracturing data. Pre-drill operator data show already elevated concentrations of methane and inorganic parameters at this location. Post-drill and post-fracturing data (this study) show CH_4/C_2H_6 ratios >1800 and $\delta^{13}C_{CH4}$ values <-48.0‰ inconsistent with Marcellus Shale gas characteristics. Data from sampling conducted on 10/27/2011 in this study and by operator (with exception of methane data) are from split samples. Drill/fracture dates from Chesapeake Energy (2/12/2012).

6.2.7. Evaluation of Homeowner Well with Ca-SO_4 Type Water

One homeowner well (NEPAGW03) was observed to exhibit a seemingly anomalous high sulfate concentration (>1,200 mg/L) and correspondingly high TDS concentration (average 1,639 mg/L). The sulfate concentration measured in this well is significantly higher than the maximum sulfate concentration of 250 mg/L reported in the NWIS dataset for 121 ground water locations sampled for sulfate in Bradford County (Table 4). This well is not located in a stream valley, nor does it exhibit Na-Cl-type water or elevated methane concentrations. The well exhibits Ca-SO_4 type water and is located within a few hundred feet of a well pad (Vannoy) where one or more fluid and/or solid releases, including 420 gallons of hydrochloric acid, reportedly occurred in spring 2009 (see Appendix C).

Geochemical equilibrium modeling suggests the water from the homeowner well is at or near saturation with respect to gypsum ($CaSO_4$). The relatively consistent concentrations of sulfate (1,200 mg/L, 1,260 mg/L, and 1,230 mg/L) measured in the three rounds of sampling conducted at the homeowner well over the 1.5-year span of the study (Figure 29) appear to be more consistent with a mineral dissolution/equilibrium scenario in the subsurface rather than a transient plume migration scenario. In addition, high sulfate concentrations would normally not be expected to originate from hydraulic fracturing activities. Hayes (2009) reported a sulfate concentration range in 5-day Marcellus Shale flowback water of only 2.4 to 106 mg/L at 19 gas well locations in Pennsylvania and West Virginia and <10 mg/L to 89.3 mg/L in 14-day flowback water at 17 locations—although sulfate concentrations in injection fluids were reported to range from 2.9 mg/L to 2,920 mg/L. A possible alternative source of sulfate in the well water at NEPAGW03 could be natural oxidation of sulfide minerals occurring at depth around the well.

NEPAGW03 also exhibited the highest strontium concentrations (mean = 10.7 mg/L), the highest alkalinity (mean = 380 mg/L as $CaCO_3$), and the highest average ferrous iron content (mean = 0.68 mg/L) of all homeowner wells and springs sampled in this study. The pH in the well was consistently between 6.8 and 6.9 over the three sampling rounds. The chloride concentrations in the three rounds of sampling conducted at this location were 14.0 mg/L, 23.5 mg/L, and 20.7 mg/L (Figure 29). The average chloride concentration in the well (19.4 mg/L) was above the median concentrations for this study and the NWIS and NURE datasets (Table 4), but below the 75th percentile values for both this study and the NWIS dataset, and below the 90th percentile value for the NURE dataset. As noted earlier, this well also exhibited $^{87}Sr/^{86}Sr$ ratios consistent with $^{87}Sr/^{86}Sr$ ratios for Bradford County Marcellus Shale-produced water as observed by Chapman et al. (2012); however, because the chloride concentrations, $^{87}Sr/^{86}Sr$ ratios, and high strontium concentrations observed can also be consistent with naturally occurring ground water conditions in the study area, it cannot be concluded that the well has been impacted by hydraulic fracturing activities. If the high strontium concentrations were originating from hydraulic fracturing flowback/produced water, the chloride concentrations would be expected to be roughly 40 times greater than the strontium concentrations based on median concentrations reported for these two constituents in typical Marcellus wastewater by Boyer et al. (2011). The average chloride concentration at NEPAGW03 was instead less than twice that of the average strontium concentration.

6.2.8. Evaluation of Pond Location on NEPAGW03 Property

Samples were collected at two locations (NEPASW03 and NEPASW04) from the homeowner pond located approximately 300 feet from NEPAGW03 during the second round to evaluate potential links between the pond and the high sulfate concentrations measured at NEPAGW03. The sample results

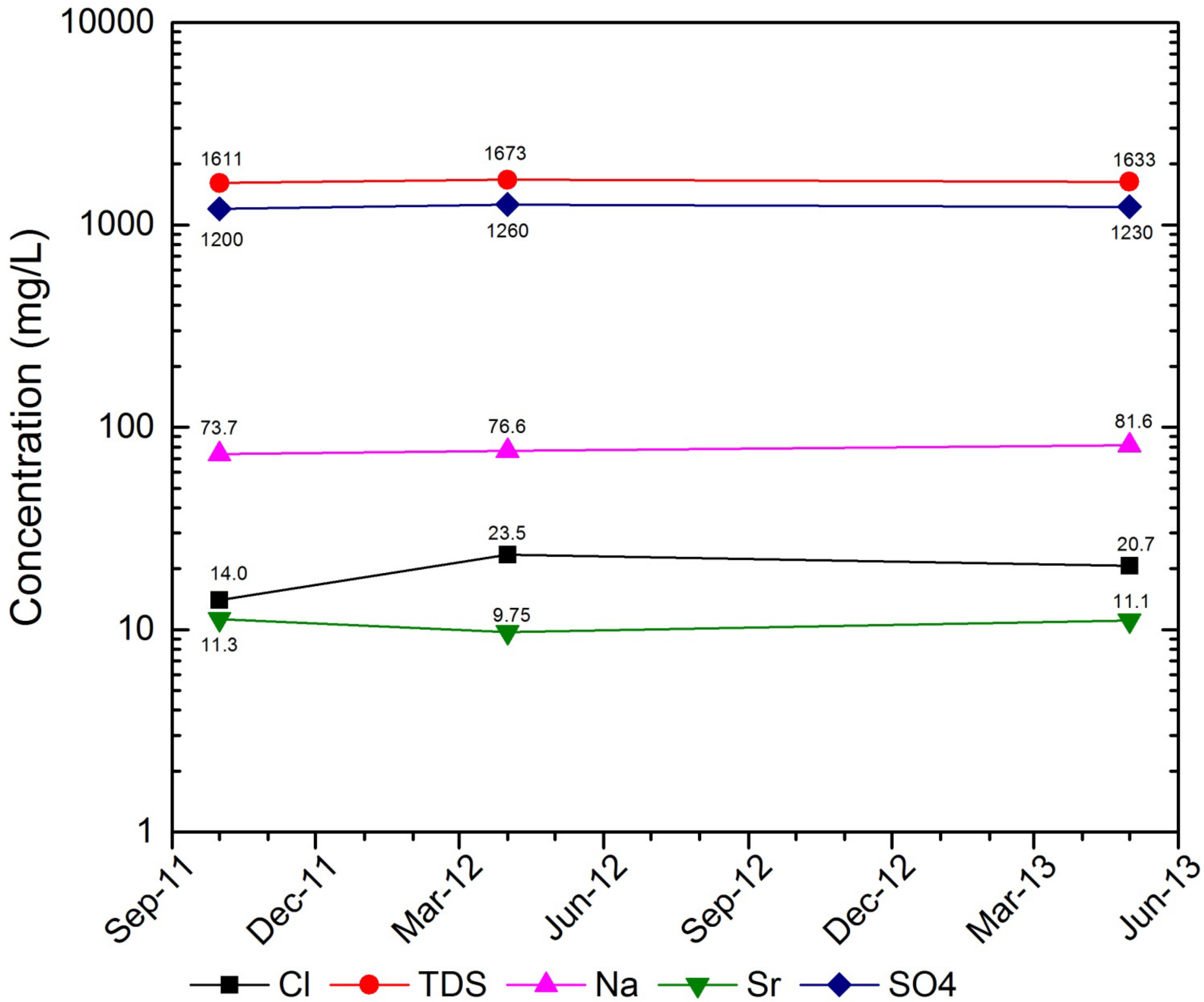


Figure 29. Time trends for selected constituents in homeowner well NEPAGW03 from this study indicating relative consistency over 1.5-year time span of study. (pH values ranged from 6.81 to 6.89 in the three rounds of sampling conducted at this location.)

showed low sulfate concentrations (<20 mg/L) but elevated concentrations of chloride (from 224 mg/L to 230 mg/L), TDS (from 529 mg/L to 563 mg/L), bromide (estimated from 0.61 mg/L to 0.97 mg/L), dissolved strontium (from 1.28 mg/L to 1.30 mg/L), and dissolved barium (from 0.656 mg/L to 0.677 mg/L). The very low alkalinity of the pond samples (≤ 25 mg/L as $CaCO_3$) suggests the pond water is not fed by a subsurface source. The chloride, TDS, and bromide concentrations detected in the pond are higher than normally found in surface waters in northeastern Pennsylvania (Battelle, 2013). For surface water locations sampled in Bradford and Susquehanna counties prior to 2007, Battelle (2013) report mean and median chloride concentrations for 309 sampling locations of 9.6 mg/L and 8.2 mg/L, respectively; mean and median TDS concentrations for 39 sampling locations of 108 mg/L and 99.6 mg/L, respectively; and mean and median bromide concentrations for 203 sampling locations of 0.045 mg/L and 0.013 mg/L, respectively. The chloride concentrations measured in the pond are also approximately 10 times greater than the chloride concentrations measured in the homeowner well (NEPAGW03). Historical surface water data for barium and strontium are not available for comparison with the concentrations measured in the pond. The presence of the elevated levels of TDS, chloride, and bromide in the pond water relative to other surface waters in the study area as reported by Battelle (2013) may reflect impacts from well pad fluid and/or solid releases reported in 2009 (see Appendix C).

The two samples collected from the homeowner pond were also analyzed for strontium isotopes and showed $^{87}Sr/^{86}Sr$ ratios of 0.710026 (for NEPASW03) and 0.710105 and 0.710045 (for NEPASW04 field duplicates). These values fall within the Bradford County Marcellus Shale-produced water range (see Figure 24) as reported by Chapman et al. (2012) and may possibly provide a further line of evidence for impacts on the pond. For comparison, $^{87}Sr/^{86}Sr$ ratios for the other surface waters (two stream samples) collected in this study in Bradford County were >0.713300. These values are much higher than the pond $^{87}Sr/^{86}Sr$ ratios and well outside the Marcellus Shale-produced water range as reported by Chapman et al. (2012) and Warner et al. (2012).

6.3. Organic Compounds

Several organic compounds were detected in water samples collected during the three rounds of sampling. The results are presented in Table 8. 1,2,4-trimethylbenzene was detected in two of the three sampling rounds at one of two springs sampled (NEPASW01). At this location, 1,2,4-trimethylbenzene was detected below the quantitation limit (0.5 µg/L) at an estimated concentration of 0.38 µg/L during the first sampling round (October 2011), and at a concentration of 1.6 µg/L during the third sampling round (May 2013). In addition, 1,2,3-trimethylbenzene was detected at a concentration of 1.1 µg/L at this location during the third sampling event. DROs were also detected at this location at concentrations above the quantitation limit (20 µg/L) in the first sampling round (23.1 µg/L and 25.1 µg/L for field duplicates) while GROs were detected at this location at a concentration of 24.2 µg/L above the quantitation limit (20 µg/L) during the third round of sampling (see Table 8). The samples showing detectable levels of 1,2,4-trimethylbenzene, 1,2,3-trimethylbenzene, DROs, and GROs were collected from a tap in the homeowner's basement connected to the spring. 1,2,4-trimethylbenzene, 1,2,3-trimethylbenzene, DROs, and GROs were not detected in the second round of sampling when samples were collected directly from the cistern at this location. Field measurements indicate the water collected directly from the cistern (using a bladder pump) was considerably more oxidized than the samples obtained from the tap, suggesting greater exposure of the water to the atmosphere prior to sampling—and therefore also a greater potential for volatilization and/or oxidation of any hydrocarbons possibly present. Although trimethylbenzenes can be constituents of hydraulic fracturing fluids and are included on PA DEP's list of chemicals found in hydraulic fracturing fluids used in Pennsylvania (PA DEP, 2010), the absence of elevated concentrations of other potential indicators (e.g., chloride, TDS, barium, strontium), in conjunction with 1,2,4-trimethylbenzene and 1,2,3-trimethylbenzene, is inconsistent with the trimethylbenzenes (and DROs and GROs) originating from hydraulic fracturing activities. Spring location NEPASW01, in fact, exhibited some of the lowest chloride, strontium, and barium concentrations of any samples collected in the study. Chloride concentrations in the spring were measured at <1 mg/L during all three rounds of sampling (average 0.79 mg/L) and were significantly below the pre-2007 NURE and NWIS dataset median concentrations of 8.05 mg/L and 10.0 mg/L, respectively. In addition, trimethylbenzenes (and GROs and DROs) were not detected in the homeowner well located within 100 feet of the spring on the same property (which was also sampled in all three rounds); nor were trimethylbenzenes detected in two wells on neighboring properties that were located within 600 feet and 900 feet of the spring collectively sampled a total of five times. In addition to being found in gasoline, 1,2,4-trimethylbenzene is also used in cleaners, pesticides, printing inks, and solvents in coatings (EPA, 1994). Off-road motorized vehicles (ATVs) were observed to be used on the property and the spring is likely more vulnerable than wells to surface release impacts. 1,2,4-trimethylbenzene appears to be quite frequently detected in ground water (USGS, 2006). In an analysis of 95 domestic wells between 1996 and 1998 in the Allegheny and Monongahela River Basins of Pennsylvania, West Virginia, New York, and Maryland, for example, 1,2,4-trimethylbenzene was detected in over 45% of the wells (Anderson et al., 2000). EPA has not set a drinking water criterion for 1,2,4-trimethylbenzene; however, the California Office of Environmental Health Hazard Assessment has recommended a health-based action level of 330 μg/L. No drinking water criterion is available for 1,2,3-trimethylbenzene.

1,2,3-trimethylbenzene was also detected in the third round of sampling at another homeowner location (NEPAGW28) approximately 10 miles from the spring location (NEPASW01). The 1,2,3-trimethylbenzene was detected in a duplicate sample from this location below the quantitation limit (0.05 μg/L) at an estimated concentration of 0.17 μg/L; however, it was not detected in the primary sample collected from this location nor was it detected in the same well in the one other round it was sampled (round 1). As in the case of the 1,2,4-trimethylbenzene detection at spring location NEPASW01, the absence of other potential indicators in the homeowner well (e.g., elevated chloride, TDS, strontium, barium concentrations) is not consistent with the 1,2,3-trimethylbenzene originating from hydraulic fracturing activities. Chloride concentrations in this well were similar in the two rounds it was sampled at concentrations of 7.31 mg/L in the first round and 6.92 mg/L in the third round. These concentrations are also below the pre-2007 NURE and NWIS dataset median chloride concentrations for Bradford County (see Table 4).

During the first sampling round, toluene was detected in the sample from homeowner well (NEPAGW13) below the quantitation limit (0.5 μg/L) at an estimated concentration of 0.24 μg/L. Toluene was not detected at this location during the second round of sampling, nor was it detected in a second well (NEPAGW37) sampled on the same property during the third round. (NEPAGW13 was not sampled in the third round because it was no longer operational.) Toluene was also not detected in the wells of two neighboring properties (NEPAGW18, NEPAGW19, NEPAGW20, and NEPAGW38) which were collectively sampled a total of six times. Although toluene can be a component of hydraulic fracturing fluids, it can originate from many other sources and is also a common laboratory contaminant (US EPA, 1992). Because toluene is a common laboratory contaminant, EPA's Guidance for Data Usability in Risk

Assessment (www.epa.gov/oswer/riskassessment/datause/parta.htm) Appendix VII states that a toluene concentration is considered useable only if it is greater than 10 times the method blank concentration or, if <10 times the method blank concentration, only when multiple aromatic or fuel hydrocarbons are also detected when it is present. The analyte (toluene) is to be excluded from consideration in all other situations. The absence of other indicators including other fuel hydrocarbons, the inability to detect toluene in the well when sampled a second time, and the absence of toluene detections in the five nearby wells—one of which was within 100 feet, two of which were located within 400 feet, and two of which were located within 700 feet of NEPAGW13—makes it improbable that the toluene originated from hydraulic fracturing activities.

Table 8. Organic compounds detected in samples from wells and springs in this study.

Chemical	Well	Concentration (µg/L)	Qualifier	Notes
October/November 2011				
Volatile Organic Compounds				
Toluene	NEPAGW13	0.24	J	MCL = 1000 µg/L
1,2,4-trimethylbenzene	NEPASW01	0.38	J	
Semi-Volatile Organic Compounds				
Bis-(2-ethylhexyl) adipate	NEPAGW01	3.06	B	MCL = 400 µg/L Similar concentrations detected in laboratory blanks; data is considered invalid and unusable
	NEPAGW02	3.57	B	
	NEPAGW02 DUP	2.76	B	
	NEPAGW03	2.99	B	
	NEPAGW04	3.10	B	
	NEPAGW05	3.47	B	
	NEPAGW06	2.89	B	
	NEPAGW06 DUP	3.92	B	
	NEPAGW07	3.59	B	
	NEPAGW08	3.35	B	
	NEPAGW09	3.54	B	
	NEPAGW10	3.88	B	
	NEPAGW11	3.15	B	
	NEPAGW12	3.39	B	
	NEPAGW13	4.04	B	
	NEPAGW14	2.34	B	

Table 8. Organic compounds detected in samples from wells and springs in this study.

Chemical	Well	Concentration (µg/L)	Qualifier	Notes
Bis-(2-ethylhexyl) phthalate	NEPAGW06 DUP	2.82	B	MCL = 6 µg/L Similar concentrations detected in laboratory blanks; data is considered invalid and unusable
	NEPAGW07	1.21	B	
	NEPAGW08	4.10	B	
	NEPAGW18	2.74	B	
	NEPAGW19	1.57	B	
	NEPAGW27	2.45	B	
Diesel Range Organics	NEPAGW04	23.4		
	NEPASW01	23.1		
	NEPASW01 DUP	25.1		
April/May 2012				
Volatile Organic Compounds				
Carbon disulfide	NEPAGW02	0.30	J	
Chloroform	NEPAGW02	5.53		MCL = 80 µg/L
Semi-Volatile Organic Compounds				
Bis-(2-ethylhexyl) phthalate	NEPAGW09	36.7		MCL = 6 µg/L Not detected in DRO chromatogram; thus invalid and unusable
	NEPASW06	3.02		
Diesel Range Organics	NEPAGW02	21.1	J-	
	NEPAGW10	28.1	J-	
	NEPAGW14	23.1	J-	
	NEPAGW27	21.1	J-	
	NEPAGW36	21.1	J-	
	NEPASW03	243	J-	
	NEPASW04	273	J-	
	NEPASW04 DUP	267	J-	
	NEPASW05	48.2	J-	
	NEPASW06	46.0	J-	

Table 8. Organic compounds detected in samples from wells and springs in this study.

Chemical	Well	Concentration (µg/L)	Qualifier	Notes
May 2013				
Volatile Organic Compounds				
Acetone	NEPAGW16	0.33	J	
	NEPAGW37	8.3		
1,2,4-trimethylbenzene	NEPASW01	1.6		
1,2,3-trimethylbenzene	NEPASW01	1.1		
	NEPAGW28 DUP	0.17	J	
Chloroform	NEPAGW29	0.40	J	MCL = 80 µg/L
Carbon disulfide	NEPAGW08	0.11	J	
	NEPAGW16	0.12	J	
Semi-Volatile Organic Compounds				
Bis-(2-ethylhexyl) phthalate	NEPAGW01	5.38		MCL = 6 µg/L
	NEPAGW03	18.3		
	NEPAGW14	5.75	B	
	NEPAGW36	3.82		
Diesel Range Organics	NEPASW01	27.7	B	Detected in field and equipment blank; thus invalid and unusable
Gasoline Range Organics	NEPASW01	24.2		

J = value is an estimate; J- = value is an estimate and may be biased low; B = analyte was found in a blank sample above the QL (See Appendix A for additional details regarding these qualifiers.)

The common laboratory contaminants acetone, carbon disulfide, and chloroform were also reported in one or more samples. Acetone was reported in two samples in the third round of sampling but was not detected in any samples in the first and second rounds. (A different analytical laboratory was used in the third round.) The highest acetone concentration (8.3 µg/L) was reported for a sample from a well sampled only in the third round (NEPAGW37). The other reported detection of acetone, estimated at 0.33 µg/L (below the quantitation limit of 1.0 µg/L), was from a well (NEPAGW16) where acetone was not detected in the first or second rounds. Carbon disulfide was also reported at an estimated concentration of 0.12 µg/L (below the quantitation limit of 0.5 µg/L) in round 3 at NEPAGW16, but was not detected at this location during the first two rounds. Carbon disulfide also was reported in a sample from NEPAGW02 at an estimated concentration of 0.30 µg/L (below the quantitation limit) during the second round of sampling (but not in the first or third round) and in a sample from NEPAGW08 at an estimated concentration of 0.11 µg/L (also below the quantitation limit) in the third round of sampling (but not in the first or second round). Chloroform was reported in a sample from NEPAGW02 during the second round at a concentration of 5.53 µg/L and during the third round in a sample from NEPAGW29 (below the quantitation limit of 0.5 µg/L) at an estimated concentration of 0.40 µg/L; however, chloroform was not detected at either of these locations during the other two rounds of sampling conducted at each location. The sporadic and inconsistent reported detections of acetone, carbon disulfide, and chloroform in samples are concluded to be most consistent with laboratory contamination or alternative undetermined causes not related to hydraulic fracturing activities. Laboratory contamination of samples and blanks is not uncommon and can occur under the most rigorous of laboratory QA/QC protocols. The issue of laboratory contamination in water samples and blanks, including those organic contaminants more susceptible to being introduced during laboratory sample preparation and analysis, are addressed by Miller (2015) and Douglas (2012).

Bis-(2-ethylhexyl) adipate was reported above the quantitation limit in 16 samples in the first round of sampling, but was also detected at similar levels in associated laboratory blanks during this round of sampling, thereby rendering the data invalid. Bis-(2-ethylhexyl) adipate was not reported in any samples in the second or third rounds of sampling. Bis-(2-ethylhexyl) phthalate was detected in many samples during all rounds of sampling, although data from the first round is concluded to be invalid due to similar levels reported in associated laboratory blanks. Bis-(2-ethylhexyl) phthalate was reported in four field samples, two field blanks, and one equipment blank in the third round and in two field samples in the second round. The highest reported concentration was 36.7 µg/L at NEPAGW09 in the second round, which is significantly higher than EPA's primary drinking water MCL of 6.0 µg/L. However, bis-(2-ethylhexyl) phthalate was not detected in the DRO chromatograms for the second round of sampling, indicating its detection, at least in the second round, was due to laboratory contamination. Bis-(2-ethylhexyl) phthalate was also reported above the MCL, at 18.3 mg/L, at location NEPAGW03 in the third round. The four locations at which bis-(2-ethylhexyl) phthalate was reported in the third round—including NEPAGW03—did not show any bis-(2-ethylhexyl) phthalate detections in the second round. Bis-(2-ethylhexyl) phthalate is a common laboratory contaminant (US EPA, 1992) and can originate from the use of plastic equipment (e.g., tubing) that contains bis-(2-ethylhexyl) phthalate as a plasticizing agent (Griffiths et al., 1985). In sum, all reported data for bis-(2-ethylhexyl) adipate and bis-(2-ethylhexyl) phthalate are concluded to be highly questionable and therefore unusable.

6.4. Water Isotopes

Water (δ^2H_{H2O} and $\delta^{18}O_{H2O}$) isotope data were also obtained for samples collected in the study. As in the case of $^{87}Sr/^{86}Sr$ ratios, Marcellus Shale-produced water also has a characteristic δ^2H_{H2O} and $\delta^{18}O_{H2O}$ isotope signature (Warner et al., 2012; Sharma et al., 2014). A water isotope signature in water samples significantly deviating to the right of the Global Meteoric Water Line (Craig, 1961) shown in Figure 30 could signify a potential impact. A majority of the δ^2H_{H2O} and $\delta^{18}O_{H2O}$ data from the study, however, as shown in Figure 30, plot to the left of the Global Meteoric Water Line and close to the Local Meteoric Water Line for Pennsylvania as described by Kendall and Coplen (2001). The only exceptions were the data from two samples collected from the homeowner pond, which plot to the right of the Global Meteoric Water Line. Although the signatures for the pond samples could be an additional line of evidence for impacts originating from the nearby well pad, the signatures may also be due to evaporation of the pond water. δ^2H_{H2O} and $\delta^{18}O_{H2O}$ (unlike $^{87}Sr/^{86}Sr$ ratios) are less sensitive indicators of impacts, and according to Warner et al. (2012), only a brine fraction of greater than 20% in receiving waters would alter the δ^2H_{H2O} and $\delta^{18}O_{H2O}$ signatures sufficiently to observe a significant change.

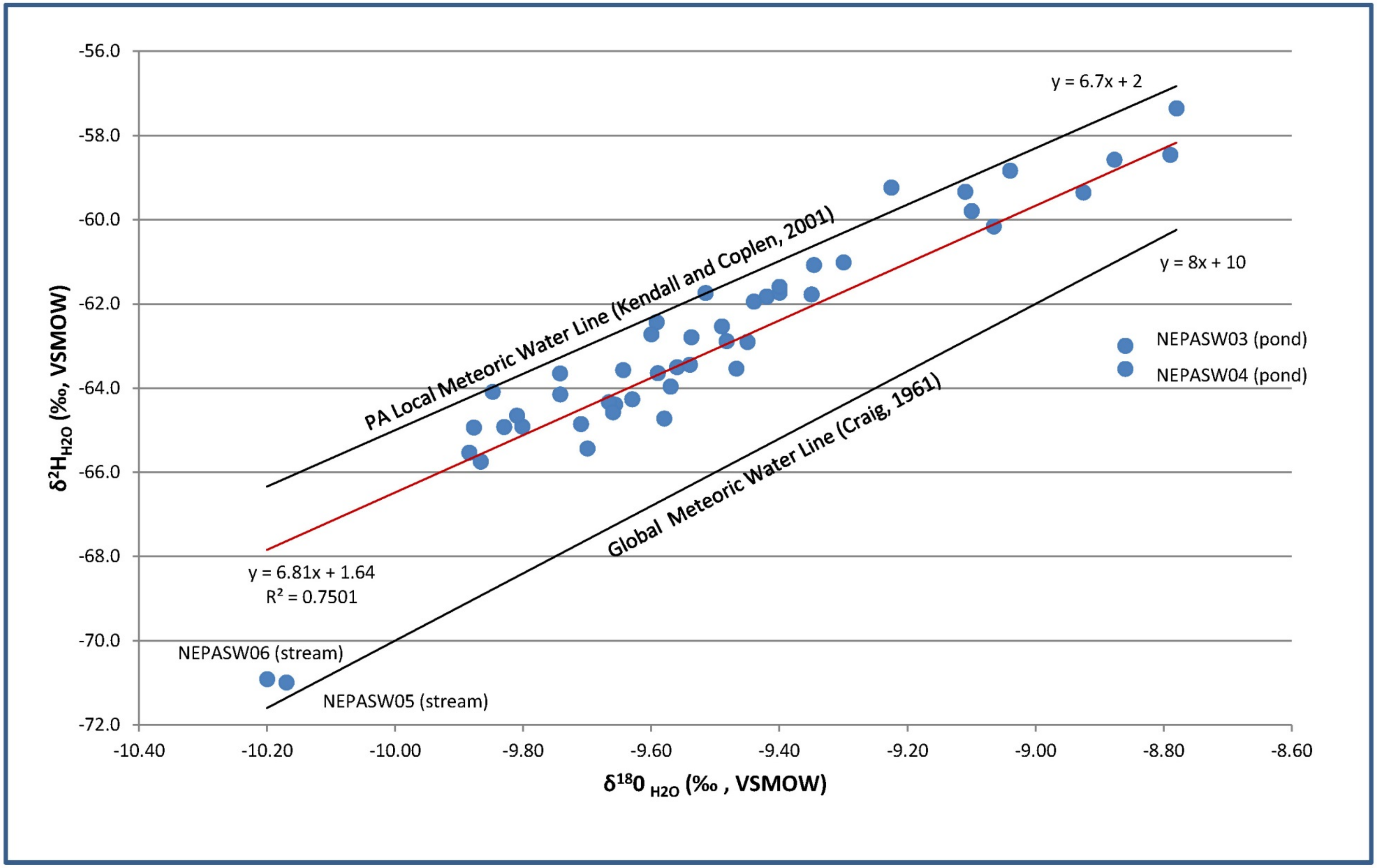


Figure 30. Water isotope plots for samples collected in this study during second and third sampling rounds relative to global meteoric water line and local meteoric water line. Only pond water samples plot to right of global meteoric water line.

6.5. Dissolved Gases

All ground water and spring water samples collected in the study area were analyzed for dissolved methane, ethane, propane, and butane. Seventeen of the 36 homeowner wells sampled over the course of the study exhibited methane concentrations >1 mg/L during at least one sampling round, and 13 exhibited methane concentrations >5 mg/L during at least one sampling round. As previously noted, Na-Cl and Na-HCO_3 type waters exhibited the greatest frequency of methane detections >1mg/L in this study (Figure 14). The highest methane concentration measured over the course of the study (56.1 mg/L) was measured in the third round of sampling at NEPAGW01, which exhibits Na-HCO_3 type water.

The presence of methane in wells does not, in itself, signify an association with hydraulic fracturing activities, since methane occurs naturally in the study area. However, the presence of methane in wells previously methane-free or any significant increase in methane concentrations observed relative to previous levels could signify an impact. In addition, a change in isotopic signature of the methane or a change in methane-to-ethane ratios could also indicate a potential impact. Although methane is considered nontoxic, its presence in wells can be of potential concern if concentrations are sufficiently high to pose an explosion risk. The influx of methane into wells may also cause suspension of well sediments and dislodging of naturally occurring mineral deposits (precipitates) from the surfaces of the well and wellbore. This can lead to increased turbidity and discoloration of well water (Gorody, 2012). The increased presence of methane in wells, if sustained, could also promote more reducing conditions, possibly leading to increased iron and manganese dissolution and subsequent liberation (dissolution) of naturally occurring contaminants such as arsenic. Ultimately, the sustained presence of methane could possibly also promote sulfate-reducing conditions, resulting in the production of hydrogen sulfide.

In cases where measured methane concentrations were >1 mg/L, isotope analyses for $\delta^{13}C$ of methane ($\delta^{13}C_{CH4}$ or $\delta^{13}C_1$) relative to the Vienna Pee Dee Belemnite (VPDB) standard and δ^2H of methane (δ^2H_{CH4} or δCD_1) relative to Vienna Standard Mean Ocean Water (VSMOW) standard were generally conducted to establish isotopic signatures for the gas. If sufficient ethane was present in samples, then $\delta^{13}C$ of ethane ($\delta^{13}C_{C2H6}$ or $\delta^{13}C_2$) was also measured to further refine the isotopic fingerprint of the gas. Révész et al. (2010) provide a summary of how stable isotope data can be used to distinguish between thermogenic gases and biogenic gases. Thermogenic methane and ethane derived from deeper formations, including where the Marcellus Shale is located, tend to be less isotopically fractionated (i.e., more $\delta^{13}C$-enriched) than shallower, microbially produced (biogenic) gases. In addition, thermogenic gases are generally wetter than biogenic gases in that they tend to have a much greater proportion of higher chain hydrocarbons (i.e., ethane, propane, butane) than biogenic gases. $\delta^{13}C$ values for methane ($\delta^{13}C_{CH4}$) greater than (i.e., more positive than) about -50‰ and a methane to combined ethane, propane, and butane ($CH_4/C_2H_6^+$) ratio <1,000 are generally more indicative of a thermogenic gas. $\delta^{13}C$ values for ethane ($\delta^{13}C_{C2H6}$) more positive than about -45‰ and a $CH_4/C_2H_6^+$ ratio <1,000 also tend to be indicative of a thermogenic gas. Gas isotope signatures can potentially also be used to distinguish thermogenic gases originating from different formations, as noted earlier. Data from mud log gas samples collected by Baldassare et al. (2014) for 234 gas well locations in a five-county area of northeastern Pennsylvania (including Bradford and Susquehanna Counties) indicate thermogenic methane and ethane from deeper formations, where the Marcellus Shale is located, tend to be less isotopically fractionated than thermogenic methane and ethane originating from shallower formations (see Table 5).

6.5.1. Methane and Ethane Isotopes

Gas isotope data for this study are presented in Table 9. The $\delta^{13}C_{CH4}$, $\delta^{2}H_{CH4}$, $\delta^{13}C_{C2H6}$, and $CH_4/C_2H_6^+$ ratio data for locations with methane concentrations >1 mg/L provided in Table 9 are generally consistent with gas of predominantly thermogenic origin. One exception was NEPAGW11, which exhibited $\delta^{13}C$ values of -73.52‰ and -73.90‰ in the two rounds that gas isotope data were collected at this location. This location also had one of the highest CH_4/C_2H_6 ratios detected in the study (2,488 in round 1). The gas isotope signature from this location is most consistent with gas of biogenic origin (Figure 31, Figure 32a). The only other $\delta^{13}C_{CH4}$ value < -50‰ observed in the study was -57.5‰ in homeowner well NEPAGW31. This signature is more consistent with a mixture of thermogenic and biogenic methane, although the low CH_4/C_2H_6 ratio of 206 is inconsistent with a significant biogenic component. The highest (most positive) $\delta^{13}C_{CH4}$ value measured in the study was at homeowner location NEPAGW06, where a value of -27.22‰ was observed in the third round of sampling.

The mean and median $\delta^{13}C_{CH4}$ values of -40.86‰ and -38.30‰, respectively, for gas samples collected from well and springs in this study are higher (more positive) than the mean and median $\delta^{13}C_{CH4}$ values of -45.33‰ and -43.19‰, respectively, for gas isotope data reported by Baldassare et al. (2014) for 67 private wells sampled in their five-county study in northeastern Pennsylvania [including Bradford and Susquehanna Counties] (see Table 10). The mean and median $\delta^{2}H_{CH4}$ values of -184.6‰ and -170.3‰, respectively, for this study are also more positive than the mean and median $\delta^{2}H_{CH4}$ values of -212.1‰ and -212.3‰, respectively, for the Baldassare et al. (2014) private well study. In contrast, the mean $\delta^{13}C_{C2H6}$ value for this study was very similar to that of the Baldassare et al. (2014) study (-35.03‰ and -35.67‰, respectively), while the median $\delta^{13}C_{C2H6}$ value of -37.1‰ was considerably more negative than the value of -34.6‰ for the Baldassare et al. (2014) study (Table 10). In general, the data indicate methane in gas samples from homeowner wells in this study was less fractionated than methane from private wells in the Baldassare et al. (2014) study, whereas ethane was more fractionated. This could indicate a greater contribution of gases from deeper formations (e.g., Middle Devonian strata) in homeowner wells in this study relative to homeowner wells in the Baldassare et al. (2014) study.

6.5.2. Inorganic Carbon Isotopes

Samples were also analyzed for $\delta^{13}C$ of DIC ($\delta^{13}C_{DIC}$) to further aid in interpretation of gas data. DIC in ground water can originate from processes such as decaying organic matter, carbonate rock dissolution, silicate mineral weathering, and microbial sulfate reduction (Warner et al., 2013; Sharma et al., 2014). Production of carbon dioxide (CO_2) associated with microbial methane production (methanogenesis) from the degradation of organic compounds would tend to result in the enrichment of $\delta^{13}C$ of DIC (and therefore more positive $\delta^{13}C_{DIC}$ values) as well as increased alkalinity (Jackson et al., 2013a; Baldassare et al., 2014). A system dominated by DIC production from microbial methanogenesis would be expected to yield positive $\delta^{13}C_{DIC}$ values (e.g., > +10‰).

$\delta^{13}C_{DIC}$ data provided in Table 9 for the locations where methane concentrations exceeded 1 mg/L indicate $\delta^{13}C_{DIC}$ values were less than -12‰ at all sampling locations, with the exception of homeowner location NEPAGW01. The negative values are not only inconsistent with a significant contribution from microbial methanogenesis, but would also appear to be inconsistent with the DIC originating directly from deeper formations like the Marcellus Shale. Sharma et al. (2014) report $\delta^{13}C_{DIC}$ values greater than +21‰ in produced water from three Marcellus Shale gas wells in Greene County, in southwestern Pennsylvania. The somewhat less negative $\delta^{13}C_{DIC}$ values of -7.25‰ and -6.30‰ measured in

Table 9. Locations in this study sampled for gas isotope data where methane concentrations were greater than 1 mg/L.

Sampling Location	Sampling Round	CH_4 (mg/L)	C_2H_6 (mg/L)	CH_4 / C_2H_6	$\delta^{13}C_{CH4}$ ($\delta^{13}C_1$) (‰)	δ^2H_{CH4} (‰)	$\delta^{13}C_{C2H6}$ ($\delta^{13}C_2$) (‰)	$\delta^{13}C_{DIC}$ (‰)	$\delta^{13}C_2$ - $\delta^{13}C_1$ (‰)
NEPAGW01	R2	40.4	0.0184	2196	-39.42	-203.9	*	-7.25	–
	R3	56.1	0.0267	2101	-39.27	-201.0	*	-6.30	–
NEPAGW02	R1	40.7	0.0257	1584	-38.43	-206.7	-32.0	-15.34	6.43
	R2	39.4	0.0265	1487	-38.26	-204.7	-31.4	-13.86	6.86
	R3	44.7	0.0267	1674	-38.20	-204.0	-31.3	-14.00	6.90
NEPAGW04	R2	27.6	0.0165	1673	-38.24	-201.9	*	-12.30	–
NEPAGW06	R2	1.10	0.0176	63	-29.95	-136.2	*	-17.66	–
	R3	0.740	0.0097	76	-27.22	-138.8	*	-17.20	–
NEPAGW08	R2	17.3	0.0065	2682	-49.96	-228.7	*	-14.06	–
	R3	20.0	0.0088	2275	-48.85	-221.1	*	-13.40	–
NEPAGW11	R2	3.06	0.0012	2488	-73.52	-252.8	*	-14.14	–
	R3	2.44	<0.0028	>871	-73.90	-251.0	*	-13.50	–
NEPAGW13	R2	21.7	0.4970	44	-33.01	-166.0	-37.2	-18.36	-4.15
NEPAGW16	R2	8.19	0.1090	75	-39.41	-170.4	-37.7	-16.26	1.71
	R2 dup	7.67	0.1040	74	-39.36	-171.5	-37.7	-16.39	1.66
	R3	7.53	0.0701	107	-40.91	-169.0	-37.3	-15.80	3.61
NEPAGW17	R2	24.6	0.0291	845	-46.46	-202.3	-38.2	-12.91	8.26
NEPAGW18	R2	7.90	0.2590	31	-31.82	-168.0	-36.2	-17.48	-4.38
NEPAGW20	R1	7.55	0.2160	35	-32.32	-165.4	-36.3	-17.78	-3.98
	R2	18.4	0.4140	44	-33.32	-173.7	-36.4	-17.62	-3.08
	R2 dup	18.0	0.4010	45	-33.30	-171.0	-37.0	-18.07	-3.66
NEPAGW31	R1	1.95	0.0095	206	-57.50	-156.3	*	-24.38	–
NEPAGW32	R1	0.729	<0.0028	>260	-27.70	-79.0	*	-17.52	–
	R2	2.42	<0.0028	>864	-38.80	-190.5	*	-17.71	–
	R3	1.23	<0.0028	>439	-32.34	-145.1	*	-17.30	–
NEPAGW33	R2	37.2	0.0616	604	-38.49	-217.5	-28.0	-15.76	10.49
	R3	41.5	0.0882	471	-38.30	-215.2	-30.6	-14.90	7.70
NEPAGW37	R3	15.5	0.3840	40	-31.92	-163.3	-37.1	-19.00	-5.18
NEPAGW38	R3	17.5	0.4280	41	-32.22	-163.9	-37.4	-17.70	-5.18
	R3 dup	16.9	0.4150	41	-32.19	-162.3	-37.4	-17.80	-5.21

* Insufficient ethane (C_2H_6) present to analyze.

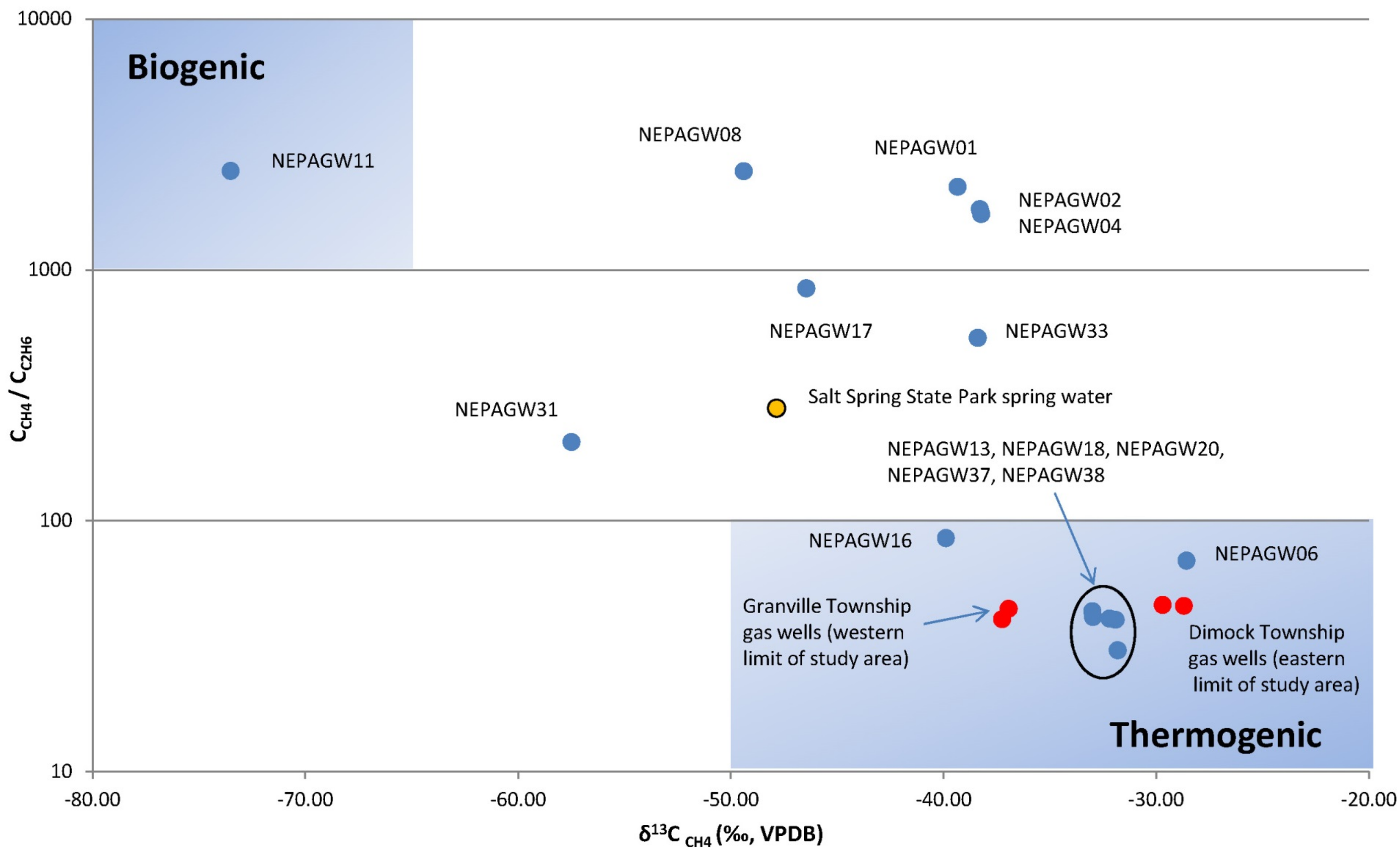


Figure 31. Bernard plot showing $\delta^{13}C_{CH4}$ values for homeowner wells sampled in this study with detectable ethane concentrations and methane concentrations >1 mg/L relative to available gas well data from study area. Only one location (NEPAGW11) plots distinctly as biogenic gas. Data for locations sampled in more than one round are averaged. Dimock Township gas well data (collected 11/4/2011) and Salt Spring State Park data (collected 11/10/2010) from Molofsky et al. (2013); Granville Township gas well data (collected 12/10/2010) from PA DEP.

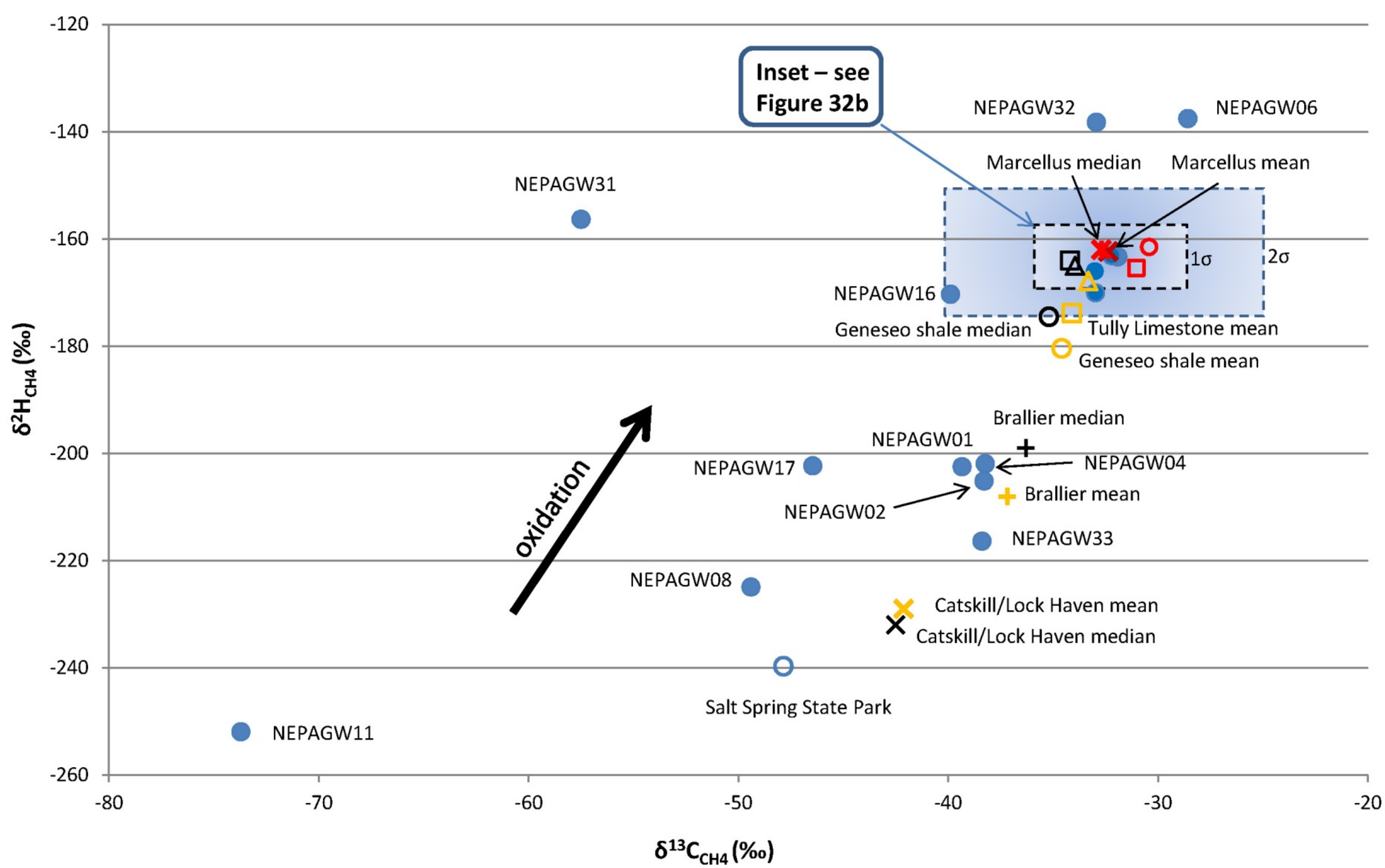


Figure 32a. Schoell plot showing $\delta^{13}C_{CH4}$ versus $\delta^{2}H_{CH4}$ values for homeowner wells sampled in this study with methane concentrations >1 mg/L relative to different formation means and medians, and the one and two standard deviation (1σ and 2σ) range about the mean for over 1500 Marcellus Shale mud log gas samples analyzed from 234 gas wells in northeastern Pennsylvania (Baldasarre et al., 2014). Data for homeowner locations sampled in more than one round in this study are averaged. Salt Spring State Park data from Molofsky et al. (2013).

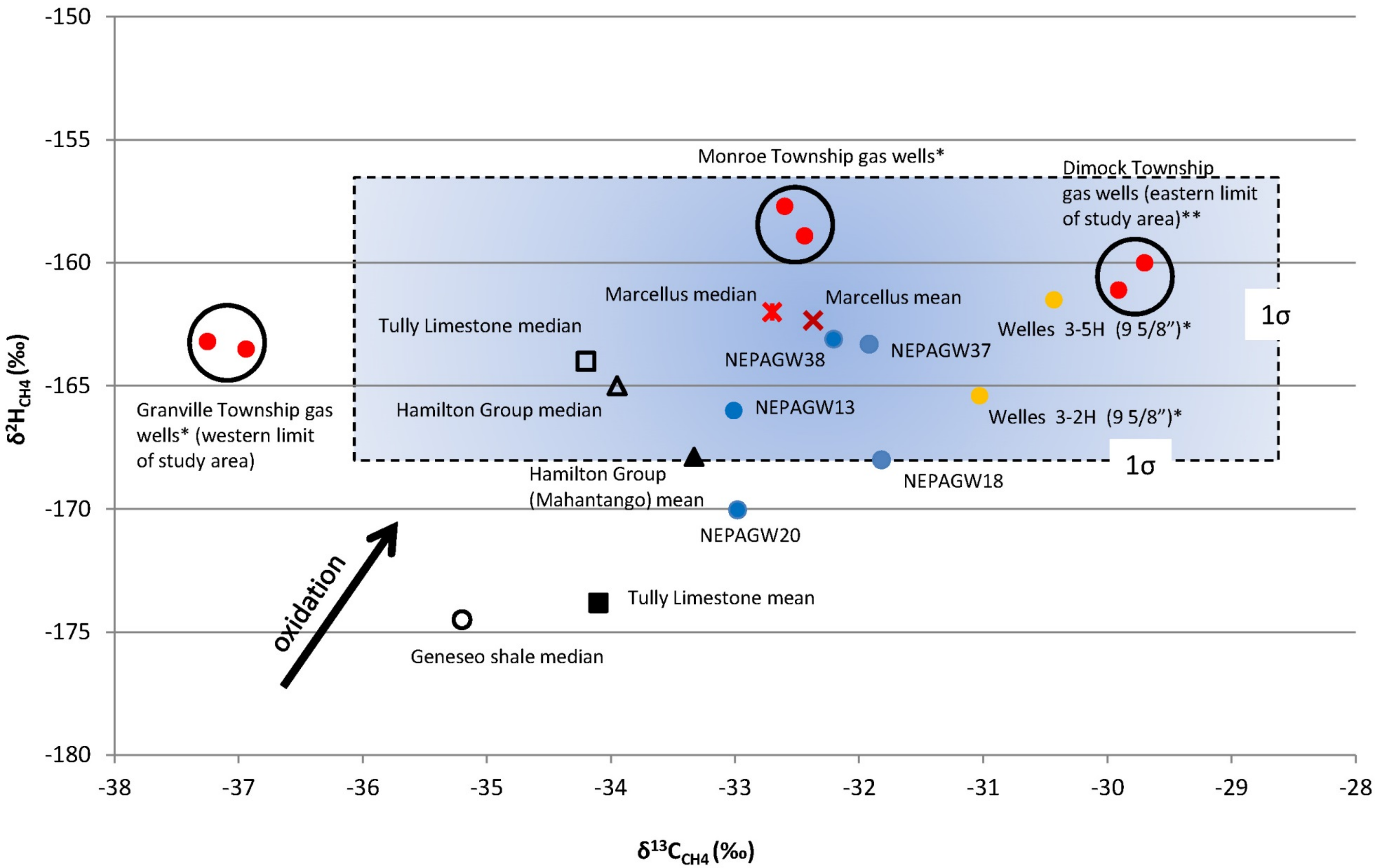


Figure 32b. Schoell plot close-up showing $\delta^{13}C_{CH4}$ versus $\delta^{2}H_{CH4}$ values for homeowner wells from this study within one standard deviation (1σ) of the mean $\delta^{13}C_{CH4}$ and $\delta^{2}H_{CH4}$ values reported by Baldasarre et al. (2014) for mud log gas samples collected from the Marcellus Shale. (* PA DEP data; ** Molofsky et al. (2013) data).

Table 10. Gas isotope data from homeowner wells in this study compared to data for private wells sampled in five-county region of northeastern Pennsylvania (Tioga, Bradford, Susquehanna, Wyoming, and Sullivan) reported by Baldassare et al. (2014).

	Parameter	***n***	**mean ‰**	**min ‰**	**25th ‰**	**median ‰**	**75th ‰**	**90th ‰**	**max ‰**
Baldassare et al. (2014)	$\delta^{13}C_{CH4}$	67	-45.33	-67.17	-46.91	-43.19	-40.22	-38.08	-34.47
This Study	$\delta^{13}C_{CH4}$	16	-40.86	-73.71	-43.18	-38.30	-32.96	-32.03	-28.59
Baldassare et al. (2014)	$\delta^{2}H_{CH4}$	67	-212.1	-263.9	-222.6	-212.3	-197.5	-190.3	-162.5
This Study	$\delta^{2}H_{CH4}$	16	-184.6	-251.9	-203.8	-170.3	-163.2	-145.4	-137.5
Baldassare et al. (2014)	$\delta^{13}C_{C2H6}$	13	-35.03	-42.4	-37.7	-34.6	-32.7	-31.7	-27.0
This Study	$\delta^{13}C_{C2H6}$	9	-35.67	-38.2	-37.4	-37.1	-36.2	—	-29.3

homeowner well NEPAGW01 (for the two rounds $\delta^{13}C_{DIC}$ data were collected from this location), along with the relatively high average CH_4/C_2H_6 ratio (>2000) observed for this location, may indicate a more significant contribution from microbial methanogenesis.

6.6. Homeowner Well Dissolved Gas Scenarios

Multiple rounds of pre-drill methane data were generally not available for homeowner locations in the study area, making it challenging to evaluate potential gas impacts in the study. In addition, operator gas isotope data for individual gas wells of interest in Bradford County were not available. This limited the ability to evaluate potential links, if any, between gas in homeowner wells and gas originating from the Marcellus Shale. Nevertheless, several notable dissolved gas scenarios/evaluations in the study are listed below and discussed in the ensuing sections.

Scenario 1: Homeowner wells located in valley settings in the study area that exhibit Na-Cl type water with methane concentrations >10 mg/L.

Scenario 2: Homeowner well in a valley setting for which pre- and post-hydraulic fracturing data were collected during the course of this study.

Scenario 3: Homeowner well where three rounds of pre-gas drilling data were available and where methane and ethane concentrations increased significantly following initiation of hydraulic fracturing activities.

Scenario 4: Homeowner wells exhibiting the highest methane concentrations observed in the study (up to 56.1 mg/L).

Scenario 5: Homeowner location where evacuation of home was required due to gas build-up.

Scenario 6: Homeowner location where discoloration of well water appeared to coincide with entry of methane gas into the homeowner well.

6.6.1. Scenario 1: Valley wells with Na-Cl type water and elevated methane levels

The three homeowner wells (NEPAGW04, NEPAGW08, and NEPAGW17) in Bradford County with geochemical characteristics similar to the naturally occurring spring water in Salt Spring State Park (Susquehanna County) exhibited methane concentrations ranging from 14.0 mg/L to 27.6 mg/L over the course of the study. These wells are all located in stream/river valleys and exhibit the Na-Cl type water described by Williams et al. (1998) as characteristic of many stream valley wells in the study area (Appendix E). Average TDS concentrations in each of these wells were measured at >1,000 mg/L, and chloride concentrations were consistently >300 mg/L. All three wells also exhibited elevated barium concentrations, and two of the three wells (NEPAGW04 and NEPAGW17) were high in combined radium-226 and radium-228 concentrations. All three wells are located within 1 mile of one or more well pads; however, in the case of two of the three homeowner wells—NEPAGW04 and NEPAGW08—the gas wells on the nearby pads had been drilled but not yet hydraulically fractured when the first round of sampling was conducted in fall 2011. Therefore, the methane present in these wells cannot be attributed to the hydraulic fracturing (stimulation) process. Gas samples collected from the two homeowner wells exhibited significantly different isotopic signatures from those of Marcellus Shale gas in the study area (see Figure 32a). Figure 32a shows that the isotopic signatures for NEPAGW04, NEPAGW08, and NEPAGW17 are outside the two standard deviation range about the mean for the more than 1,500 Marcellus Shale mud log isotopic gas signatures reported by Baldassare et al. (2014) for gas wells in the five-county area of northeastern Pennsylvania (including Bradford and Susquehanna Counties). Pre-drill data were available for only one of the three homeowner wells (NEPAGW08). The operator-reported methane concentration in this homeowner well was >20 mg/L before drilling began on the nearby well pad (see Figure 28).

The well cap on homeowner well NEPAGW17 was reported by the homeowner to have "blown off" on August 4, 2010, approximately four weeks after drilling was completed on a well pad approximately 3,400 feet to the south of the property (see Figure 27). Gas samples collected by the PA DEP from the surface casings of the three wells on the pad showed $\delta^{13}C_{CH4}$ values ranging from -32.01‰ to -32.18‰ and $\delta^{2}H_{CH4}$ values ranging from -157.6‰ to -159.7‰. $\delta^{13}C_{CH4}$ and $\delta^{2}H_{CH4}$ values for homeowner well NEPAGW17 were measured at -46.46‰ and -202.3‰, respectively, in this study (Table 9 and Figure 27), indicating the drilled wells on the pad were not the likely source of the gas in the homeowner well. These gas isotopic signatures are also different from the gas isotopic signatures obtained from the hydraulically fractured wells on another pad located approximately 4,000 feet east of the homeowner location (see Figure 27). $\delta^{13}C_{CH4}$ and $\delta^{2}H_{CH4}$ values reported for tubing and production casings from these wells (PA DEP, 2013) were >-33‰ and >-160‰, respectively (Table 6 and Figure 27). Furthermore, no isotopic reversal was observed in a gas sample collected from NEPAGW17 indicating that, if any gas did enter the well, it would likely have been from shallower formations.

6.6.2. Scenario 2: Homeowner well with pre- and post-hydraulic fracturing data collected in the study

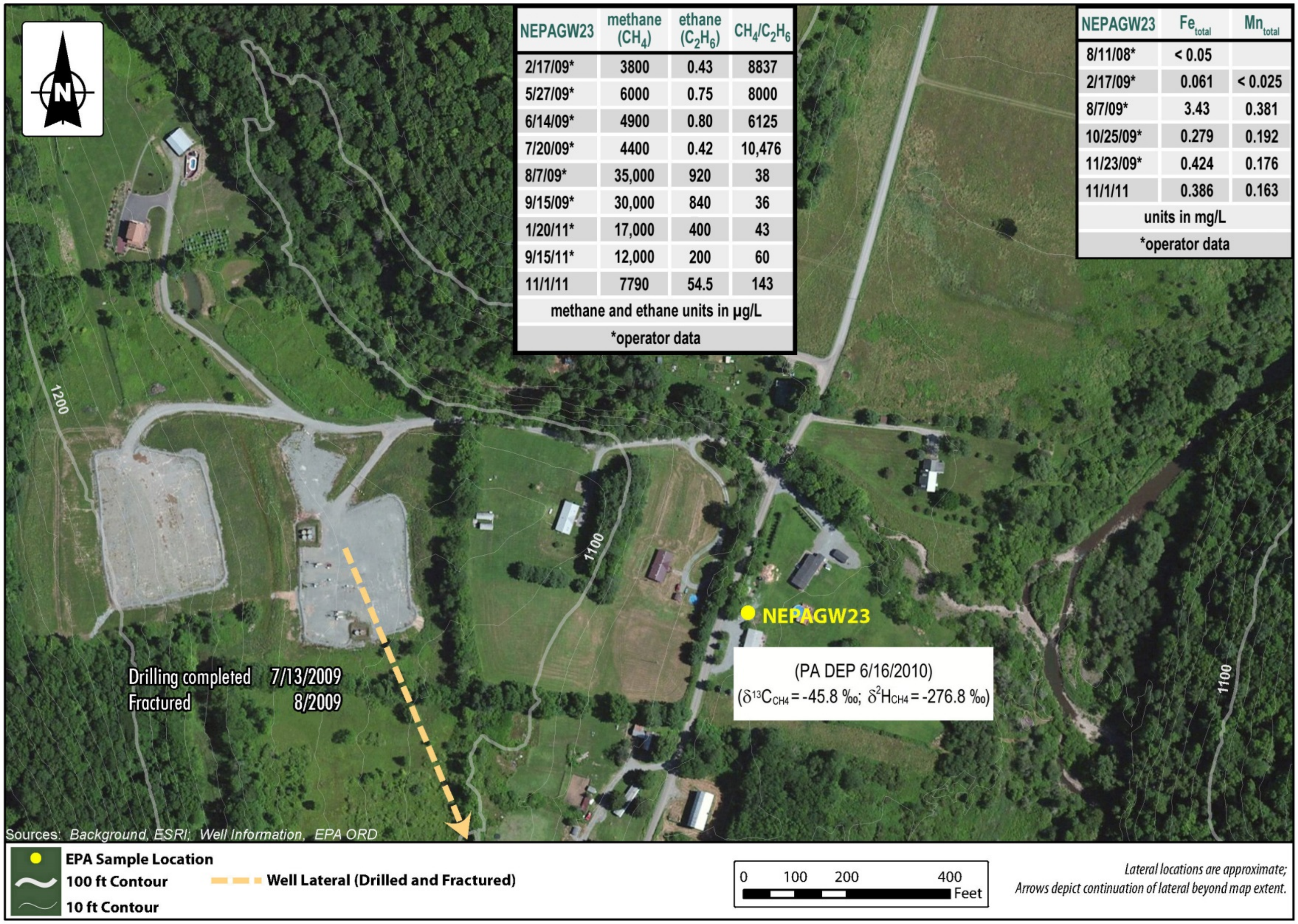
On December 31, 2011, approximately two months after completion of the first round of sampling in this study and four months preceding the second round of sampling, hydraulic fracturing (stimulation) was carried out on a well pad located approximately 4,000 feet from NEPAGW08, based on data provided by the operator (Figure 28). The lateral from this hydraulically fractured well passes near the homeowner property within a surface radius of approximately 1,200 feet—at a depth of approximately 1 mile. This homeowner location is thus of particular interest because it provides a well-specific pre- and post-hydraulic fracturing case study for the study area. Moreover, NEPAGW08 is located in a stream valley setting that some researchers believe would be more vulnerable to impacts from the hydraulic fracturing of Marcellus Shale. As previously stated, it has been hypothesized that stream valleys represent zones of weakness or increased bedrock fracturing that allowed glacial and weathering processes to down cut preferentially into the bedrock. The increased fracture density in the stream valleys could thus result in a greater abundance of preferential pathways for the flow of natural gas from depth to the surface. Molofsky et al. (2013) report that water wells in Susquehanna County exhibit median methane concentrations similar to those of upland water wells but that the 90th percentile concentrations of methane in valley wells are significantly elevated relative to upland wells. This observation, according to Molofsky et al. (2013), suggests that some valley water wells access natural sources of elevated methane via interconnection with specific ground water units and/or enhanced pathways of methane migration. Warner et al. (2012) cite the similar geochemistry between ground water in these settings and deeper formations as evidence of a pre-existing network of cross-formational pathways that has enhanced hydraulic connectivity to the deeper formations.

Gas samples collected from the homeowner well during the first round of sampling in this study (i.e., before hydraulic fracturing was conducted) showed a methane concentration of 14.8 mg/L. Following hydraulic fracturing (stimulation) on the nearby well pad, samples collected during the subsequent two sampling rounds showed dissolved methane concentrations of 17.3 mg/L and 20.0 mg/L, respectively (see Figure 28). Although this might suggest a potential trend toward increasing methane concentrations, these values are also within the margin of variability for methane measurements in water well samples. Methane concentrations measured in ground water can be variable even when using the same sample collection method and depend on many factors including the extent of homeowner well use prior to sampling, the amount of purging, the amount of water drawdown during purging and sampling, barometric pressure, and seasonal effects. Methane-to-ethane (CH_4/C_2H_6) ratios at this location were higher following hydraulic fracturing than before (2,682 after versus 1,873 before) indicating that, if any gas did enter the homeowner well, it would likely have been of predominantly biogenic origin from shallower depths rather than thermogenic gas from deeper formations. Also importantly, two gas isotope samples obtained from this well, both of which were collected after hydraulic fracturing was conducted on the well pad, showed mean $\delta^{13}C_{CH4}$ and $\delta^{2}H_{CH4}$ values of -49.41‰ and -224.9‰, respectively. These values are outside the two-standard deviation range about the mean of the over 1,500 Marcellus Shale mud log gas signatures reported by Baldassare et al. (2014) for northeastern Pennsylvania and are more similar to the isotopic signature of Salt Spring State Park spring water gas samples (Figure 32a; Table 5). Although insufficient ethane was present in the well to evaluate the presence/absence of isotope reversal, the isotopic data and other gas data evaluated appear to exclude the Marcellus Shale as the source of the gas in the homeowner well.

6.6.3. Scenario 3: Homeowner well with multiple rounds of pre-hydraulic fracturing data

One homeowner well in Susquehanna County (NEPAGW23) had three rounds of pre-drill sampling data available. The data were collected by the operator before drilling began on a nearby well pad approximately 800 feet from the homeowner well (Figure 33). The three rounds of pre-drill sampling showed average methane concentrations of 4.9 mg/L (range: 3.8 mg/L to 6.0 mg/L) and average ethane concentrations of 0.66 µg/L (range: 0.43 µg/L to 0.80 µg/L). Following the initiation of hydraulic fracturing activities on the well pad in summer 2009, the concentrations of methane and ethane increased significantly. Methane concentrations increased approximately seven-fold, while ethane concentrations increased more than 1,000-fold, indicating an influx of a different and wetter gas into the well than was previously present. Methane-to-ethane (CH_4/C_2H_6) ratios in the well decreased from over 6,000 to <50, consistent with a transition from a predominantly biogenic gas to a predominantly thermogenic gas.

Although methane and ethane concentrations appear to have decreased gradually in homeowner well NEPAGW23 since the initial influx of gas, data collected by the operator more than a year after the initial spike in gas concentrations was first observed indicated that methane concentrations as high as 30 mg/L were still present. A dissolved gas sample collected by the operator from the homeowner well in January 2011 still showed a methane concentration of 17.0 mg/L, with a still low CH_4/C_2H_6 ratio of 43. The sample collected as part of this study in November 2011 showed a methane concentration of 7.79 mg/L, with a somewhat higher CH_4/C_2H_6 ratio of 143. A gas isotope sample was not collected from this well as part of this study because sampling was not conducted in Susquehanna County in rounds 2 and 3, when the majority of methane isotope sampling was conducted. However, gas isotope data for a sample collected from this location in June 2010 by the PA DEP approximately one year following the initially observed spike in gas concentrations showed $\delta^{13}C_{CH4}$ and $\delta^{2}H_{CH4}$ values of -45.8‰ and -276‰, respectively. These $\delta^{13}C_{CH4}$ and $\delta^{2}H_{CH4}$ values are well below those reported by Molofsky et al. (2013) for



NEPAGW23	methane (CH_4)	ethane (C_2H_6)	CH_4/C_2H_6
2/17/09*	3800	0.43	8837
5/27/09*	6000	0.75	8000
6/14/09*	4900	0.80	6125
7/20/09*	4400	0.42	10,476
8/7/09*	35,000	920	38
9/15/09*	30,000	840	36
1/20/11*	17,000	400	43
9/15/11*	12,000	200	60
11/1/11	7790	54.5	143
methane and ethane units in µg/L			
*operator data			

NEPAGW23	Fe_{total}	Mn_{total}
8/11/08*	< 0.05	
2/17/09*	0.061	< 0.025
8/7/09*	3.43	0.381
10/25/09*	0.279	0.192
11/23/09*	0.424	0.176
11/1/11	0.386	0.163
units in mg/L		
*operator data		

Figure 33. Location of Susquehanna County homeowner well NEPAGW23 with several rounds of pre-drill sampling data collected**.** Data indicate methane concentrations increased >7-fold and ethane concentrations increased >1000-fold following initiation of hydraulic fracturing activities while methane to ethane ratios decreased from >5000 to <50. Data also appear to indicate increases in Fe and Mn concentrations following initiation of hydraulic fracturing activities.

Dimock area Marcellus Shale gas wells ($\delta^{13}C_{CH4}$ values >-30‰ and $\delta^{2}H_{CH4}$ >-170‰) and outside the two-standard deviation range about the mean reported by Baldassare et al. (2014) for the more than 1,500 Marcellus Shale mud log gas signatures collected in their five-county study in northeastern Pennsylvania. The signature likely reflects a mixture of pre-existing biogenic and new thermogenic gas that entered the well. Because of the marked difference in the methane isotope signature of the gas in the homeowner well relative to that of Marcellus Shale gas, it is reasonable to conclude that the gas that apparently entered the homeowner well was not Marcellus Shale gas, but rather a much more fractionated thermogenic gas originating from a shallower formation. Ethane isotope data was not reported for this well by the PA DEP and therefore the presence/absence of isotope reversal in this well could not be evaluated.

6.6.4. Scenario 4: Homeowner locations exhibiting the highest levels of methane in the study

At two homeowner well locations in Bradford County (NEPAGW01 and NEPAGW02), samples were collected for dissolved gas analysis by the operator several months after hydraulic fracturing activities began at a well pad located less than 700 feet from the homeowner wells (Figure 34). These samples showed no detectable levels of methane in the homeowner wells (<0.01 mg/L). However, the three rounds of sampling conducted as part of this study showed methane concentrations at the two well locations ranging from 37.2 mg/L to 56.1 mg/L. In the third round of sampling (May 2013), methane concentrations of 56.1 mg/L and 44.7 mg/L were measured in homeowner wells NEPAGW01 and NEPAGW02, respectively. Methane isotope data for gas samples collected from the two homeowner wells in this study showed average $\delta^{13}C_{CH4}$ and $\delta^{2}H_{CH4}$ values of -39.34‰ and -202.4‰, respectively, for NEPAGW01 and average values of -38.30‰ and -205.1‰, respectively for NEPAGW02 (Table 9). Gas samples collected by the PA DEP from the production casings from gas wells at two nearby well pads (Figure 34) on November 4, 2010, indicated $\delta^{13}C_{CH4}$ values of -36.94‰ and -37.25‰ and $\delta^{2}H_{CH4}$ values of -163.5‰ and -163.2‰. Although the homeowner $\delta^{13}C_{CH4}$ values do not appear to differ markedly from those of the production casing (i.e., Marcellus Shale gas), the $\delta^{2}H_{CH4}$ values do differ markedly and plot outside the two-standard deviation range about the mean for Marcellus Shale mud log gas isotope signatures reported by Baldassare et al. (2014) for northeastern Pennsylvania (Figure 32a). The isotope data thus indicate the gas in the homeowner wells is not consistent with gas from the two nearby gas wells. In addition, there was no isotope reversal in the one well (NEPAGW02) that yielded sufficient ethane for isotopic analysis and the CH_4/C_2H_6 ratios for gas in both homeowner wells (>1,400) were considerably higher than the CH_4/C_2H_6 ratios of <50 reported by the PA DEP for gas obtained from the production casings at the two nearby well pads. This further appears to exclude Marcellus Shale gas from the nearby gas wells as the source of methane in the two homeowner wells. However, this does not preclude the gas in the homeowner wells having originated from shallower formations as a result of drilling and well completion operations.

The observations at these two homeowner locations are also of interest in that, the initial operator data showing non-detectable levels of gas in the homeowner wells would indicate a significant delay in the arrival of gas at the two homeowner wells following drilling and hydraulic fracturing on the nearby well pad. The initial non-detectable concentrations of methane in the two homeowner wells were observed more than one month after the last of the nearby gas wells was drilled and fractured (see Figure 34).

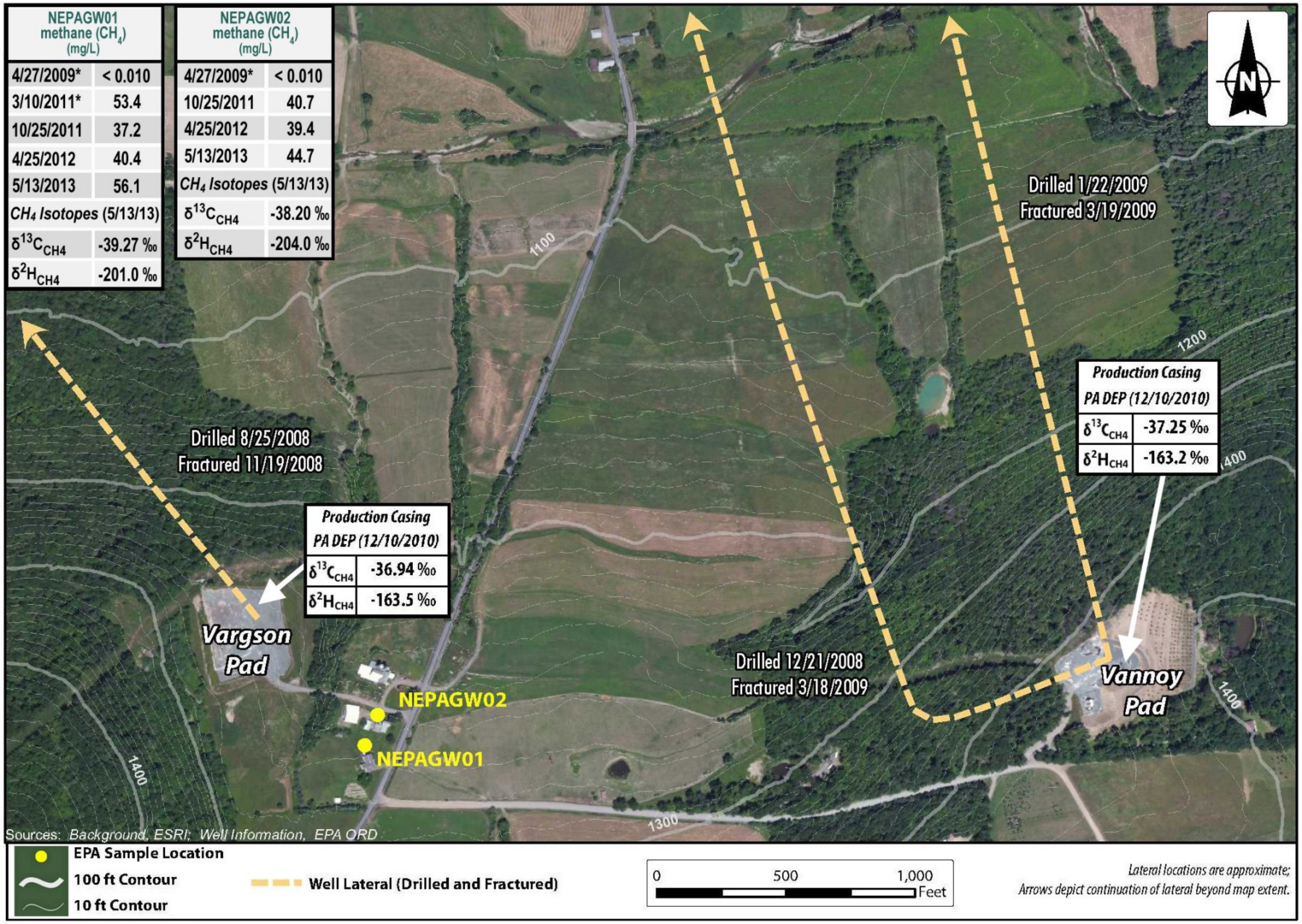


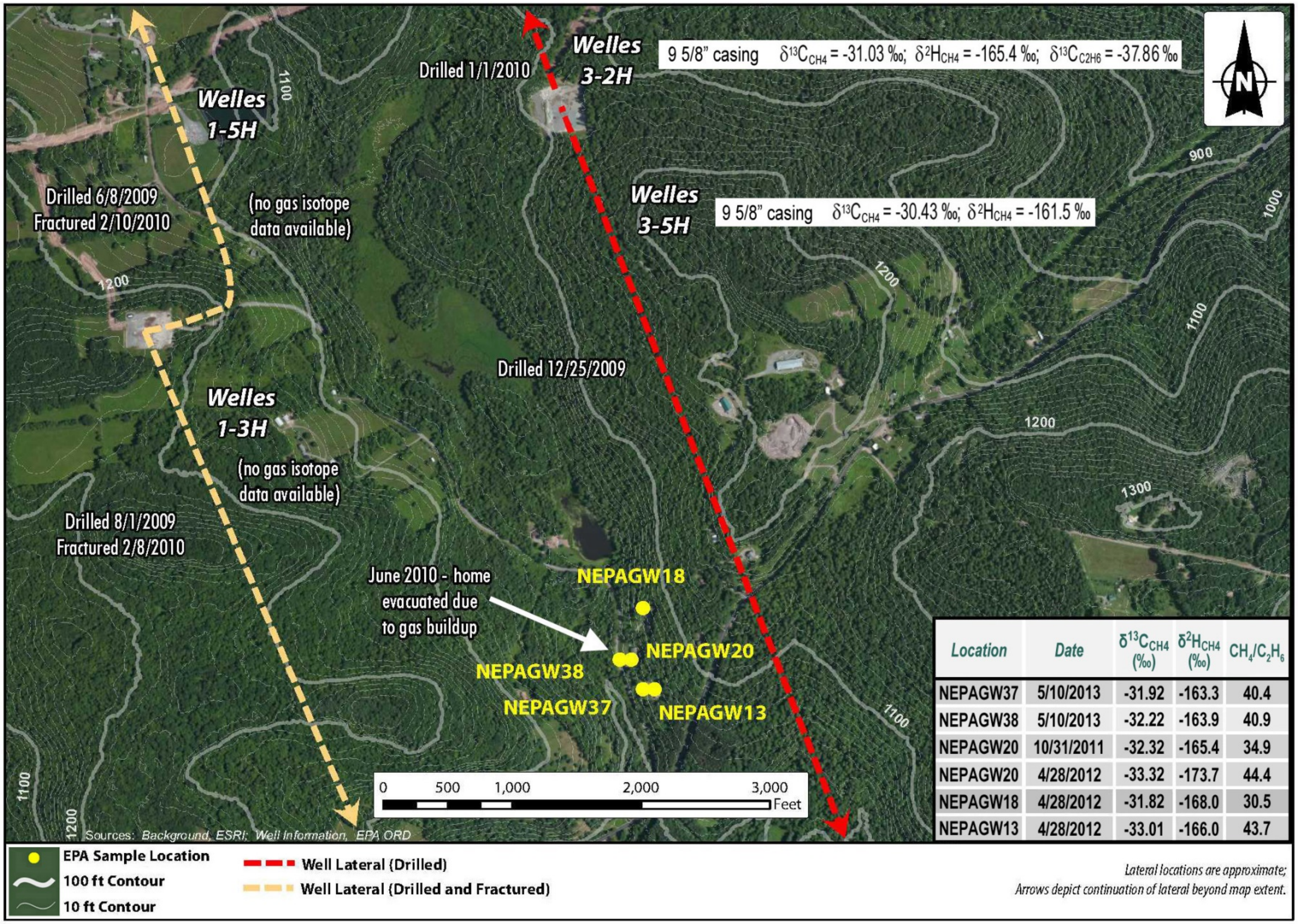
Figure 34. Locations of homeowner wells NEPAGW01 and NEPAGW02 with highest measured methane concentrations in this study and where gas data suggest delayed arrival of gas in homeowner wells following gas drilling activities. Drill/fracture dates from Chesapeake Energy (2/12/2012). (* Operator data).

6.6.5. Scenario 5: Location requiring temporary evacuation of home due to gas build-up

Gas samples collected from three homeowner wells in Terry Township (Bradford County) exhibited methane isotope signatures consistent with deeper formation (e.g., Middle Devonian) thermogenic gas. These homes were purchased by the operator during the course of this study as part of a settlement reached between the operator and the three homeowners. The homeowners alleged gas intrusion into their wells as a result of hydraulic fracturing activities nearby. The operator, in response to initial complaints from the homeowners in summer 2010, installed new wells on each of the properties. These new wells (NEPAGW13, NEPAGW18, and NEPAGW20), as well as the original wells (NEPAGW37, NEPAGW19, and NEPAGW38) on the three properties, were all sampled at least once as part of this study and showed varying levels of dissolved methane, up to a concentration of 21.7 mg/L. The complaints of stray gas in the wells were lodged by the homeowners approximately four months after hydraulic fracturing (stimulation) had been completed on one well pad (Welles 1) and approximately six months after drilling (only) had been completed on another well pad (Welles 3), both of which are located 4,000 to 5,000 feet from the homeowner locations (Figure 35). No pre-drill samples were collected by the operator at the homeowner locations. As shown in Figure 32b, the isotopic signatures for methane at NEPAGW13, NEPAGW18, NEPAGW37, and NEPAGW38 were within one standard deviation of the mean for the Marcellus Shale mud log gas samples reported by Baldassare et al. (2014) for northeastern Pennsylvania.

Although the data suggest potential Marcellus Shale gas impacts on the homeowner wells, gas isotopic data collected by the PA DEP in September 2010 from the annular spaces of the two drilled (but not yet hydraulically fractured) wells on the Welles 3 pad showed $\delta^{13}C_{CH4}$ values of -30.43‰ and -31.03‰ and $\delta^{2}H_{CH4}$ values of -161.5‰ and -165.4‰ (Figure 35). The $\delta^{13}C_{CH4}$ values for these non-fractured wells are very similar to those measured in the homeowner wells (Figure 32b). Gas isotope signatures for the two hydraulically fractured horizontal wells on the Welles 1 pad (Figure 35) were not available.

The gas samples collected from homeowner wells NEPAGW37, NEPAGW38, NEPAGW18, NEPAGW13, and NEPAGW20 also exhibited the isotope reversal properties (i.e., $\delta^{13}C_{CH4} > \delta^{13}C_{C2H6}$) commonly characteristic of deeper thermogenic gases originating from Middle Devonian sequences such as the Marcellus Shale (Table 9). The magnitudes of the isotope reversal differences were slightly less than those calculated from the mean $\delta^{13}C_{CH4}$ and $\delta^{13}C_{C2H6}$ values reported by Baldassare et al. (2014) for Marcellus Shale gas but slightly higher than those calculated for the Hamilton Group sequences above the Marcellus Shale (Table 5; Figure 36). Specifically, gas samples collected from NEPAGW37 and NEPAGW38 in this study indicated isotope reversal differences of -5.18‰ and -5.21‰, respectively, while isotope reversal differences for gas samples collected from NEPAGW18, NEPAGW13, and NEPAGW20 were less at -4.38‰, -4.15‰, and -3.08‰, respectively (Table 9; Figure 32b and Figure 36). As previously noted, Marcellus Shale gas in the Dimock area of Susquehanna County has been reported to exhibit an isotope reversal difference ($\delta^{13}C_{C2H6} - \delta^{13}C_{CH4}$) ranging from -5‰ to -7‰ according to Molofsky et al. (2013), while data from the Baldassare et al. (2014) mud log gas study indicate an average isotope reversal difference of -6.11‰ for Marcellus Shale mud log gas samples and -4.49‰ for mud log gas samples from Hamilton Group sequences above the Marcellus Shale (Table 5). Also as previously noted, gas from production casing and tubing at a well pad in central Bradford County showed isotope reversals ranging from -6.66‰ to -6.97‰ (Table 6). Ethane isotope data provided by the PA DEP for the gas sample collected from the annular space of one of the two drilled (but not



Location	Date	$\delta^{13}C_{CH4}$ (‰)	$\delta^{2}H_{CH4}$ (‰)	CH_4/C_2H_6
NEPAGW37	5/10/2013	-31.92	-163.3	40.4
NEPAGW38	5/10/2013	-32.22	-163.9	40.9
NEPAGW20	10/31/2011	-32.32	-165.4	34.9
NEPAGW20	4/28/2012	-33.32	-173.7	44.4
NEPAGW18	4/28/2012	-31.82	-168.0	30.5
NEPAGW13	4/28/2012	-33.01	-166.0	43.7

Figure 35. Location of homeowner wells where one homeowner evacuated home due to reported gas buildup. Gas isotope data and CH_4/C_2H_6 ratios (as well as isotope reversal differences not shown) indicate gas is more consistent with Middle Devonian origin than Upper Devonian origin. Drill/fracture dates from Chesapeake Energy (2/12/2012).

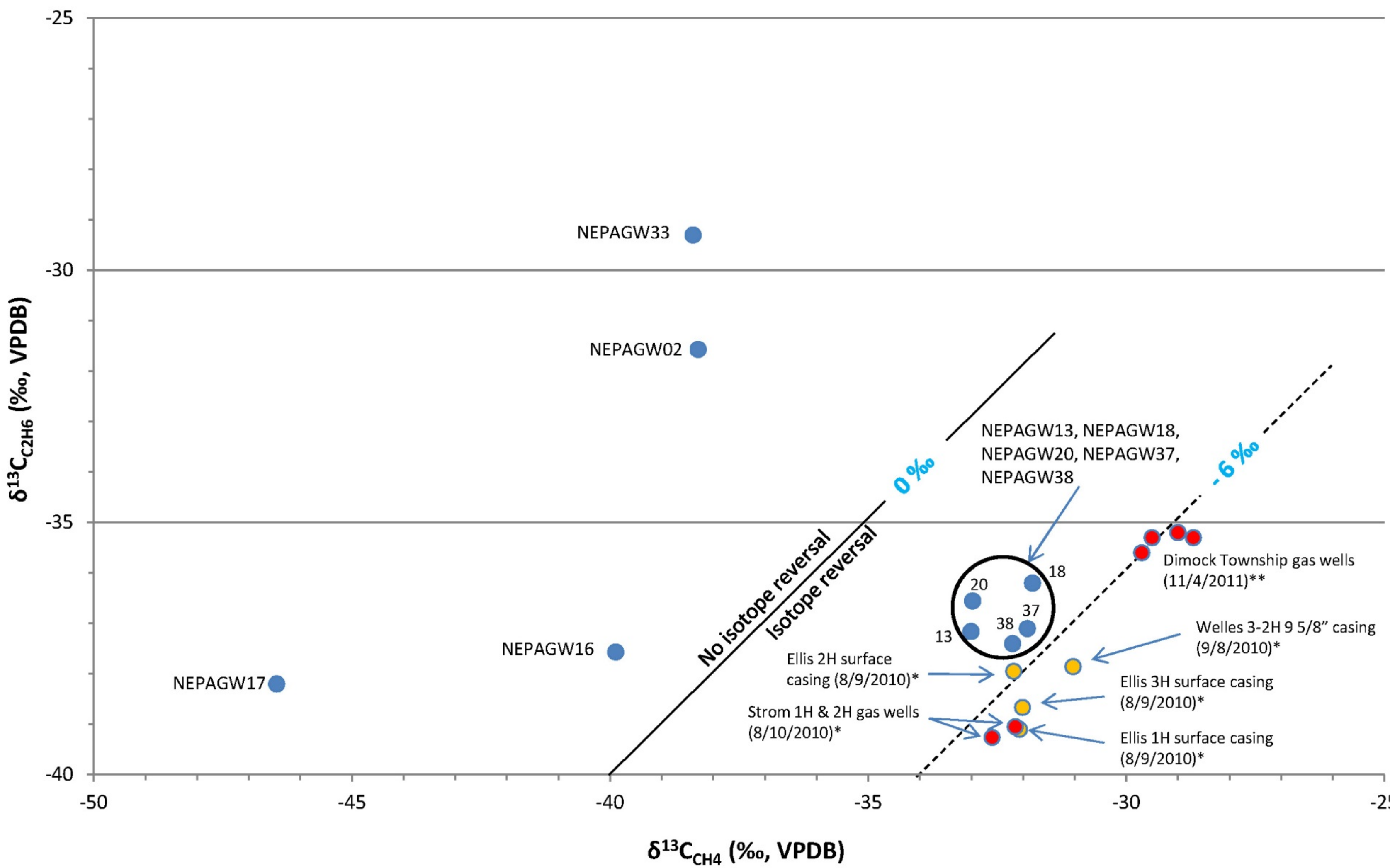


Figure 36. Isotope reversal presence/absence for samples in this study (with sufficient ethane present for isotopic analysis) relative to isotope reversals for Marcellus gas wells on the Strom pad in central Bradford County (PA DEP 8/10/2010) and for Marcellus gas wells in Dimock Township in Susquehanna County reported by Molofsky et al. (2013). Also shown are isotope reversal differences calculated from gas data collected by PA DEP from annular spacings of well casings for drilled (but not yet fractured) wells on the Ellis and Welles 3 well pads. Locations of pads are shown in Figures 27 and 35. (*PA DEP; **Molofsky et al. [2013])

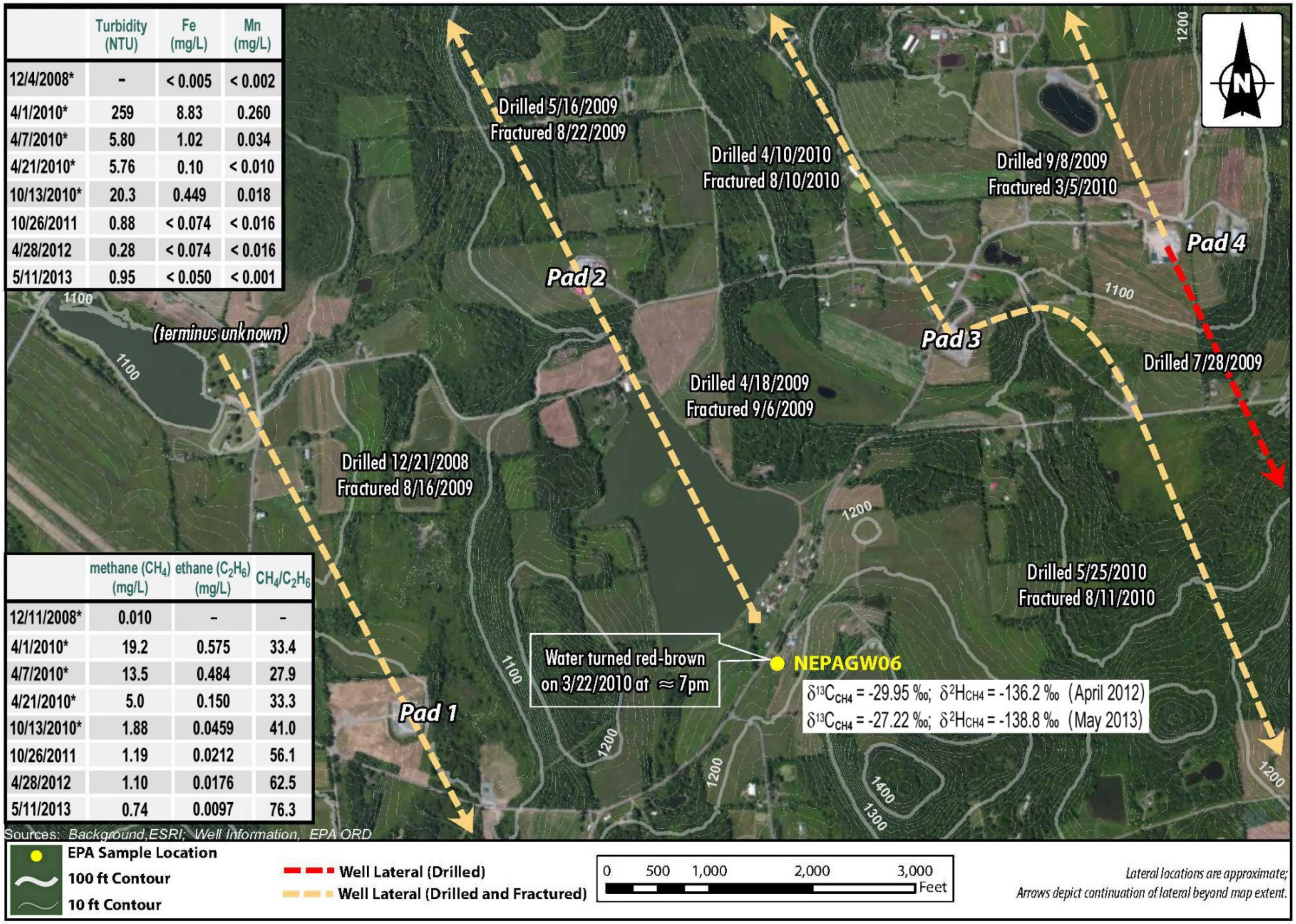
fractured) horizontal wells on the nearby Welles 3 well pad indicated an isotope reversal difference of -6.83‰. The gas isotope data from this study would appear to indicate that gas in one or more of the subject homeowner wells likely originates from Middle Devonian strata, although it is unknown whether any of the gas is specifically originating from the Marcellus Shale itself.

A potential complicating factor in the use of isotope reversal differences in determining the source of gas is the fact that ethane biodegrades preferentially relative to methane (James and Burns, 1984). It is therefore conceivable that enrichment of $^{13}C_{C2H6}$ and a gradual narrowing (reduction) of the isotope reversal difference may possibly occur with time. In addition, some mixing of gases may occur during ascent of gas to the surface, resulting in modified isotope reversal differences. Whether these processes are a factor in the magnitude of isotope reversal differences observed in homeowner wells in this study is unknown.

Well water from two wells (NEPAGW13 and NEPAGW37) on one of the three homeowner properties exhibited Ca-HCO_3 type water per the criteria of Deutsch (1997) used by Molofsky et al. (2013) in their study of methane distribution in Susquehanna County. Molofsky et al. (2013) report that of a total of 281 samples exhibiting Ca-HCO_3 type water in their study per the criteria of Deutsch (1997), none exhibited methane concentrations above 1 mg/L. The presence of methane at concentrations of 5.62 mg/L and 21.7 mg/L in the two rounds of sampling conducted at NEPAGW13, and the presence of methane at a concentration of 15.5 mg/L during the one round of sampling conducted at NEPAGW37 in this study, are thus in contrast to the observations of Molofsky et al. (2013) for Ca-HCO_3 type ground water in their study. The presence of methane concentrations >1 mg/L in these two wells with Ca-HCO_3 water may provide an additional line of evidence for the presence of stray gas in the wells.

6.6.6. Scenario 6: Homeowner well showing sudden discoloration and high turbidity

A homeowner at a location sampled in Bradford County (NEPAGW06) reported that at approximately 7:00 p.m. on March 22, 2010, their well water suddenly changed from a relatively clear, non-turbid state to a discolored (red-brown), turbid state. Pre-drill data from a sample collected at this location on December 11, 2008 (as reported by PA DEP, Appendix E, Table E-1), showed a very low methane concentration of 0.010 mg/L (Figure 37). Data collected by the PA DEP on April 1, 2010, approximately 10 days following the observed discoloration of the water, showed a methane concentration of 19.2 mg/L. A subsequent sample collected by the operator on April 7, 2010, showed a methane concentration of 13.5 mg/L, and subsequent samples collected by PA DEP on April 21 and October 13, 2010, showed methane concentrations of 5.0 mg/L and 1.88 mg/L, respectively. The turbidity in a sample collected from the homeowner well by PA DEP on April 1, 2010 (i.e., approximately 10 days after the observed discoloration of the water) was very high, with a reported value of 259 NTUs. On April 21 and October 13, 2010, PA DEP-measured turbidity values were 5.76 NTU and 20.3 NTU, respectively. The total iron and manganese concentrations measured in the sample collected on April 1, 2010 were 8.83 mg/L and 0.260 mg/L, respectively, far exceeding the respective EPA secondary drinking water MCLs of 0.3 mg/L and 0.05 mg/L. Pre-drill data reported by PA DEP for December 2008 showed non-detectable levels of total iron (<0.005 mg/L) and manganese (<0.002 mg/L) in the well (Appendix E, Table E-1).



	Turbidity (NTU)	Fe (mg/L)	Mn (mg/L)
12/4/2008*	-	< 0.005	< 0.002
4/1/2010*	259	8.83	0.260
4/7/2010*	5.80	1.02	0.034
4/21/2010*	5.76	0.10	< 0.010
10/13/2010*	20.3	0.449	0.018
10/26/2011	0.88	< 0.074	< 0.016
4/28/2012	0.28	< 0.074	< 0.016
5/11/2013	0.95	< 0.050	< 0.001

	methane (CH_4) (mg/L)	ethane (C_2H_6) (mg/L)	CH_4/C_2H_6
12/11/2008*	0.010	-	-
4/1/2010*	19.2	0.575	33.4
4/7/2010*	13.5	0.484	27.9
4/21/2010*	5.0	0.150	33.3
10/13/2010*	1.88	0.0459	41.0
10/26/2011	1.19	0.0212	56.1
4/28/2012	1.10	0.0176	62.5
5/11/2013	0.74	0.0097	76.3

Figure 37. Location of homeowner well NEPAGW06 where well water is reported to have turned reddish-brown on March 22, 2010, appearing to coincide with the temporary entry of gas into the homeowner well. Drill/fracture dates from Chesapeake Energy (2/12/2012). *From data compiled by PA DEP (see Appendix E, Table E-1).

The high turbidity and high iron and manganese concentrations coinciding with the high methane concentrations in the well are consistent with gas entering the well, likely causing physical agitation of well sediments and/or dislodging of naturally occurring iron and manganese mineral deposits from the well and wellbore surfaces. The methane-to-ethane ratio of the gas in the well was low (<80) for all three sampling rounds in this study, consistent with the gas having a strong thermogenic origin (see Figure 31). The $\delta^{13}C_{CH4}$ values for dissolved gas samples collected in the second and third rounds were -29.95‰ and -27.22‰, respectively (Table 9), indicating an isotopic signature more consistent with deeper Middle Devonian formations where the Marcellus Shale is found. Sufficient ethane was not available at this homeowner location to conduct a ^{13}C isotope analysis of ethane ($\delta^{13}C_{C2H6}$) for determination of the presence/absence of isotope reversal. The well water at this homeowner location is also a Ca-HCO_3 type water per the classification used by Molofsky et al. (2013) for their study in Susquehanna County. As noted earlier, no Ca-HCO_3 type ground water samples (n=281) exhibited methane concentrations above 1 mg/L in their study. However, the considerably more positive δ^2H_{CH4} value of the homeowner well sample (δ^2H_{CH4} > -140‰) relative to δ^2H_{CH4} values reported for Marcellus Shale gas by the PA DEP, Molofsky et al. (2013), and the two standard deviation range about the mean for Marcellus Shale gas samples evaluated by Baldassare et al. (2014) in their study (Figure 32a), would be inconsistent with the gas originating from the Marcellus Shale. The possibility that methane could have originated from the Marcellus Shale and undergone oxidation over time to acquire the more positive δ^2H_{CH4} value observed, though, cannot be discounted. Regardless of origin, gas entry into the homeowner well appears to have been a transient occurrence as evidenced by the apparent gradual transition of the well back to its original state. This is supported by the data collected in this study showing turbidity levels in all three rounds of sampling at <1 NTU, total iron and manganese concentrations at <0.10 mg/L and <0.025 mg/L, respectively, and methane concentrations at <1.5 mg/L.

7. Summary of Case Study Results

Water sampling and analyses were conducted over a span of 1.5 years at 36 homeowner wells, two springs, one pond, and one stream in northeastern Pennsylvania. Sampling was conducted primarily in Bradford County, mainly across the southern half of the county, while some limited sampling was conducted in Susquehanna County. With one exception, all sampling locations were within 1 mile of one or more drilled gas wells and, with three exceptions, all sampling locations were within 1 mile of one or more gas wells that had been hydraulically fractured (stimulated) prior to water sampling in this study. Collectively, a total of approximately 100 drilled gas wells, most of which were fractured, were within 1 mile of sampling locations in the study.

A multiple-lines-of-evidence approach was used in this study to evaluate potential cause and effect relationships between hydraulic fracturing activities and contaminant presence in ground water since many constituents of fracturing fluids and flowback/produced water can also originate from other sources, both natural and anthropogenic. The presence of a constituent in ground water that is also found in hydraulic fracturing fluids or flowback/produced waters does not necessarily implicate hydraulic fracturing activities as a potential cause. However, such a finding does signify that more focused attention is required to evaluate the potentially impacted sampling location to determine whether additional lines of evidence might exist that could specifically link the constituent(s) to hydraulic fracturing activities. This was the specific approach employed in this study.

The study was not random as it focused only on locations where homeowners had lodged complaints or expressed concerns regarding potential impacts to their wells/springs from nearby hydraulic fracturing activities. Many of the parameters that would normally serve as reliable indicators of potential hydraulic fracturing impacts in other study areas could not be as effectively applied in this study area due to the naturally-occurring elevated concentrations of these indicators within certain geologic settings in the study area. Distinguishing between those findings more consistent with natural presence and those findings more consistent with potential anthropogenic (e.g., hydraulic fracturing) impacts presented a challenge in this study.

Parameter-specific observations of note in this study are summarized in Table 11. With the exception of stray gas in the form of methane and ethane, the study revealed no anomalies or water quality impairments likely linked to hydraulic fracturing activities based on our analyses of a broad suite of inorganic and organic constituents and compounds in ground water samples collected from homeowner wells and springs in the study area. The presence of the organic compounds 1,2,4-trimethylbenzene and 1,2,3-trimethylbenzene near quantitation limits in one spring; 1,2,3-trimethylbenzene below the quantitation limit in a duplicate sample at one homeowner well in one round; and toluene below the quantitation limit in a sample from another homeowner well in one round are attributed to other anthropogenic sources that could not be determined. The study results did indicate elevated iron and/or manganese concentrations above secondary MCLs at over 40% of ground water sampling locations; however, this is consistent with historical data for the study area. Elevated concentrations of iron and manganese generally coincided with reducing (i.e., low oxygen or anoxic) conditions in the ground water. Ground water sampling results also indicated elevated concentrations of TDS, chloride, sodium, barium, strontium, and/or combined radium-226 and radium-228 at a few locations (see examples in Table 11). Elevated concentrations of these analytes are attributed to known localized natural background conditions in the study area associated with specific geologic settings (e.g., stream valley settings). High sulfate concentrations (>1,000 mg/L) measured in one homeowner well appeared to be consistent with the subsurface presence and dissolution of the mineral gypsum. There is no evidence from this study that hydraulic fracturing fluids, flowback waters, or produced waters associated with hydraulic fracturing activities are entering homeowner wells.

Table 11. Parameter-specific observations of note from the case study conducted in northeastern Pennsylvania.

Parameter	Sample Type	Location(s)	Description	Potential Sources
Dissolved methane	Ground water (detected in 27 of 36 wells) (>1.0 mg/L in 17 of 36 wells)	NEPAGW01, NEPAGW02 NEPAGW04, NEPAGW06 NEPAGW08, NEPAGW11 NEPAGW13, NEPAGW16 NEPAGW17, NEPAGW18 NEPAGW20, NEPAGW23 NEPAGW31, NEPAGW32 NEPAGW33, NEPAGW37 NEPAGW38	Detections from 1.0 to 56.1 mg/L; mainly thermogenic with exception of NEPAGW11	Natural background conditions or hydraulic fracturing related (e.g., drilling-induced, inadequate cementing, casing joint leaks, etc.) *(Well-specific details provided in main body of report.)*
Sulfate	Ground water (one well)	NEPAGW03	>1,000 mg/L; Secondary MCL exceedance	Natural equilibrium with gypsum and/or natural sulfide oxidation
Barium	Ground water (two wells)	NEPAGW04 NEPAGW17	>5.0 mg/L; Primary MCL exceedance	Natural background conditions known to occur in some valley settings in study area
Combined Ra-226 + Ra-228	Ground water (two wells)	NEPAGW04 NEPAGW17	>5.0 pCi/L; Primary MCL exceedance	Natural background conditions known to occur in some valley settings in study area
Iron and/or Manganese	Ground water (16 of 36 wells and 1 of 2 springs)	NEPAGW03, NEPAGW04 NEPAGW09, NEPAGW15 NEPAGW16, NEPAGW17 NEPAGW22, NEPAGW23 NEPAGW24, NEPAGW26 NEPAGW29, NEPAGW31 NEPAGW33, NEPAGW36 NEPAGW37, NEPAGW38 NEPASW01	Fe > 0.3 mg/L and/or Mn > 0.05 mg/L Secondary MCL exceedance	Natural background conditions in study area; possibly stray gas-influenced at one or more locations
Chloride	Ground water (3 wells)	NEPAGW04, NEPAGW08 NEPAGW17	>250 mg/L; Secondary MCL exceedance	Natural background conditions known to occur in some valley settings in study area
	Surface water (homeowner pond)	NEPASW03 NEPASW04	224-230 mg/L; high for surface waters in study area	Release of fluids or leachate from adjacent well pad; non-point sources

Table 11. Parameter-specific observations of note from the case study conducted in northeastern Pennsylvania.

Parameter	Sample Type	Location(s)	Description	Potential Sources
TDS	Ground water (4 wells)	NEPAGW03, NEPAGW04 NEPAGW08, NEPAGW17	>500 mg/L; Secondary MCL exceedance	Natural background conditions known to occur in some valley settings in study area
	Surface water (homeowner pond)	NEPASW03 NEPASW04	>500 mg/L; high for surface waters in study area	Release of fluids or leachate from adjacent well pad; non-point sources
Trimethyl-benzenes	Ground water (one spring)	NEPASW01	<2.0 µg/L	Localized fuel spill or alternative source not related to hydraulic fracturing activities

The study did appear to provide evidence of chloride and TDS impacts on a surface water (a homeowner pond not used as a drinking water source) located adjacent to a well pad where past fluid and solid releases reportedly occurred. The study also indicated that stray gas impacts on ground water have likely occurred in one or more homeowner wells sampled in the study. Perhaps the strongest evidence of a stray gas occurrence is at location NEPAGW23 in Susquehanna County, where pre-drill and post-fracture data collected by the operator show marked before-and-after differences in methane concentrations and, particularly, ethane concentrations. NEPAGW23 is a location where at least three rounds of pre-drill gas sampling were conducted by the operator, and where post-drill and post-fracture data indicated increases in ethane concentrations of more than 1,000-fold. Moreover, the post-drill and post-fracture methane-to-ethane ratio of the gas in the homeowner well decreased from values greater than 6,000 to values less than 50, suggesting a transition from a previously predominantly biogenic gas to a more thermogenic gas.

The entry of gas into homeowner wells would explain many of the issues (e.g., effervescing, increased turbidity, discoloration, etc.) reported by homeowners who have suspected impacts from hydraulic fracturing activities. Stray gas associated with oil and gas exploration in the study area is not a new phenomenon and has been an issue in the study area long before the advent of modern-day hydraulic fracturing. Nevertheless, stray gas entering homeowner wells, regardless of its point of origin, can be a concern. In addition to posing a potential explosion risk (if allowed to accumulate in confined spaces), gas entering homeowner wells—if sustained—can promote more reducing conditions which can potentially lead to reductive dissolution reactions that increase the concentrations of iron and manganese and possibly arsenic associated with iron and manganese. In this study, arsenic was measured below the MCL of 10 µg/L at all locations and generally less than 5 µg/L. Ultimately, increased reducing conditions can also potentially promote microbially-mediated sulfate reduction resulting in the production of hydrogen sulfide that can impart a rotten egg odor to well water. It is generally accepted that well integrity issues usually related to inadequate cementing in the annular spacing of gas wells are the cause of stray gas problems in the study area (Groundwater Protection Council, 2012). Other issues, such as casing joint leaks, may also be contributing factors (Baldassare et al., 2014). The added unique feature of cyclical pressurization and depressurization of casing during the multiple stages of hydraulic fracturing could also conceivably impact the integrity of the cement seal in the annuli of gas wells more so than in conventional well systems (Jackson et al., 2013b; McDaniel et al., 2014). This may potentially make hydraulically fractured gas wells more vulnerable to stray gas problems.

The significant background levels of thermogenic gas that exist at almost all depths within the study area and the processes of mixing and biodegradation that can impact gas isotopic signatures in the subsurface make gas source determination a very difficult and complex task. The scenarios presented in this report pertaining to the presence of gas in various homeowner wells sampled in the study indicate that, in some cases, the gas present in homeowner wells is almost certainly naturally occurring background (pre-existing) gas (e.g., NEPAGW04, NEPAGW08, and NEPAGW17). However, in other cases, such as at NEPAGW01, NEPAGW02, NEPAGW06, NEPAGW13, NEPAGW18, NEPAGW20, NEPAGW23, NEPAGW37, and NEPAGW38, gas other than background gas appears to have entered the homeowner well. At several of these locations (e.g., NEPAGW01, NEPAGW02, and NEPAGW23), the gas clearly appears to be originating from shallower depths (Upper Devonian formations), based on the much greater isotopic fractionation of the gas relative to Marcellus Shale gas, the high methane-to-ethane ratios, and the absence of isotope reversal. However, for the cluster of homeowner wells NEPAGW13, NEPAGW18, NEPAGW20, NEPAGW37, and NEPAGW38, the gas appears to be originating from deeper formations—likely the Middle Devonian and possibly the Marcellus Shale itself—also based on observed isotopic signatures, methane-to-ethane ratios, and isotope reversal differences. Linking gas in homeowner wells to a specific formation such as the Marcellus Shale is challenging given the range of isotopic signatures and isotope reversal differences that can be characteristic of a given formation, and the significant overlap that apparently occurs with respect to isotopic signatures and isotope reversal magnitudes amongst the different formations. Recent work by Darrah et al. (2014) has shown that the evaluation of noble gases in combination with gas isotopic signatures may offer a potentially improved means of distinguishing amongst gases originating from different formations.

Homeowner well location NEPAGW08 was of particular interest in this study because hydraulic fracturing was carried out at a nearby well pad during the course of the study between the first and second rounds of sampling. This homeowner well is located in a stream/river valley setting that some researchers believe would be more vulnerable to stray gas impacts from hydraulic fracturing of Marcellus Shale because of the more extensive natural bedrock fracturing that is believed to be characteristic of these settings. Gas isotope data and methane-to-ethane ratio data collected from NEPAGW08 both before and after hydraulic fracturing (stimulation) on the nearby well pad are not consistent with the entry of Marcellus Shale gas into the homeowner well. The data from this study, combined with operator pre-drill data, also do not indicate any impacts from fluids injected or produced in association with hydraulic fracturing conducted at the nearby well pad.

The key observations/findings from this study are summarized below.

- No evidence of impacts from flowback water, produced water, or injected hydraulic fracturing fluids on homeowner wells and springs sampled in this study was indicated. Detections of inorganic and organic constituents (other than methane and ethane) in ground water samples could not be attributed to hydraulic fracturing activities.
- Evidence did indicate one or more homeowner wells have been impacted by stray gas associated with nearby hydraulic fracturing activities. Stray gas (in the form of methane and ethane) entering homeowner wells can account for observed changes to well water appearance

and quality (e.g., effervescing, increased turbidity, discoloration) reported by some homeowners.

- The specific formation(s) from which stray gas is originating could not be determined with certainty although stray gas appears to be primarily—if not entirely—originating from formations above the Marcellus Shale. The inability to determine the specific formation(s) from which gas is originating is due to the overlap of isotopic signatures (including isotope reversal differences) that can occur amongst the different formations in the study area.
- Gas isotope data for one cluster of homeowner wells in the study indicated gas in the homeowner wells likely originated from deeper Middle Devonian strata and possibly the Marcellus Shale itself. The isotopic signatures observed were similar to that of gas from the annular space of a nearby Marcellus Shale gas well that had been drilled but not yet fractured.
- Iron and/or manganese concentrations exceeded secondary MCLs at over 40% of ground water locations sampled in the study consistent with historical data for the study area.
- The presence of total dissolved solids (TDS), chloride, sodium, barium, strontium, and combined radium-226 and radium-228 in a few homeowner wells at concentrations above those more commonly found in the study area is attributed to localized natural background conditions known to occur in the study area in certain valley settings.
- Elevated levels of chloride and total dissolved solids were observed in a homeowner pond (not used as a drinking water source) and may be due to past reported fluid and/or solid releases that occurred on an adjacent well pad where hydraulic fracturing activities had taken place. The elevated chloride and TDS concentrations in the pond are inconsistent with naturally occurring surface water concentrations in the study area.

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Appendix A
QA/QC Summary
Retrospective Case Study in Northeastern Pennsylvania

U.S. Environmental Protection Agency
Office of Research and Development
Washington, DC

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A.1. Introduction

This Appendix describes general Quality Assurance (QA) and results of Quality Control (QC) samples, including discussion of chain of custody (COC), holding times, blank results, field duplicate results, laboratory QA/QC results, data usability, double lab comparisons, performance evaluation samples, Quality Assurance Project Plan (QAPP) additions and deviations, field QA/QC, application of data qualifiers, tentatively identified compounds (TICs), Audits of Data Quality (ADQ), and field and laboratory Technical System Audits (TSAs). All reported data for the Retrospective Case Study in Northeastern Pennsylvania met project requirements unless otherwise indicated by the application of data qualifiers in the final data summaries. In rare cases, data were rejected as unusable and not reported.

A.1.1. October/November 2011 Sampling Event

The October/November 2011 sampling event and analytical activities were conducted under an approved QAPP titled "Hydraulic Fracturing Retrospective Case Study, Bradford-Susquehanna Counties, PA," revision 0, which was approved on October 5, 2011. Deviations from this QAPP are described in Section A9. Thirty-three domestic wells and two springs were sampled during this event. A total of 810 samples were collected and delivered to six laboratories for analysis: Shaw Environmental, Ada, OK; EPA Office of Research and Development/National Risk Management Research Laboratory (ORD/NRMRL), Ada OK; EPA Region 8, Golden, CO; EPA Region 3, Fort Meade, MD; Isotech Laboratories, Inc., Champaign, IL; and USGS Laboratory, Denver, CO. Measurements were made for over 225 analytes per sample location. Of the 810 samples, 277 samples (34%) were QC samples, including blanks and field duplicates, matrix spikes, and matrix spike duplicates.

A.1.2. April/May 2012 Sampling Event

The April/May 2012 sampling event and analytical activities were conducted under an approved QAPP titled "Hydraulic Fracturing Retrospective Case Study, Bradford-Susquehanna Counties, PA," revision 1 approved on April 12, 2012. Specific changes made to the quality assurance documentation are described in the revised QAPP. Deviations from this QAPP are described in Section A9. An Addendum to revision 1 approved on December 20, 2012, was prepared to document QC acceptance criteria for the reanalysis of samples for metals collected during the April/May 2012 sampling event. Twenty-two domestic wells, one spring, one pond (two locations), and one stream (two locations) were sampled during this event. A total of 745 samples were collected and delivered to eight laboratories for analysis: Shaw Environmental, Ada, OK; EPA ORD/NRMRL, Ada OK; EPA Region 8, Golden, CO; EPA Region 3, Fort Meade, MD; Isotech Laboratories, Inc., Champaign, IL; ALS Environmental, Fort Collins, CO; USGS Laboratory, Denver, CO; and Chemtech Consulting Group, Mountainside, NJ. Measurements were made for over 225 analytes per sample location. Of the 745 samples, 217 samples (29%) were QC samples, including blanks, field duplicates, matrix spikes, and matrix spike duplicates.

A.1.3. May 2013 Sampling Event

The May 2013 sampling event and analytical activities were conducted under an approved QAPP titled "Hydraulic Fracturing Retrospective Case Study, Bradford-Susquehanna Counties, PA," revision 2, approved on April 23, 2013. Specific changes made to the QA documentation are described in the revised QAPP. Deviations from this QAPP are described in Section A9. Twenty-one domestic wells and one spring were sampled during this event. A total of 659 samples were collected and delivered to eight laboratories for analysis: CB&I, Ada, OK; EPA ORD/NRMRL, Ada OK; SWRI, San Antonio, TX; EPA Region 8, Golden, CO; EPA Region 3, Fort Meade, MD; Isotech Laboratories, Inc., Champaign, IL; ALS Environmental, Fort Collins, CO; and USGS Laboratory, Denver, CO. Note that the Shaw Environmental laboratory name changed to CB&I for the final round of sampling (same laboratory equipment, procedures, and staff). Measurements were made for over 225 analytes per sample location. Of the 659 samples, 226 samples (34%) were QC samples, including blanks and field duplicates. Additional QC samples included matrix spikes and matrix spike duplicates per the requirements specified in the QAPP.

A final version of the QAPP titled "Hydraulic Fracturing Retrospective Case Study, Marcellus Shale, Bradford-Susquehanna Counties, PA," revision 3, was approved on October 25, 2013. The QAPP is available at http://www2.epa.gov/sites/production/files/documents/bradford-review-casestudy.pdf.

A.2. Chain of Custody

Sample types, bottle types, sample preservation methods, analyte holding times, and laboratories that received samples for analysis are listed in Table A1. Samples collected in the field were packed on ice and placed into coolers for shipment by overnight delivery with completed COC documents and temperature blank containers. In general, all samples collected in the field were successfully delivered to the laboratories responsible for conducting analyses. The following sections describe any noted issues related to the sample shipments and potential impacts on data quality.

A.2.1. October/November 2011 Sampling

Both of the bottle lids for the TPH-DRO fraction of sample NEPAGW26 were broken when received by the Region 8 lab. The samples were still intact and were analyzed. There is a potential impact (positive or negative) that is taken into account for data usability.

Both of the bottle lids for the 8270 fraction of sample NEPAGW25 were broken when received by the Region 8 lab. The samples were still intact and were analyzed. There is a potential impact (positive or negative) that is taken into account for data usability.

A.2.2. April/May 2012 Sampling

A cooler received on May 3, 2012, by Shaw Environmental had only one of two COC seals intact. The second COC seal was intact and the cooler was securely taped on both sides. There was no impact on data quality, and affected sample results were not qualified.

A.2.3. May 2013 Sampling

A cooler shipped on May 3, 2012, to Isotech Laboratories, Inc., with samples for methane, ethane, and dissolved inorganic carbon (DIC) isotope analyses was missing a 60-milliliter (mL) bottle that should have contained sample NEPAGW32 for isotope analysis of DIC. A sample was instead pulled from a second larger (1-L) bottle containing water collected from NEPAGW32 to be analyzed for isotopes of methane and ethane. There was no expected impact on data quality, and the sample results were not qualified.

The SWRI laboratory measured pH >2 in dissolved metals sample NEPAGW10 and in a dissolved metals equipment blank and total metals equipment blank collected on May 11, 2013. The laboratory added nitric acid to bring the pH below 2 and allowed the samples to sit several days prior to analysis. There was no expected impact on data quality, and the sample results were not qualified.

A.3. Holding Times

Holding times are the length of time a sample can be stored after collection and prior to analysis without significantly affecting the analytical results. Holding times vary with the analyte, sample matrix, and analytical methodology. Sample holding times for the various analyses conducted in this investigation are listed in Table A1 and range from 7 days to 6 months. Generally, estimated analyte concentration for samples with holding time exceedances are considered to be biased low.

A.3.1. October/November 2011 Sampling

Volatile organic compound (VOC) samples collected on November 1, November 2, and November 3, 2011, exceeded the 14-day holding time by up to 48 hours. The affected sample results (see Appendix B) have an "H" qualifier for all analytes. Impact on data usability is considered minimal since the exceedance was limited. VOCs were not detected in any of the affected samples.

Some samples were reanalyzed (due to instrument sensitivity issues) for acrylonitrile and styrene more than 65 days past holding time. The affected sample results (see Appendix B) were qualified with an "H". The data are considered unusable due to the long holding time.

A.3.2. April/May 2012 Sampling

Samples analyzed for bromide did not meet holding times by up to 26 days. This is because an alternative method of Br analysis (RSKSOP-288) was ultimately required due to continued significant interference problems posed by the high chloride content in some samples. The data are considered usable with caution.

For semivolatile organic compounds (SVOCs), sample NEPAGW36 was extracted four hours past the holding time. The "H" qualifier was applied to all the results for this sample. Since the holding time exceedance was minor, the data is considered usable. The field blank collected on April 30, 2012, was extracted 20 minutes past the holding time. The "H" qualifier was applied to all the results for this sample. Since the holding time exceedance was insignificant, the data are considered usable.

A.3.3. May 2013 Sampling

All samples met holding times.

A.4. Blank Samples Collected During Sampling

An extensive series of blank samples were collected during all sampling events, including field blanks, equipment blanks, and trip blanks (Table A2). These QC samples were intended to test for possible bias from potential sources of contamination during field sample collection, equipment cleaning, sample bottle transportation to and from the field, and laboratory procedures. The same source of water was used for the preparation of all blank samples (Barnstead NANOpure Diamond UV water). Field blanks were collected to evaluate potential contamination from sample bottles and environmental sources. Equipment blanks were collected to determine whether cleaning procedures or sample equipment (filters, fittings, tubing) potentially contributed to analyte detections. Trip blanks consisted of serum bottles or VOC vials filled with NANOpure water and sealed in the laboratory. Trip blanks were used to evaluate whether VOC and dissolved gas serum bottles were contaminated during sample storage, sampling, or shipment to and from the field. All analyses have associated field and equipment blanks, except for field parameters and isotope analyses for which no blank sampling schemes are appropriate. Sample bottle types, preservation, and holding times were applied to blank samples in the same way as they were applied to field samples (Table A1).

The following criteria were used for flagging samples with potential blank contamination. Sample contamination was considered significant if analyte concentrations in blanks were above the method quantitation limit (QL) and if the analyte was present in an associated field sample at a level <10× the concentration in the blank. In cases where both the sample and its associated laboratory, equipment, field, or trip blank were between the method detection limit (MDL) and the QL, the sample data were reported as less than the QL with a “U” qualifier. Blank samples were associated to field samples by dates of collection; for example, most sample shipments included both field samples and blank samples that were used for blank assessments. Results of blanks analyses are reported in Tables A3-A12. In general, field blank samples were free from detections of the vast majority of analytes examined in this study. The following sections describe instances where blank detections were noted and potential impacts on data quality and usability. As previously stated, a majority of these blanks were free from detections or were less than QL, and in these cases, the sample data were not affected and are not discussed in the following sections.

A.4.1. October/November 2011 Sampling

Dissolved organic carbon (DOC) was reported just above the QL in one equipment blank collected on October 26, 2011 (Table A3); four affected samples collected on October 26, 2011, are qualified with “B” as estimated. Affected sample concentrations are similar to the blank; therefore, the data is considered unusable.

Acetate was detected above the QL in all field blanks and the equipment blank (Table A7). (It was later determined that the TSP preservative was the source of the acetate contamination.) All acetate data were qualified with “R” and rejected as unusable. The field blanks collected on October 31, 2011, November 2, 2011, and November 3, 2011, also contained formate above the QL. The “B” qualifier was applied for formate to affected samples NEPAGW18 and NEPAGW19, and NEPAGW25 through NEPAGW30 (Table A7). Formate detections in the field samples were similar to detections in the field blanks, thus making the data unusable.

Dissolved gases were detected in trip blanks for October 25 and 26, 2011, and equipment blank for October 31, 2011 (Table A8), due to carryover in the gas chromatograph from standards analyzed prior to blanks being analyzed. The “B” qualifier was applied to affected samples NEPAGW05, NEPAGW07, and NEPAGW19. Methane results for the affected samples were too close to blank results and the data was thus deemed unusable. Ethane results are ~6x the blank values and may be usable with caution.

Bis-(2-ethylhexfyl) adipate was detected in four field blanks above the QL (Table A10), likely due to the detection of the compound in laboratory method blanks. This resulted in the "B" qualifier being applied to a total of 16 field samples whose values were <10x that of the respective method blank detections. The values for the samples qualified with "B" were close to the values of the method blanks, and the data were thus deemed unusable. Bis-(2-ethylhexyl) adipate was also detected in an equipment blank above the QL; however, bis-(2-ethylhexyl) adipate in the associated field samples was not detected above the QL. Bis-(2-ethylhexyl) phthalate was also detected in laboratory method blanks, resulting in affected sample results being qualified with "B". The values of the sample results qualified with "B" were close to the values for the method blanks, and the data were thus deemed unusable.

A.4.2. April/May 2012 Sampling

Two equipment blanks had DOC detections above the QL (Table A3). DOC concentrations in affected samples NEPASW05, NEPASW06, NEPAGW36, and NEPAGW29 were less than 10x the associated equipment blank values, and the results were thus qualified with "B". DOC concentrations in NEPASW05 and NEPASW06 were almost 10x the equipment blank value and were deemed usable with caution. Values for NEPAGW29 and NEPAGW36 were near the associated equipment blank value and were deemed unusable.

All dissolved metal blanks were free from detectable analyte concentrations (Table A4), with the exception of dissolved phosphorus in one blank. Dissolved phosphorus was not detected in the associated samples. Detections of total metals in blank samples were all below the QL, except for sulfur in one field blank collected on April 30, 2012 (Table A5), requiring the "B" qualifier be applied to the results for the three associated field samples.

Total sulfur was detected above the QL in a field blank collected on April 30, 2012 (Table A5). The "B" qualifier was applied to the results for affected samples (NEPAGW15, NEPASW01, and NEPAGW32). Results for the affected samples were close to the equipment blank results and were thus deemed unusable.

Formate was detected in a field blank at the QL (Table A7). The results for the affected samples (NEPAGW02, NEPAGW03, NEPASW04 and NEPASW04dup) were qualified with "B". Values for NEPAGW03, NEPASW04 and NEPASW04dup were near the values of the field blank and were thus deemed unusable. The value for NEPAGW02 was more than 9 times the field blank value data and the data was thus deemed usable with caution.

DRO was detected at a concentration equal to the QL in a field blank collected on May 1, 2012 (Table A11). However, there was no impact on data quality because the one associated field sample (NEPAGW29) collected on the same day did not show detectable levels of DRO above the QL.

A.4.3. May 2013 Sampling

Methane was detected in some argon laboratory blanks during analysis, which in one case impacted sample NEPAGW03. The methane concentration for this sample was close to the blank value and is thus unusable.

Dissolved arsenic was detected above the QL in an equipment blank collected on May 14, 2013 (Table A4). The "B" qualifier was applied to the results for the affected samples (NEPASW01, NEPAGW15, NEPAGW16, and NEPAGW29). The results for the affected samples were sufficiently close to the value for the equipment blank to make the data unusable.

Dissolved Cu was detected above the QL in a field blank collected on May 15, 2013, and in two equipment blanks collected on May 11 and 14, 2013 (Table A4). The "B" qualifier was applied to the results for the affected samples (NEPAGW06, NEPAGW10, NEPAGW12, NEPAGW16, NEPAGW28, and NEPAGW28dup). The results for the affected samples were either less than (NEPAGW06 and NEPAGW16) or sufficiently close to the equipment blank value to make the data unusable.

In a number of field and equipment blanks, total metals were detected at concentrations above the QL (Table A5), requiring the "B" qualifier be applied to the associated sample results. These included five samples for total arsenic because two equipment blanks exceeded the QL; five samples for total copper because one equipment blank exceeded the QL; eight samples for total molybdenum because one equipment blank and one field blank exceeded the QL; two samples for total nickel because one equipment blank exceeded the QL; seven samples for total lead because two equipment blanks exceeded the QL; and three samples for total zinc because one field blank exceeded the QL. With the exception of total nickel and total zinc for NEPAGW12, total metals results for the affected samples were sufficiently close to the blank values to make the data unusable. All sample results for total vanadium (except for one sample) required the "B" qualifier be applied due to the detection of total vanadium in laboratory blanks (Table A5). For total vanadium, samples NEPAGW38 and NEPAGW38dup are usable with caution; the vanadium data for all other samples are too close to the blank value to be usable.

For semi-volatile organic compound (SVOC) analysis, the results for the equipment blank collected on May 14, 2013, were rejected (see Table A10) because the sample "dried up during extraction." The equipment blank had a lower-than-acceptable internal standard response for all but one internal standard (1,4-dichlorobenzene). All surrogates were well below the acceptable range. The QC results for internal standards and surrogate recoveries, along with the analyst notation on the raw data form, indicate that, for all intents and purposes, the sample was lost. All data for this equipment blank are qualified "R" and are rejected and unusable. Bis-(2-ethyl hexyl) phthalate was detected above the QL in field blanks collected on May 9 and 10, 2013, and in an equipment blank collected on May 9, 2013, requiring that the "B" qualifier be applied to the results for one field sample, NEPAGW14. Bis-(2-ethyl hexyl) phthalate was detected above the QL in a laboratory method blank associated with these samples, requiring the results for these field blanks and equipment blank to be qualified "B." These data are unusable for bis-(2-ethyl hexyl) phthalate as their concentrations are similar to the laboratory method blanks.

Diesel range organics (DROs) were detected above the QL in two of the six field blanks collected and in all six equipment blanks collected (Table A11). The likely source of the DRO in the blanks was peristaltic pump tubing used to facilitate collection of the blanks. DRO was detected above the QL in only one sample, NEPASW01, and although a peristaltic pump was not used to collect the sample, the "B" qualifier was nevertheless applied. The data for this sample is considered unusable.

Field and equipment blanks were not collected for radiologicals in the final round of sampling. However, on each day samples were collected, samples from at least two sampling locations showed Ra-226, Ra-228, gross alpha, and gross beta values below reporting limits. These samples with values below the reporting limits can thus be considered in place of field and equipment blanks. Results for radiologicals (Ra-226, Ra-228, gross alpha, and gross beta) above reporting limits are thus considered valid and usable.

A.5. Duplicate Samples

Field duplicate samples were collected to measure the reproducibility and precision of field sampling and analytical procedures. The relative percent difference (RPD) was calculated to compare concentration differences between the primary (sample 1) and duplicate sample (sample 2) using the following equation:

$$\text{RPD }(\%) = ABS\left(\frac{2 \times (\text{sample } 1 - \text{sample } 2)}{(\text{sample } 1 + \text{sample } 2)}\right) \times 100 \cdot$$

RPDs were calculated when the constituents in both the primary sample and duplicate sample were >5 times the method QLs. Sample results are qualified if RPDs are $>30\%$.

A.5.1. All Sampling Events

Field duplicate results and calculated RPDs are presented in Tables A13 to A25 for each analytical method. The field duplicates were evaluated for all parameters for which duplicate samples were analyzed in each respective round. The only parameters that required qualification based on RPDs not meeting the 30% criteria were the dissolved gases methane and ethane in sample NEPAGW02 from Round 1 in October 2011. The RPDs were 37% for methane and 40% for ethane. Data from the original sample are usable. All other duplicates for dissolved gas in all rounds showed good precision.

Field duplicate precision was assessed for select samples with results greater than 5 times the QL for anions (Table A13), dissolved metals (Table A14), total metals (Table A15), DRO/GRO (Table A21), and isotopic analyses (Tables A22, A23, and A24). The field duplicate results were non-detect or less than 5 times the QL for all other analyses.

A.6. Laboratory QA/QC Results and Data Usability Summary

The QA/QC requirements for laboratory analyses conducted as part of this case study are provided in the QAPPs. Table A26 summarizes laboratory QA/QC results identified during sample analysis, such as laboratory duplicate analysis, laboratory blank analysis, matrix spike results, calibration, continuing calibration checks, as well as field QC. Impacts on data quality and usability as well as any issues noted in the QA/QC results are also presented in Table A26. Data qualifiers are listed in Table A28. Many of the specific QA/QC observations noted in the Audits of Data Quality are summarized in Table A26.

A majority of the reported data met project requirements. Data that did not meet QA/QC requirements specified in the QAPP are indicated by the application of data qualifiers in the final data summaries. Data determined to be unusable were rejected and qualified with an “R.” Depending on the data qualifier, data usability is affected to varying degrees. For example, data qualified with a "B" would not be appropriate to use when the sample concentration is below the blank concentration. But as the sample data increase in concentration and approach 10x the blank concentration, they may be more appropriate to use. Data with a "J" flag is usable with the understanding that it is an approximate concentration, but the analyte is positively identified. A "J+" or "J-" qualifier indicates a potential positive or negative bias, respectively. An "H" qualifier, for exceeding sample holding time, is considered a negative bias. An "*" indicates that the data are less precise than project requirements. Each case is evaluated to determine the extent to which the data are usable or not (Table A26).

A.7. Double-lab Comparisons

No double-lab comparisons were conducted for this case study.

A.8. Performance Evaluation Samples

A series of performance evaluation (PE) samples were analyzed by the laboratories conducting critical analyses to support the Hydraulic Fracturing Retrospective Case Studies. The PE samples were analyzed as part of the normal QA/QC standard operating procedures (SOPs) and, in the case of certified laboratories, as part of the certification process and to maintain certification for that laboratory. Results of the PE tests are presented in tabular form in the Wise County, Texas, Retrospective Case Study QA/QC Appendix and are not repeated here. These tables present the results of 1,354 tests; 98.6% of the reported values fell within the acceptance range. For the ORD/NRMRL Laboratory, a total of 95 tests were performed, with 96.9% of the reported values falling within acceptable range. Similarly, for the Shaw Environmental Laboratory, a total of 835 tests were performed, with 98.7% of the reported values falling within the acceptable range. For the EPA Region 8 Laboratory, a total of 424 tests were performed, with 98.8% of the reported values falling within the acceptable range. These PE sample results demonstrate the high quality of analytical data reported here. Analytes not falling within the acceptable range were examined, and corrective action was undertaken to ensure data quality in future analysis.

A.9. QAPP Additions and Deviations

The October/November 2011 sampling event was conducted using the QAPP titled "Hydraulic Fracturing Retrospective Case Study, Bradford-Susquehanna Counties, PA," revision 0, which was approved on October 5, 2011. The April/May 2012 sampling event was conducted using the QAPP titled "Hydraulic Fracturing Retrospective Case Study, Bradford-Susquehanna Counties, PA," revision 1, which was approved on April 12, 2012. The May 2013 sampling event was conducted using the QAPP titled "Hydraulic Fracturing Retrospective Case Study, Bradford-Susquehanna Counties, PA," revision 2, which was approved on April 23, 2013.

A deviation from the proposed sampling procedures described in the QAPP was split sampling conducted during two of the three sampling events. During the October/November 2011 sampling event, incremental split sampling was initially conducted at the request of one of the operators. Incremental split sampling (which involved alternately adding sample water in increments to the bottles of the different stakeholders until all bottles were filled) was conducted only for non-volatile analytes, including metals, anions, and semi-volatiles, and at only three sampling locations (NEPAGW01, NEPAGW08, and NEPAGW09). Incremental split sampling was subsequently terminated (due to time constraints and concerns regarding samples in bottles remaining exposed to the elements for extended periods of time) in favor of split sampling using a Y-adapter that allowed simultaneous sampling by two parties. Y-adapter split sampling was continued for the duration of the October/November 2011 sampling event, but only at locations where homeowners permitted sampling by other stakeholders. The Y-adaptor was also used during the May 2013 sampling event at all sampling locations where homeowners permitted sampling by other stakeholders. There is no known adverse impact on data quality as a result of the split sampling procedures used in the study. The three locations where incremental split sampling was briefly employed in the first round were sampled in all three rounds, and no inconsistencies in water analyses were identified that would suggest any kind of impact from the procedure.

An additional deviation from the proposed sampling procedures was the collection of samples from location NEPAGW14 in pre-labeled NEPAGW15 bottles and the collection of samples from location NEPAGW15 in pre-labeled NEPAGW14 bottles during the April/May 2012 sampling round. This was the result of the pre-labeled NEPAGW15 bottles (rather than the NEPAGW14 bottles) having been mistakenly loaded into the sampling vehicle on the day NEPAGW14 was to be sampled. Rather than lose valuable time in the field driving back to the hotel to retrieve the pre-labeled NEPAGW14 bottles, a decision was made to collect the samples from NEPAGW14 in the pre-labeled NEPAGW15 bottles. Conversely, on the day NEPAGW15 was sampled, the samples from this location were collected in the pre-labeled NEPAGW14 bottles. The results for the two sampling locations have been properly reconciled and recorded in Appendix B tables (i.e., April/May 2012 analytical results for NEPAGW15-labeled samples were applied to location NEPAGW14 and vice versa). There is no impact on the data.

A deviation from planned analyses described in the QAPP was that none of the ICP-MS metals data from the October/November 2011 sampling event were reported. These data were not reported because of concerns about data quality. Instead, ICP-OES data were reported for the ICP-MS metals As, Cd, Cr, Cu, Ni, Pb, and Se. ICP-MS data were collected for the April/May 2012 and May 2013 sampling events. In general, the ICP-OES trace metal data cannot be compared with the subsequent ICP-MS data; therefore, trace metal evaluations consider only data collected during the last two sampling events. Information about the ICP-OES concentrations of As, Cd, Cr, Cu, Ni, Pb, and Se from the first round is considered to be for screening level evaluation.

Analysis of the original ICP-MS results for the April/May 2012 sampling event indicated that the laboratory did not analyze interference check solutions (ICSs) as described in EPA Method 6020A. These ICSs would have enabled the laboratory to evaluate the analytical method’s ability to appropriately handle known potential interferences and other matrix effects. In ICP-MS analysis, the ICS is used to verify that interference levels are corrected by the data system within quality control limits. Because of the importance of this missing quality control check, it was deemed necessary to reject the data from the original analysis. Because samples were within the method holding time, reanalysis was conducted by the EPA Superfund Analytical Services CLP for Al, As, Cd, Cr, Cu, Ni, Pb, Sb, Se, Th, Tl, and uranium (U) by ICP-MS. This additional work was completed under an Addendum to Revision 1 of the QAPP.

A.10. Field QA/QC

A YSI Model 556 electrodes and flow-cell assembly was used to measure temperature, specific conductance, pH, oxidation-reduction potential (ORP), and dissolved oxygen. YSI electrodes were calibrated in the morning of each sampling day. Performance checks were conducted after initial calibration, midday (when possible), and at the end of each day at a minimum (Table A27). Midday checks were not done every day of sampling. Since an end of the day check was done to verify the meter was still in calibration, it was confirmed that sample measurements were made with a system within control criteria. One exception was November 4, 2011, when an end-of-day performance check was either not recorded or not conducted. However, because all performance checks conducted throughout the entire study showed performance within acceptable limits without exception (Table A27), and because the YSI data collected from the final two locations on November 4, 2011, were consistent with readings measured at these same locations in the subsequent two rounds of sampling, there is no expected impact on data quality. NIST-traceable buffer solutions (4.00, 7.00, and/or 10.01) were used for pH calibration and for continuing checks. YSI ORP standard was used for calibration of redox potential measurements. Oakton conductivity standard was used for calibration of specific conductance measurements. Dissolved oxygen sensors were calibrated with air each morning and checked with zero-oxygen solutions to ensure good performance at low oxygen levels. Table A27 provides the results of performance checks. Prior to field deployment, the electrode assembly and meter were checked to confirm good working order. Field performance checks were within acceptance limits (Table A27).

Field parameters for this case study location consisted of turbidity, alkalinity, total dissolved sulfide species (ΣH_2S), and ferrous iron. Because all sample preparations and measurements were made in an uncontrolled environment (i.e., the field), concentration data for these parameters are qualified in all cases as estimated. The turbidity was measured using a HACH 2100Q Portable Turbimeter, which was calibrated using a HACH 2100Q StablCal Calibration Set. The HACH 2100Q StablCal Calibration Set consists of the 20 nephelometric unit (NTU), 100 NTU, and 800 NTU standards, with a 10 NTU calibration verification standard. For alkalinity measurements, a HACH Model AL-DT Digital Titrator was used. The total dissolved sulfide species and ferrous iron measurements were collected using HACH DR2700 and DR890 spectrometers, respectively. The equipment for measuring alkalinity, total dissolved sulfide species, and ferrous iron measurements were tested in the lab prior to field deployment using known standards. In the field, a blank sample (distilled water) was measured to confirm that no cross contamination had occurred. This was also the case for turbidity; however, a 10 NTU standard was also used to verify the calibration.

A.11. Data Qualifiers

Data qualifiers and their definitions are listed in Table A28. Many factors can impact the quality of data reported for environmental samples, including factors related to sample collection in the field, transport of samples to laboratories, and the work conducted by various analytical laboratories. The list of qualifiers in Table A28 is based on the Data Qualifier Definitions presented in the EPA CLP National Functional Guidelines for Superfund Organic Methods Data Review (USEPA/540/R-01, 2008) and the EPA CLP National Functional Guidelines for Superfund Inorganic Methods Data Review

(USEPA/540/R/10/011, 2010) with the addition of data qualifiers “H” and “B”, which are necessary for communicating issues that occur during analysis in laboratories not bound by the CLP statement of work. The “R” qualifier is used in cases where it was determined that data need to be rejected. Data rejection can occur for many reasons and must be explained in the QA/QC narratives. Conditions regarding the application of qualifiers include:

- If the analyte was not detected, then it was reported as <QL and qualified with U.
- If the analyte concentration was between the MDL and QL, then it was qualified with J.
- If the analyte concentration was <QL, then the B qualifier was not applied.
- If both the analyte and an associated blank concentration were between the MDL and QL, then the sample results were reported as <QL and qualified with U.
- For samples associated with high matrix spike recoveries, the J+ qualifier was not applied if the analyte was <QL.
- For samples associated with low matrix spike recoveries, the J- qualifier was applied to the analyte with low recovery regardless of analyte concentration (< or > QL).

A.12. Tentatively Identified Compounds

The EPA Region 8 Laboratory reported tentatively identified compounds (TICs) from SVOC analyses. Several SVOC TICs were identified in samples and blanks (Tables A29). To be identified as a TIC, a peak had to have an area at least 10% as large as the area of the nearest internal standard and a match quality greater than 80. The TIC match quality is based on the number and ratio of the major fragmentation ions. A perfect match has a value of 99. Although the TIC report is essentially a qualitative report, an estimated concentration is calculated based on a response factor of 1.00 and the area of the nearest internal standard. The search for TICs includes the whole chromatogram from approximately 3.0 to 41.0 minutes for SVOCs. TICs are compounds that can be detected, but, without the analysis of standards, cannot be confirmed or reliably quantified. Oftentimes, TICs are representative of a class of compounds rather than indicating a specific compound. Only the top TIC is reported for each peak.

A.13. Audits of Data Quality

An ADQ was performed for each sampling event per EPA’s NRMRL SOP, “Performing Audits of Data Quality (ADQs),” to verify that requirements of the QAPP were properly implemented for the analysis of critical analytes for samples submitted to laboratories identified in the QAPPs associated with this project. The ADQs were performed by a QA support contractor, Neptune and Company, Inc., and reviewed by NRMRL QA staff. NRMRL QA staff provided the ADQ results to the project Principal Investigator for response and assisted in the implementation of corrective actions. The ADQ process is an important element of Category I (highest of four levels in EPA ORD) Quality Assurance Projects, which this study operated under for all aspects of ground water sample collection and analysis.

Complete data packages were provided to the auditors for the October/November 2011, April/May 2012, and May 2013 sampling events. A complete data package consists of the following: sample information; method information; a data summary; laboratory reports; raw data, including QC results;

and data qualifiers. The QAPP was used to identify data quality indicator requirements and goals, and a checklist was prepared based on the types of data collected. The data packages were reviewed against the checklist by tracing a representative set of the data in detail from raw data and instrument readouts through data transcription or transference through data manipulation (either manually or electronically by commercial or customized software), and through data reduction to summary data, data calculations, and final reported data. All calibration and QA/QC data were reviewed for all available data packages. Data summary spreadsheets prepared by the Principal Investigator were also reviewed to determine whether data had been accurately transcribed from lab summary reports and appropriately qualified based on lab and field QC results.

The ADQs focused on the critical analytes, as identified in revision 3 of the QAPP. These are GRO; DRO; SVOCs (see footnote of Table 2 and Table 7 of QAPP); VOCs (ethanol, isopropyl alcohol, tert butyl alcohol, benzene, toluene, ethylbenzene, xylenes, and naphthalene); trace elements (As, Se, Sr, and Ba); major cations (Ca,Mg, Na, and K); and major anions (chloride and sulfate). Also included in the ADQ were the glycols and all metals analyzed. The non-conformances identified in an ADQ can consist of the following categories: (1) a finding (a deficiency that has or may have a significant effect on the quality of the reported results; a corrective action response is required); or (2) observation (a deficiency that does not have a significant effect on the quality of the reported results; a corrective action response is required). The ADQ for the October/November 2011 sampling event noted 1 finding and 10 observations; the April/May 2012 sampling event had 2 findings and 8 observations; and the May 2013 event had no findings and 15 observations. The ADQ findings and observations that had an impact on data quality and usability are found in Table A26, along with the corrective actions taken and data qualifications. All findings and observations were resolved through corrective actions.

A.14. Laboratory Technical System Audits

Laboratory Technical Systems Audits (TSAs) were conducted early in the project to allow for identification and correction of any issues that may affect data quality. Laboratory TSAs focused on the critical target analytes. Laboratory TSAs were conducted on-site at ORD/NRMRL Laboratory and Shaw Environmental [both laboratories are located at the Robert S. Kerr Research Center, Ada, OK] and at the EPA Region 8 Laboratory (Golden, CO), which analyzed for sVOCs, DRO, and GRO. Detailed checklists, based on the procedures and requirements specified in the QAPP, related SOPs, and EPA Methods, were prepared and used during the TSAs. These audits were conducted with contract support from Neptune and Co., with oversight by NRMRL QA Staff. The QA Manager tracked implementation and completion of any necessary corrective actions. The TSAs took place in July 2011. The TSAs found good QA practices in place at each laboratory. There were no findings and six observations across the three laboratories audited. All observations were resolved through corrective actions. The observations had no impact on the sample data quality.

A.15. Field TSAs

For Category 1 QA projects, TSAs are conducted on both field and laboratory activities. Detailed checklists based on the procedures and requirements specified in the QAPP, SOPs, and EPA Methods were prepared and used during the TSAs. The field TSA took place during the first sampling event in

October 2011 (audit date: October 27, 2011). Three observations were noted in the field TSA related to split (incremental) sampling, sulfide calibration checks, and dissolved gas collection. All observations were resolved through corrective actions. There was no impact on the sample data quality.

Appendix A Tables

Table A1. Sample containers, preservation, and holding times for water samples

Sample Type	Analysis Method (Lab Method)	Sample Bottles/ # of bottles[1]	Preservation/ Storage	Holding Time(s)	Sampling Rounds[2]
Dissolved Gases	Shaw Environmental[6]: No EPA Method (RSKSOP-194v4 &-175v5)	60-mL serum bottles/2	No headspace TSP[3], pH >10; refrigerate ≤6°C[4]	14 days	1, 2, 3
Dissolved Metals (Filtered)	Shaw Environmental: EPA Methods 200.7 & 6020A (RSKSOP-213v4 & -257v2 or -332v0)	125-mL plastic bottle/1	HNO_3, pH<2	6 months (Hg 28 days)	1, 2
Dissolved Metals (Filtered)	EPA Region 7 RASP Contract Southwest Research Institute: EPA Methods 200.7 & 6020A	1-L plastic bottle/1	HNO_3, pH<2	6 months	3
Total Metals (Unfiltered)	Shaw Environmental: Analysis- EPA Methods 200.7 & 6020A (RSKSOP-213v4 & -257v2 or -332v0); and Digestion- EPA Method 3015A (RSKSOP-179v3)	125-mL plastic bottle/1	HNO_3, pH<2	6 months	1, 2
Total Metals (Unfiltered)	EPA Region 7 RASP Contract Southwest Research Institute: EPA Methods 200.7 & 6020A; and Digestion EPA Method 200.7	1-L plastic bottle/1	HNO_3, pH<2	6 months	3
Trace Metals (Total and Dissolved)	EPA CLP Inorganic Statement of Work (SOW) ISM01.3, Exhibit D – Part B, "Analytical Methods for Inductively Coupled Plasma – Mass Spectrometry", with modifications as noted in QAPP revision 1 addendum	125-mL plastic bottle/1 for each total and dissolved fraction	HNO_3, pH<2	6 months	2
Sulfate (SO_4), Chloride (Cl), Fluoride (F), Bromide (Br)	ORD/NRMRL (Ada): EPA Method 6500 (RSKSOP-276v3)	30-mL plastic bottle/1	Refrigerate ≤6°C	28 days	1, 2, 3

Table A1. Sample containers, preservation, and holding times for water samples

Sample Type	Analysis Method (Lab Method)	Sample Bottles/ # of bottles[1]	Preservation/ Storage	Holding Time(s)	Sampling Rounds[2]
Br	ORD/NRMRL (Ada): EPA Method 6500 (RSKSOP-288v3)	30-mL plastic bottle/1	Refrigerate ≤6°C	28 days	2,3
Nitrate+Nitrite (NO_3+NO_2)	ORD/NRMRL (Ada): EPA 353.1 (RSKSOP-214v5)	60-mL plastic bottle/1	H_2SO_4, pH<2; refrigerate ≤6°C	28 days	1, 2, 3
Ammonia (NH_3)	ORD/NRMRL (Ada): EPA Method 350.1 (RSKSOP-214v5)	60-mL plastic bottle/1	H_2SO_4, pH<2; refrigerate ≤6°C	28 days	1, 2, 3
Dissolved Inorganic Carbon (DIC)	ORD/NRMRL (Ada): EPA Method 9060A (RSKSOP-330v0)	40-mL clear glass VOA vial/2	Refrigerate ≤6°C	14 days	1, 2, 3
Dissolved Organic Carbon (DOC)	ORD/NRMRL (Ada): EPA Method 9060A (RSKSOP-330v0)	40-mL clear glass VOA vial/2	H_3PO_4; refrigerate ≤6°C	28 days	1, 2, 3
Volatile Organic Compounds (VOC)	Shaw Environmental: EPA Method 5021A + 8260C (RSKSOP-299v1)	40-mL amber glass VOA vial/2	No headspace TSP[3], pH >10; refrigerate ≤6°C	14 days	1, 2
Volatile Organic Compounds (VOC)	EPA Region 7 RASP Contract Southwest Research Institute: EPA Methods 8260B	40-mL amber glass VOA vial/4	No headspace HCl, pH <2; refrigerate ≤6°C	14 days	3
Low-Molecular-Weight Acids	Shaw Environmental[6]: No EPA Method (RSKSOP-112v6)	40-mL amber glass VOA vial/2	TSP[3], pH >10; refrigerate ≤6°C	30 days	1, 2, 3
Semi-volatile organic compounds (SVOC)	EPA Region 8: EPA Method 8270D (ORGM-515 r1.1)	1-L amber glass bottle/2	Refrigerate ≤6°C	7 days extraction, 30 days after extraction	1, 2, 3
Diesel-Range Organics (DRO)	EPA Region 8: EPA Method 8015D (ORGM-508 r1.0)	1-L amber glass bottle/2	HCl, pH<2; refrigerate ≤6°C	7 days extraction, 40 days after extraction	1, 2, 3
Gasoline-Range Organics (GRO)	EPA Region 8: EPA Method 8015D (ORGM-506 r1.0)	40-mL amber VOA vial/2	No headspace HCl, pH <2; refrigerate ≤6°C	14 days	1, 2, 3
Glycols	EPA Region 3: No EPA Method (R3 Method[5])	40-mL amber VOA vial/2	Refrigerate ≤6°C	14 days	1, 2, 3

Table A1. Sample containers, preservation, and holding times for water samples

Sample Type	Analysis Method (Lab Method)	Sample Bottles/ # of bottles[1]	Preservation/ Storage	Holding Time(s)	Sampling Rounds[2]
$^{87}Sr/^{86}Sr$ Isotope Analysis	USGS: No EPA Method (Thermal ionization mass spectrometry)	500-mL plastic bottle/2	Refrigerate ≤6°C	6 months	1, 2, 3
^{226}Ra	ALS SOP783v9 (EPA Method 903.1)	1-L plastic/1	HNO_3, pH<2; room temperature	6 months	2, 3
^{228}Ra	ALS SOP746v9 (EPA Method 904.0)	2-L plastic/1	HNO_3, pH<2; room temperature	6 months	2, 3
Gross Alpha/Beta	ALS SOP702v20 & 724v11 (EPA Method 900.0)	1-L plastic/1	HNO_3, pH<2; room temperature	6 months	2, 3
O, H stable isotopes of water	Shaw Environmental: No EPA Method (RSKSOP-296v0); IRMS	20-ml glass VOA vial/1	Refrigerate ≤6°C	Stable	1
O, H stable isotopes of water	Shaw Environmental[6]: No EPA Method (RSKSOP-334v0); CRDS	20-ml glass VOA vial/1	Refrigerate ≤6°C	Stable	2, 3
$\delta^{13}C$ of inorganic carbon	Isotech; gas stripping and IRMS (No EPA Method)	60-mL plastic bottle/1	Refrigerate ≤6°C	14 days	1, 2, 3
$\delta^{13}C$ and $\delta^{2}H$ of methane	Isotech; gas stripping and IRMS (No EPA Method)	1-L plastic bottle/1	Caplet of benzalkonium chloride; refrigerate ≤6°C	3 months	1, 2, 3

[1] Spare bottles made available for laboratory QC samples and for replacement of compromised samples (broken bottle, QC failures, etc.).
[2] Sampling rounds occurred in October/November 2011 (round 1), April/May 2012 (round 2), and May 2013 (round 3).
[3] Trisodium phosphate.
[4] Above freezing point of water.
[5] EPA Methods 8000C and 8321 were followed for method development and QA/QC; method based on ASTM D773-11.
[6] Analyses in round 3 were performed by CB&I (name changed from Shaw).

Table A2. Field QC samples for ground water and surface water analysis

QC Sample	Purpose	Method	Frequency	Acceptance Criteria[1]/ Corrective Actions
Trip Blanks (VOCs and Dissolved Gases only)	Assess contamination during transportation.	Fill bottles with reagent water and preserve, take to field and return without opening.	One in an ice chest with VOA and dissolved gas samples.	<QL Samples are flagged when the analyte concentration was >QL, but <10X the concentration found in the blank.
Equipment Blanks	Assess contamination from field equipment, sampling procedures, decontamination procedures, sample container, preservative, and shipping.	Apply only to samples collected via equipment, such as filtered samples: Reagent water is filtered and collected into bottles and preserved same as filtered samples.	One per day of sampling.	
Field Blanks[1]	Assess contamination introduced from sample container with applicable preservation.	In the field, reagent water is collected into sample containers with preservatives.	One per day of sampling.	
Field Duplicates	Represent precision of field sampling, analysis, and site heterogeneity.	One or more samples collected immediately after original sample.	One in every 10 samples, or if <10 samples collected for a water typed (ground or surface), collect a duplicate for one sample.	RPD<30% for results > 5X the QL. Affected data were flagged as needed.
Temperature Blanks	Measure temperature of samples in the cooler.	Water sample that is transported in cooler to lab.	One per cooler.	The temperature was recorded by the receiving lab upon receipt.[2]

[1] Blank samples were not collected for isotope ratio measurements, including $^{18}O/^{16}O$, H^2/H, and $^{13}C/^{12}C$. [2] The PI was notified if the samples arrived with no ice and/or if the temperature recorded from the temperature blank was >6°C.

Table A3. DOC, DIC, Ammonia, and Anion Blanks

Sample ID	Date Collected	DOC	DIC	NO_3 + NO_2	NH_3	Br	Cl	SO_4^{2-}	F
Units		mg /L	mg /L	mg /L	mg /L	mg /L	mg /L	mg/L	mg /L
October 2011									
Field Blank	10/25/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	10/26/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	10/27/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	10/28/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	10/29/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	10/31/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	11/1/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	11/2/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	11/3/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	11/4/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	10/25/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	10/26/2011	0.26	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	10/27/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	10/28/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	10/29/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	10/31/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	11/1/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	11/2/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	11/3/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	11/4/2011	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
MDL		0.07	0.02	0.01	0.01	0.13	0.11	0.05	0.03
QL		0.25	1.00	0.10	0.10	1.00	1.00	1.00	0.20
Detection in samples		21/39	39/39	19/39	13/39	7/39	39/39	36/39	22/39
Concentration min		0.25	15.1	0.10	0.01	0.14	0.75	0.14	0.03
Concentration max		1.30	97.2	3.24	1.32	1.46	525	1200	0.52
April 2012									
Field Blank	4/24/2012	0.04	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	4/25/2012	0.04	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	4/26/2012	0.02	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	4/27/2012	0.03	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	4/28/2012	0.05	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20

Table A3. DOC, DIC, Ammonia, and Anion Blanks

Sample ID	Date Collected	DOC	DIC	$NO_3 + NO_2$	NH_3	Br	Cl	SO_4^{2-}	F
Units		mg /L	mg /L	mg /L	mg /L	mg /L	mg /L	mg/L	mg /L
Field Blank	4/30/2012	0.02	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank	5/1/2012	0.04	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	4/24/2012	0.23	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	4/25/2012	0.14	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	4/26/2012	0.39	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	4/27/2012	0.06	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	4/28/2012	0.15	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	4/30/2012	0.22	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank	5/1/2012	1.50	<1.00	<0.05	<0.10	<1.00	<1.00	<1.00	<0.20
QL		0.25	1.00	0.05	0.10	1.00	1.00	1.00	0.20
MDL		0.01	0.04	0.01	0.01	0.16	0.11	0.05	0.03
Detection in samples		20/30	30/30	14/30	8/30	9/30	30/30	27/30	25/30
Concentration min		0.25	7.75	0.06	0.14	0.18	0.72	0.77	0.04
Concentration max		7.48	103	2.81	1.42	4.70	495	1260	0.62
May 2013									
Field Blank1	5/9/2013	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank2	5/10/2013	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank3	5/11/2013	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank4	5/13/2013	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank5	5/14/2013	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Field Blank6	5/15/2013	<0.25	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank1	5/9/2013	0.15	<1.00	0.02	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank2	5/10/2013	0.23	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank3	5/11/2013	0.13	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank4	5/13/2013	0.17	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank5	5/14/2013	0.19	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
Equipment Blank6	5/15/2013	0.20	<1.00	<0.10	<0.10	<1.00	<1.00	<1.00	<0.20
QL		0.25	1.00	0.10	0.10	1.00	1.00	1.00	0.20
MDL		0.05	0.09	0.01	0.02	0.17	0.13	0.16	0.05
Detection in samples		14/25	25/25	14/25	12/25	5/25	25/25	20/25	23/25
Concentration min		0.22	19.1	0.01	0.02	0.19	0.75	7.15	0.05

Table A3. DOC, DIC, Ammonia, and Anion Blanks

Sample ID	Date Collected	DOC	DIC	NO_3 + NO_2	NH_3	Br	Cl	SO_4^{2-}	F
Units		mg /L	mg /L	mg /L	mg /L	mg /L	mg /L	mg/L	mg /L
Concentration max		1.09	94.5	2.49	0.83	2.09	440	1230	0.66

Table A4. Dissolved Metal Blanks

Sample ID	Date Collected	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L
October 2011																				
Field Blank	10/25/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Field Blank	10/26/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Field Blank	10/27/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Field Blank	10/28/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Field Blank	10/29/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Field Blank	10/31/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Field Blank	11/1/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Field Blank	11/2/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Field Blank	11/3/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Field Blank	11/4/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank	10/25/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank	10/26/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank	10/27/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank	10/28/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank	10/29/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank	10/31/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank	11/1/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank	11/2/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank	11/3/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank	11/4/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
Equipment Blank GW31	11/4/2011	<14	<494	<20	<333	<4	<10	<0.29	<4	<4	<7	<20	<67	<0.35	NA	<0.10	<14	<17	<1.71	<84
MDL		4	148	6	100	1	3	0.09	1	1	2	6	20	0.11		0.03	4	5	0.51	25
QL		14	494	20	333	4	10	0.29	4	4	7	20	67	0.35		0.10	14	17	1.71	84
Detection in samples		0/39	1/39	0/39	14/39	39/39	0/39	39/39	0/39	3/39	0/39	6/39	20/39	39/39		39/39	28/39	5/39	39/39	0/39
Concentration min		<14	336	<20	122	10	<10	9.21	<4	1	<7	6	32	0.73		1.89	7	6	2.04	<84
Concentration max		<14	336	<20	580	5180	<10	335	<4	3	<7	31	3260	3.92		127	1260	13	280	<84
April 2012																				
Field Blank	4/24/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Field Blank	4/25/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Field Blank	4/26/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Field Blank	4/27/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Field Blank	4/28/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Field Blank	4/30/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Field Blank	5/1/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Equipment Blank	4/24/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Equipment Blank	4/25/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Equipment Blank	4/26/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Equipment Blank	4/27/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Equipment Blank	4/28/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Equipment Blank	4/30/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
Equipment Blank	5/1/2012	<14	<20.0	<1.0	<333	<4	<10	<0.29	<1.0	<4	<2.0	<2.0	<67	<0.35	<10.0	<0.10	<14	<17	<1.71	<1.0
QL		14	20.0	1.0	333	4	10	0.29	1.0	4	2.0	2.0	67	0.35	10.0	0.10	14	17	1.71	1.0
MDL		4	2.2	0.18	100	1	3	0.09	0.06	1	0.06	0.11	20	0.11	3.1	0.03	4	5	0.51	0.11

Table A4. Dissolved Metal Blanks

Sample ID	Date Collected	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L
Detection in samples		0/30	6/30	12/30	11/30	30/30	0/30	30/30	0/30	9/30	0/30	11/30	21/30	30/30	25/30	30/30	26/30	0/30	29/30	5/30
Concentration min		<14	24.8	1.0	129	9.0	<10	12.1	<1.0	1	<2.0	2.2	28	0.29	14.5	1.96	6	<17	1.93	1.1
Concentration max		<14	297	6.0	571	4950	<10	352	<1.0	3	<2.0	14.2	3530	4.08	557	129	2700	<17	290	4.7

Table A4. Dissolved Metal Blanks

Sample ID	Date Collected	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L
May 2013																				
Field Blank1	5/9/2013	<10	<20	<0.2	<40	<5	<5	<0.10	<0.2	<5	<2	<0.5	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
Field Blank2	5/10/2013	<10	<20	<0.2	<40	<5	<5	<0.10	<0.2	<5	<2	<0.5	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
Field Blank3	5/11/2013	<10	<20	<0.2	<40	<5	<5	<0.10	<0.2	<5	<2	<0.5	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
Field Blank4	5/13/2013	<10	6.0	<0.2	<40	<5	<5	<0.10	<0.2	<5	<2	<0.5	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
Field Blank5	5/14/2013	<10	4.2	<0.2	<40	<5	<5	<0.10	<0.2	<5	0.45	0.33	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
Field Blank6	5/15/2013	<10	<20	<0.2	<40	<5	<5	<0.10	<0.2	<5	0.38	1.5	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
Equipment Blank1	5/9/2013	<10	<20	<0.2	<40	<5	<5	<0.10	<0.2	<5	<2	0.30	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
Equipment Blank2	5/10/2013	<10	<20	<0.2	<40	<5	<5	0.02	<0.2	<5	<2	<0.5	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
Equipment Blank3	5/11/2013	<10	<20	<0.2	<40	<5	<5	0.01	<0.2	<5	<2	2.7	<100	<0.5	<10	<0.05	<5	<0.5	0.02	<0.2
Equipment Blank4	5/13/2013	<10	6.3	0.05	<40	<5	<5	0.02	<0.2	<5	<2	<0.5	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
Equipment Blank5	5/14/2013	<10	4.3	0.92	<40	<5	<5	0.03	<0.2	<5	0.44	2.4	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
Equipment Blank6	5/15/2013	<10	5.1	<0.2	<40	<5	<5	0.02	<0.2	<5	0.45	<0.5	<100	<0.5	<10	<0.05	<5	<0.5	<0.25	<0.2
QL		10	20	0.2	40	5	5	0.10	0.2	5	2	0.5	100	0.5	10	0.05	5	0.5	0.25	0.2
MDL		0.6	3.5	0.04	4.2	0.1	0.1	0.01	0.1	1	0.3	0.2	14	0.05	0.4	0.003	0.2	0.15	0.01	0.2
Detection in samples		0/25	0/25	23/25	18/25	25/25	1/25	25/25	0/25	1/25	4/25	16/25	11/25	25/25	21/25	25/25	22/25	13/25	25/25	25/25
Concentration min		<10	<20	0.13	47.4	10.0	0.12	12.1	<0.2	1.7	0.39	0.26	107	0.65	11.5	2.01	0.22	0.58	2.79	0.41
Concentration max		<10	<20	5.6	582	2020	0.12	385	<0.2	1.7	0.74	26.2	3810	4.00	468	134	2560	3.00	336	13.0

Table A4. Dissolved Metal Blanks

Sample ID	Date Collected	P	Pb	S	Sb	Se	Si	Sr	Th	Ti	Tl	U	V	Zn
Units		mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011														
Field Blank	10/25/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Field Blank	10/26/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Field Blank	10/27/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Field Blank	10/28/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	5	R	<10	<50
Field Blank	10/29/2011	0.10	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Field Blank	10/31/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Field Blank	11/1/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Field Blank	11/2/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Field Blank	11/3/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Field Blank	11/4/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Equipment Blank	10/25/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Equipment Blank	10/26/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Equipment Blank	10/27/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Equipment Blank	10/28/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	6	R	<10	<50
Equipment Blank	10/29/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Equipment Blank	10/31/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Equipment Blank	11/1/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Equipment Blank	11/2/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Equipment Blank	11/3/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Equipment Blank	11/4/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
Equipment Blank GW31	11/4/2011	<0.06	<17	<0.46	R	<30	<0.43	<4	NA	<7	<17	R	<10	<50
MDL		0.02	5	0.14		9	0.13	1		2	5		3	15
QL		0.06	17	0.46		30	0.43	4		7	17		10	50
Detection in samples		1/39	0/39	36/39		6/39	39/39	39/39		2/39	0/39		0/39	2/39
Concentration min		0.10	<17	0.22		9	3.55	30		3	<17		<10	25
Concentration max		0.10	<17	384		21	9.09	11300		9	<17		<10	43
April 2012														
Field Blank	4/24/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Field Blank	4/25/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Field Blank	4/26/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Field Blank	4/27/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Field Blank	4/28/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Field Blank	4/30/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Field Blank	5/1/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Equipment Blank	4/24/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Equipment Blank	4/25/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Equipment Blank	4/26/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Equipment Blank	4/27/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Equipment Blank	4/28/2012	0.02	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Equipment Blank	4/30/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
Equipment Blank	5/1/2012	<0.06	<1.0	<0.46	<2.0	<5.0	<0.43	<4	R	<7	<1.0	R	<10	<50
QL		0.06	1.0	0.46	2.0	5.0	0.43	4		7	1.0	1.0	10	50
MDL		0.02	0.03	0.14	0.08	1.2	0.13	1		2	0.04	0.04	3	15

Table A4. Dissolved Metal Blanks

Sample ID	Date Collected	p	Pb	S	Sb	Se	Si	Sr	Th	Ti	Tl	U	V	Zn
Units		mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Detection in samples		6/30	2/30	21/30	0/30	9/30	30/30	30/30		1/30	0/30	9/18	0/30	1/30
Concentration min		0.02	1.3	0.30	<2.0	1.3	0.79	62		43	<1.0	1.4	<10	55
Concentration max		0.09	1.5	391	<2.0	7.3	9.14	9750		43	<1.0	5.6	<10	55

Table A4. Dissolved Metal Blanks

Sample ID	Date Collected	p	Pb	S	Sb	Se	Si	Sr	Th	Ti	Tl	U	V	Zn
Units		mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
May 2013														
Field Blank1	5/9/2013	<50	0.07	NR	<0.2	<2	<0.10	<2	<0.2	<5	<0.2	<0.2	<0.2	<5
Field Blank2	5/10/2013	<50	<0.2	NR	<0.2	<2	<0.10	<2	<0.2	<5	<0.2	<0.2	<0.2	<5
Field Blank3	5/11/2013	<50	<0.2	NR	<0.2	<2	<0.10	<2	<0.2	<5	<0.2	<0.2	<0.2	2.1
Field Blank4	5/13/2013	<50	<0.2	NR	<0.2	<2	<0.10	<2	<0.2	<5	<0.2	<0.2	<0.2	<5
Field Blank5	5/14/2013	6.3	<0.2	NR	<0.2	<2	<0.10	<2	<0.2	<5	<0.2	<0.2	<0.2	<5
Field Blank6	5/15/2013	11.6	<0.2	NR	<0.2	<2	<0.10	<2	<0.2	<5	<0.2	<0.2	<0.2	<5
Equipment Blank1	5/9/2013	<50	<0.2	NR	<0.2	0.43	<0.10	<2	<0.2	<5	0.10	<0.2	<0.2	1.9
Equipment Blank2	5/10/2013	<50	<0.2	NR	<0.2	<2	<0.10	<2	<0.2	<5	<0.2	<0.2	<0.2	<5
Equipment Blank3	5/11/2013	<50	0.08	NR	<0.2	<2	0.01	<2	<0.2	<5	<0.2	<0.2	<0.2	<5
Equipment Blank4	5/13/2013	<50	<0.2	NR	<0.2	<2	<0.10	<2	<0.2	<5	0.10	<0.2	<0.2	<5
Equipment Blank5	5/14/2013	10.5	<0.2	NR	<0.2	<2	<0.10	<2	<0.2	<5	<0.2	<0.2	0.94	<5
Equipment Blank6	5/15/2013	5.1	<0.2	NR	<0.2	<2	<0.10	<2	<0.2	<5	<0.2	<0.2	<0.2	<5
QL		50	0.2		0.2	2	0.10	2	0.2	5	0.2	0.2	0.2	5
MDL		4.5	0.05		0.1	0.4	0.005	0.1	0.1	0.2	0.05	0.05	0.02	0.5
Detection in samples		7/25	9/25		3/25	2/25	25/25	25/25	0/25	1/25	0/25	18/25	11/25	15/25
Concentration min		18.5	0.06		0.12	0.40	3.39	90.3	<0.2	5.1	<0.2	0.19	0.03	0.58
Concentration max		497	0.52		0.13	0.45	8.18	11100	<0.2	5.1	<0.2	7.0	0.25	49.2

Table A5. Total Metal Blanks

Sample ID	Date Collected	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L
October 2011																				
Field Blank	10/25/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	<22	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Field Blank	10/26/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	<22	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Field Blank	10/27/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	10	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Field Blank	10/28/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	8	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Field Blank	10/29/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	<22	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Field Blank	10/31/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	8	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Field Blank	11/1/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	<22	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Field Blank	11/2/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	<22	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Field Blank	11/3/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	<22	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Field Blank	11/4/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	13	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Equipment Blank	10/25/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	10/26/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	10/27/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	10/28/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	10/29/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	10/31/2011	<16	<548	<22	<370	<4	<11	<0.32	<4	<4	<8	<22	<74	<0.39	NA	<0.11	<16	<19	<1.90	<93
Equipment Blank	11/1/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	11/2/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	11/3/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	11/4/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank GW31	11/4/2011	<16	<548	<22	<370	2	<11	<0.32	<4	<4	<8	11	111	<0.39	NA	<0.11	<16	<19	<1.90	<93
MDL		4	164	7	111	1	3	0.10	1	1	2	7	22	0.12		0.03	4	6	0.57	28
QL		16	548	22	370	4	11	0.32	4	4	8	22	74	0.39		0.11	16	19	1.90	93
Detection in samples		1/39	9/39	1/39	14/39	39/39	0/39	39/39	0/39	1/39	2/39	12/39	32/39	39/39		39/39	31/39	5/39	39/39	0/39
Concentration min		30	166	9	123	10	<11	9.72	<4	12	4	7	22	0.75		2.00	5	6	2.07	<93
Concentration max		30	10700	9	580	5430	<11	346	<4	12	11	46	10700	5.25		126	2470	7	291	<93

Table A5. Total Metal Blanks

Sample ID	Date Collected	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L
April 2012																				
Field Blank	4/24/2012	<16	<20.0	<1.0	<370	<4	<11	<0.32	<1.0	<4	<2.0	<2.0	<74	<0.39	<10.0	<0.11	<16	<19	<1.90	<1.0
Field Blank	4/25/2012	<16	<20.0	<1.0	<370	<4	<11	<0.32	<1.0	<4	<2.0	<2.0	<74	<0.39	<10.0	<0.11	<16	<19	<1.90	<1.0
Field Blank	4/26/2012	<16	<20.0	<1.0	<370	<4	<11	<0.32	<1.0	<4	<2.0	<2.0	<74	<0.39	<10.0	<0.11	<16	<19	<1.90	<1.0
Field Blank	4/27/2012	<16	<20.0	<1.0	<370	<4	<11	<0.32	<1.0	<4	<2.0	<2.0	<74	<0.39	<10.0	<0.11	<16	<19	<1.90	<1.0
Field Blank	4/28/2012	<16	<20.0	<1.0	<370	<4	<11	<0.32	<1.0	<4	<2.0	<2.0	<74	<0.39	<10.0	<0.11	<16	<19	<1.90	<1.0
Field Blank	4/30/2012	<16	<20.0	<1.0	<370	<4	<11	<0.32	<1.0	<4	<2.0	<2.0	<74	<0.39	<10.0	<0.11	<16	<19	<1.90	<1.0
Field Blank	5/1/2012	<16	<20.0	<1.0	<370	<4	<11	<0.32	<1.0	<4	<2.0	<2.0	<74	<0.39	<10.0	<0.11	<16	<19	<1.90	<1.0
Equipment Blank	4/24/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	4/25/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	4/26/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	4/27/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	4/28/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	4/30/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	5/1/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
QL		16	20.0	1.0	370	4	11	0.32	1.0	4	2.0	2.0	74	0.39	10.0	0.11	16	19	1.90	1.0
MDL		4	2.2	0.18	111	1	3	0.10	0.06	1	0.06	0.11	22	0.12	3.1	0.03	4	6	0.57	0.11
Detection in samples		1/30	17/30	13/30	11/30	30/30	0/30	30/30	0/30	5/30	0/30	17/30	28/30	30/30	25/30	30/30	27/30	0/30	29/30	8/30
Concentration min		31	24.5	1.0	124	11	<11	12.3	<1.0	2	<2.0	2.1	26	0.67	14.5	2.05	7	<19	2.51	1.1
Concentration max		31	459	6.9	588	5130	<11	377	<1.0	3	<2.0	22.9	3810	4.57	567	144	2880	<19	287	3.5

Table A5. Total Metal Blanks

Sample ID	Date Collected	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L
May 2013																				
Field Blank1	5/9/2013	<10	<20	<0.2	<20	<2.5	<2.5	<0.05	<0.2	<2.5	<2	0.20	<50	<0.25	<5	<0.025	<2.5	0.18	<0.125	<0.2
Field Blank2	5/10/2013	<10	<20	<0.2	<20	<2.5	<2.5	<0.05	<0.2	<2.5	<2	<0.5	<50	<0.25	<5	<0.025	<2.5	<0.5	<0.125	<0.2
Field Blank3	5/11/2013	<10	<20	<0.2	<20	<2.5	<2.5	<0.05	<0.2	<2.5	<2	<0.5	<50	<0.25	<5	<0.025	<2.5	0.56	<0.125	<0.2
Field Blank4	5/13/2013	<10	<20	<0.2	<20	<2.5	<2.5	<0.05	<0.2	<2.5	<2	0.28	7.9	<0.25	<5	<0.025	<2.5	<0.5	<0.125	<0.2
Field Blank5	5/14/2013	<10	<20	<0.2	<20	<2.5	<2.5	<0.05	<0.2	<2.5	<2	<0.5	<50	<0.25	<5	<0.025	<2.5	<0.5	<0.125	<0.2
Field Blank6	5/15/2013	<10	<20	<0.2	<20	<2.5	<2.5	<0.05	<0.2	<2.5	<2	<0.5	11.6	<0.25	<5	<0.025	<2.5	<0.5	<0.125	<0.2
Equipment Blank1	5/9/2013	<10	<20	<0.2	<20	<2.5	<2.5	<0.05	<0.2	<2.5	<2	0.20	<50	<0.25	<5	<0.025	<2.5	0.48	<0.125	<0.2
Equipment Blank2	5/10/2013	<10	<20	<0.2	<20	<2.5	<2.5	<0.05	<0.2	<2.5	<2	5.5	<50	<0.25	<5	<0.025	<2.5	0.60	<0.125	<0.2
Equipment Blank3	5/11/2013	<10	<20	<0.2	<20	<2.5	<2.5	<0.05	<0.2	<2.5	<2	0.24	<50	<0.25	<5	<0.025	<2.5	0.18	<0.125	<0.2
Equipment Blank4	5/13/2013	<10	<20	0.21	<20	<2.5	<2.5	<0.05	<0.2	<2.5	0.59	<0.5	<50	<0.25	<5	<0.025	<2.5	<0.5	<0.125	<0.2
Equipment Blank5	5/14/2013	<10	<20	<0.2	<20	<2.5	<2.5	<0.05	<0.2	<2.5	0.79	<0.5	<50	<0.25	<5	<0.025	<2.5	<0.5	<0.125	<0.2
Equipment Blank6	5/15/2013	<10	<20	0.21	<20	<2.5	<2.5	<0.05	<0.2	<2.5	0.34	<0.5	<50	<0.25	<5	<0.025	<2.5	<0.5	<0.125	0.21
QL		10	20	0.2	20	2.5	2.5	0.05	0.2	2.5	2	0.5	50	0.25	5	0.025	2.5	0.5	0.125	0.2
MDL		0.6	3.5	0.04	2.1	0.05	0.05	0.005	0.1	0.5	0.3	0.2	7	0.023	0.2	0.003	0.1	0.15	0.004	0.2
Detection in samples		0/25	10/25	24/25	21/25	25/25	1/25	25/25	0/25	6/25	4/25	25/25	24/25	25/25	23/25	25/25	23/25	17/25	25/25	25/25
Concentration min		<10	20.0	0.29	24.4	9.4	0.05	12.5	<0.2	0.53	0.80	0.66	55.5	0.645	0.65	2.11	0.66	0.50	2.85	0.60
Concentration max		<10	1550	5.9	619	2050	0.05	370	<0.2	2.3	3.6	78.5	4720	4.23	460	141	2640	2.8	335	9.80

Table A5. Total Metal Blanks

Sample ID	Date Collected	P	Pb	S	Sb	Se	Si	Sr	Th	Ti	Tl	U	V	Zn
Units		mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011														
Field Blank	10/25/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Field Blank	10/26/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Field Blank	10/27/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Field Blank	10/28/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Field Blank	10/29/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Field Blank	10/31/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Field Blank	11/1/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Field Blank	11/2/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Field Blank	11/3/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Field Blank	11/4/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Equipment Blank	10/25/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	10/26/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	10/27/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	10/28/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	10/29/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	10/31/2011	< 0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	<56
Equipment Blank	11/1/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	11/2/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	11/3/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	11/4/2011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank GW31	11/4/2011	0.07	<19	<0.51	R	<33	<0.48	<4	NA	<8	<19	R	<11	49
MDL		0.02	6	0.15		10	0.14	1		2	6		3	17
QL		0.07	19	0.51		33	0.48	4		8	19		11	56
Detection in samples		8/39	1/39	32/39		0/39	39/39	39/39		10/39	0/39		2/39	2/39
Concentration min		0.02	26	0.16		<33	3.84	30		3	<19		4	30
Concentration max		0.33	26	376		<33	24.9	10100		374	<19		19	226

Table A5. Total Metal Blanks

Sample ID	Date Collected	p	Pb	S	Sb	Se	Si	Sr	Th	Ti	Tl	U	V	Zn
Units		mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
April 2012														
Field Blank	4/24/2012	<0.07	<1.0	<0.51	<2.0	<5.0	<0.48	<4	R	<8	<1.0	R	<11	<56
Field Blank	4/25/2012	<0.07	<1.0	<0.51	<2.0	<5.0	<0.48	<4	R	<8	<1.0	R	<11	<56
Field Blank	4/26/2012	<0.07	<1.0	<0.51	<2.0	<5.0	<0.48	<4	R	<8	<1.0	R	<11	<56
Field Blank	4/27/2012	<0.07	<1.0	<0.51	<2.0	<5.0	<0.48	<4	R	<8	<1.0	R	<11	<56
Field Blank	4/28/2012	<0.07	<1.0	<0.51	<2.0	<5.0	<0.48	<4	R	<8	<1.0	R	<11	<56
Field Blank	4/30/2012	<0.07	<1.0	1.72	<2.0	<5.0	<0.48	<4	R	<8	<1.0	R	<11	<56
Field Blank	5/1/2012	<0.07	<1.0	<0.51	<2.0	<5.0	<0.48	<4	R	<8	<1.0	R	<11	<56
Equipment Blank	4/24/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	4/25/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	4/26/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	4/27/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	4/28/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	4/30/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equipment Blank	5/1/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
QL		0.07	1.0	0.51	2.0	5.0	0.48	4		8	1.0	1.0	11	56
MDL		0.02	0.03	0.15	0.08	1.2	0.14	1		2	0.04	0.04	3	17
Detection in samples		13/30	4/30	24/30	0/30	6/30	30/30	30/30		10/30	0/30	9/22	2/30	1/30
Concentration min		0.02	1.2	0.41	<2.0	2.0	0.79	61		2	<1.0	1.4	4	90
Concentration max		0.10	3.1	385	<2.0	8.0	9.81	10300		80	<1.0	5.7	6	90

Table A5. Total Metal Blanks

Sample ID	Date Collected	p	Pb	S	Sb	Se	Si	Sr	Th	Ti	Tl	U	V	Zn
Units		mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
May 2013														
Field Blank1	5/9/2013	<25	<0.2	NR	<0.2	<2	<0.05	<2	<0.2	<2.5	<0.2	<0.2	0.32	<2.5
Field Blank2	5/10/2013	<25	<0.2	NR	<0.2	<2	<0.05	<2	<0.2	<2.5	<0.2	<0.2	0.33	0.34
Field Blank3	5/11/2013	<25	<0.2	NR	<0.2	<2	<0.05	<2	<0.2	<2.5	<0.2	<0.2	0.34	3.4
Field Blank4	5/13/2013	<25	<0.2	NR	<0.2	<2	<0.05	<2	<0.2	<2.5	<0.2	<0.2	0.31	<2.5
Field Blank5	5/14/2013	<25	<0.2	NR	<0.2	<2	<0.05	<2	<0.2	<2.5	<0.2	<0.2	0.26	<2.5
Field Blank6	5/15/2013	<25	<0.2	NR	<0.2	<2	<0.05	<2	<0.2	<2.5	<0.2	<0.2	0.31	<2.5
Equipment Blank1	5/9/2013	<25	<0.2	NR	<0.2	<2	<0.05	<2	0.17	<2.5	<0.2	<0.2	0.31	<2.5
Equipment Blank2	5/10/2013	<25	0.68	NR	<0.2	<2	0.08	<2	<0.2	<2.5	<0.2	<0.2	0.32	0.27
Equipment Blank3	5/11/2013	<25	0.09	NR	<0.2	<2	<0.05	<2	<0.2	<2.5	<0.2	<0.2	0.18	<2.5
Equipment Blank4	5/13/2013	<25	<0.2	NR	<0.2	<2	0.05	<2	0.18	<2.5	<0.2	<0.2	0.38	<2.5
Equipment Blank5	5/14/2013	<25	0.58	NR	<0.2	<2	<0.05	<2	<0.2	<2.5	<0.2	<0.2	0.32	<2.5
Equipment Blank6	5/15/2013	<25	<0.2	NR	<0.2	<2	<0.05	<2	<0.2	<2.5	<0.2	<0.2	0.38	<2.5
QL		25	0.2		0.2	2	0.05	2	0.2	2.5	0.2	0.2	0.2	2.5
MDL		2.2	0.05		0.1	0.4	0.002	0.1	0.1	0.1	0.05	0.05	0.02	0.25
Detection in samples		7/25	16/25		4/25	0/25	25/25	25/25	4/25	15/25	0/25	21/25	24/25	20/25
Concentration min		30.0	0.14		0.15	<2	3.53	90.4	0.10	0.12	<0.2	0.05	0.10	0.59
Concentration max		100	8.0		0.16	<2	8.39	12200	0.42	21.4	<0.2	6.4	2.7	72.4

Table A6. VOC Blanks

Sample ID	Date Collected	ethanol (64-17-5)	isopropanol (67-63-0)	acrylonitrile (107-13-1)	styrene (100-42-5)	acetone (67-64-1)	tert-butyl alcohol (75-65-0)	methyl tert-butyl ether (1634-04-4)	diisopropyl ether (108-20-3)	ethyl tert-butyl ether (637-92-3)	tert-amyl methyl ether (994-05-8)	vinyl chloride (75-01-4)	1,1-dichloroethene (75-35-4)	carbon disulfide (75-15-0)	methylene chloride (75-09-2)	trans-1,2-dichloroethene (156-60-5)	1,1-dichloroethane (75-34-3)	cis-1,2-dichoroethene (156-59-2)	chloroform (67-66-3)	1,1,1-trichloroethane (71-55-6)
Units		µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L
October 2011																				
Field Blank	10/25/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	10/26/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	10/27/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	10/28/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	10/29/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	10/31/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	11/1/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	11/2/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	11/3/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	11/4/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank	10/31/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/25/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/26/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/27/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/28/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/29/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/31/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	11/1/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	11/2/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	11/3/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	11/4/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
MDL		12.4	6.4	6.8	0.16	0.63	2.8	0.41	0.12	0.17	0.15	0.18		0.07	0.14	0.11	0.08	0.14	0.07	0.09
QL		100	25.0	25.0	0.5	1.0	5.0	1.0	1.0	1.0	1.0	0.5		0.5	1.0	0.5	0.5	0.5	0.5	0.5
Detection in samples		0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39		0/39	0/39	0/39	0/39	0/39	0/39	0/39
Concentration min		<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5		<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Concentration max		<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5		<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5

Table A6. VOC Blanks

Sample ID	Date Collected	ethanol (64-17-5)	isopropanol (67-63-0)	acrylonitrile (107-13-1)	styrene (100-42-5)	acetone (67-64-1)	tert-butyl alcohol (75-65-0)	methyl tert-butyl ether (1634-04-4)	diisopropyl ether (108-20-3)	ethyl tert-butyl ether (637-92-3)	tert-amyl methyl ether (994-05-8)	vinyl chloride (75-01-4)	1,1-dichloroethene (75-35-4)	carbon disulfide (75-15-0)	methylene chloride (75-09-2)	trans-1,2-dichloroethene (156-60-5)	1,1-dichloroethane (75-34-3)	cis-1,2-dichoroethene (156-59-2)	chloroform (67-66-3)	1,1,1-trichloroethane (71-55-6)
Units		µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L
April 2012																				
Field Blank	4/24/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4/25/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4/26/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4/27/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4/28/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4/30/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	5/1/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	4/24/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	4/25/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	4/29/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	5/1/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank	4/26/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank	4/30/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
QL		100	25.0	25.0	0.5	1.0	5.0	1.0	1.0	1.0	1.0	0.5		0.5	1.0	0.5	0.5	0.5	0.5	0.5
MDL		12.4	6.4	6.8	0.16	0.63	2.8	0.41	0.12	0.17	0.15	0.18		0.07	0.14	0.11	0.08	0.14	0.07	0.09
Detection in samples		0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30		1/30	0/30	0/30	0/30	0/30	1/30	0/30
Concentration min		<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5		0.30	<1.0	<0.5	<0.5	<0.5	5.53	<0.5
Concentration max		<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5		0.30	<1.0	<0.5	<0.5	<0.5	5.53	<0.5

Table A6. VOC Blanks

Sample ID	Date Collected	ethanol (64-17-5)	isopropanol (67-63-0)	acrylonitrile (107-13-1)	styrene (100-42-5)	acetone (67-64-1)	tert-butyl alcohol (75-65-0)	methyl tert-butyl ether (1634-04-4)	diisopropyl ether (108-20-3)	ethyl tert-butyl ether (637-92-3)	tert-amyl methyl ether (994-05-8)	vinyl chloride (75-01-4)	1,1-dichloroethene (75-35-4)	carbon disulfide (75-15-0)	methylene chloride (75-09-2)	trans-1,2-dichloroethene (156-60-5)	1,1-dichloroethane (75-34-3)	cis-1,2-dichoroethene (156-59-2)	chloroform (67-66-3)	1,1,1-trichloroethane (71-55-6)
Units		µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L
May 2013																				
Field Blank1	5/9/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank2	5/10/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank3	5/11/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank4	5/13/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank5	5/14/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank6	5/15/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank1	5/9/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank2	5/10/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank3	5/11/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank4	5/13/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank5	5/14/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank6	5/15/2013	<100	<10	<1	<0.5	0.20	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank1	5/9/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank2	5/10/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank3	5/11/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank4	5/13/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank5	5/14/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank6	5/15/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
QL		100	10	1	0.5	1	10	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MDL		63	7.4	0.07	0.05	0.28	4.9	0.07	0.08	0.11	0.51	0.14	0.09	0.10	0.10	0.07	0.06	0.10	0.05	0.09
Detection in samples		0/25	0/25	0/25	0/25	2/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	2/25	0/25	0/25	0/25	0/25	1/25	0/25
Concentration min		<100	<10	<1	<0.5	0.33	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.11	<0.5	<0.5	<0.5	<0.5	0.4	<0.5
Concentration max		<100	<10	<1	<0.5	8.3	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.12	<0.5	<0.5	<0.5	<0.5	0.4	<0.5

Table A6. VOC Blanks

Sample ID	Date Collected	carbon tetrachloride (56-23-5)	benzene (71-43-2)	1,2-dichloroethane (107-06-2)	trichloroethene (79-01-6)	toluene (108-88-3)	1,1,2-trichloroethane (79-00-5)	tetrachloroethene (127-18-4)	chlorobenzene (108-90-7)	ethylbenzene (100-41-4)	m+p xylene (108-38-3, 106-42-3)	o-xylene (95-47-6)	isopropylbenzene (98-82-8)	1,3,5-trimethylbenzene (108-67-8)	1,2,4-trimethylbenzene (95-63-6)	1,3-dichlorobenzene (541-73-1)	1,4-dichlorobenzene (106-46-7)	1,2,3-trimethylbenzene (526-73-8)	1,2-dichlorobenzene (95-50-1)	naphthalene (91-20-3)
Units		µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L
October 2011																				
Field Blank	10/25/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	10/26/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	10/27/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	10/28/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	10/29/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	10/31/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	11/1/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	11/2/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	11/3/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	11/4/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank	10/31/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/25/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/26/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/27/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/28/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/29/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	10/31/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	11/1/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	11/2/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	11/3/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	11/4/2011	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MDL		0.10	0.07	0.16	0.15	0.10		0.10	0.09	0.07	0.17	0.06	0.06	0.06	0.06	0.10	0.08	0.12	0.13	0.12
QL		0.5	0.5	0.5	0.5	0.5		0.5	0.5	1.0	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Detection in samples		0/39	0/39	0/39	0/39	1/39		0/39	0/39	0/39	0/39	0/39	0/39	0/39	2/39	0/39	0/39	0/39	0/39	0/39
Concentration min		<0.5	<0.5	<0.5	<0.5	0.24		<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	0.38	<0.5	<0.5	<0.5	<0.5	<0.5
Concentration max		<0.5	<0.5	<0.5	<0.5	0.24		<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	0.39	<0.5	<0.5	<0.5	<0.5	<0.5

Table A6. VOC Blanks

Sample ID	Date Collected	carbon tetrachloride (56-23-5)	benzene (71-43-2)	1,2-dichloroethane (107-06-2)	trichloroethene (79-01-6)	toluene (108-88-3)	1,1,2-trichloroethane (79-00-5)	tetrachloroethene (127-18-4)	chlorobenzene (108-90-7)	ethylbenzene (100-41-4)	m+p xylene (108-38-3, 106-42-3)	o-xylene (95-47-6)	isopropylbenzene (98-82-8)	1,3,5-trimethylbenzene (108-67-8)	1,2,4-trimethylbenzene (95-63-6)	1,3-dichlorobenzene (541-73-1)	1,4-dichlorobenzene (106-46-7)	1,2,3-trimethylbenzene (526-73-8)	1,2-dichlorobenzene (95-50-1)	naphthalene (91-20-3)
Units		µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L
April 2012																				
Field Blank	4/24/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4/25/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4/26/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4/27/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4/28/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	4/30/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank	5/1/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	4/24/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	4/25/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	4/29/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank	5/1/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank	4/26/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank	4/30/2012	<0.5	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
QL		0.5	0.5	0.5	0.5	0.5		0.5	0.5	1.0	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MDL		0.10	0.07	0.16	0.15	0.10		0.10	0.09	0.07	0.17	0.06	0.06	0.06	0.06	0.10	0.08	0.12	0.13	0.12
Detection in samples		0/30	0/30	0/30	0/30	0/30		0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30
Concentration min		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Concentration max		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table A6. VOC Blanks

Sample ID	Date Collected	carbon tetrachloride (56-23-5)	benzene (71-43-2)	1,2-dichloroethane (107-06-2)	trichloroethene (79-01-6)	toluene (108-88-3)	1,1,2-trichloroethane (79-00-5)	tetrachloroethene (127-18-4)	chlorobenzene (108-90-7)	ethylbenzene (100-41-4)	m+p xylene (108-38-3, 106-42-3)	o-xylene (95-47-6)	isopropylbenzene (98-82-8)	1,3,5-trimethylbenzene (108-67-8)	1,2,4-trimethylbenzene (95-63-6)	1,3-dichlorobenzene (541-73-1)	1,4-dichlorobenzene (106-46-7)	1,2,3-trimethylbenzene (526-73-8)	1,2-dichlorobenzene (95-50-1)	naphthalene (91-20-3)
Units		µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L
May 2013																				
Field Blank1	5/9/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank2	5/10/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank3	5/11/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank4	5/13/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank5	5/14/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Field Blank6	5/15/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank1	5/9/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank2	5/10/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank3	5/11/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank4	5/13/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank5	5/14/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Equipment Blank6	5/15/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank1	5/9/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank2	5/10/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank3	5/11/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank4	5/13/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank5	5/14/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trip Blank6	5/15/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
QL		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MDL		0.09	0.05	0.04	0.12	0.07	0.07	0.13	0.08	0.06	0.15	0.06	0.07	0.08	0.03	0.09	0.07	0.15	0.05	0.08
Detection in samples		0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	1/25	0/25	0/25	2/25	0/25	0/25
Concentration min		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.6	<0.5	<0.5	0.17	<0.5	<0.5
Concentration max		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.6	<0.5	<0.5	1.1	<0.5	<0.5

Table A7. Low Molecular Weight Acid Blanks

Sample ID	Date Collected	Lactate (50-21-5)	Formate (64-18-6)	Acetate (64-19-7)	Propionate (79-09-4)	Isobutyrate (79-31-2)	Butyrate (107-92-6)
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
October 2011							
Field Blank	10/25/2011	<0.10	0.05	R	<0.10	<0.10	<0.10
Field Blank	10/26/2011	<0.10	0.05	R	<0.10	<0.10	<0.10
Field Blank	10/27/2011	<0.10	0.05	R	<0.10	<0.10	<0.10
Field Blank	10/28/2011	<0.10	0.05	R	<0.10	<0.10	<0.10
Field Blank	10/29/2011	<0.10	0.05	R	<0.10	<0.10	<0.10
Field Blank	10/31/2011	<0.10	0.11	R	<0.10	<0.10	<0.10
Field Blank	11/1/2011	<0.10	<0.10	R	<0.10	<0.10	<0.10
Field Blank	11/2/2011	<0.10	0.13	R	<0.10	<0.10	<0.10
Field Blank	11/3/2011	<0.10	0.12	R	<0.10	<0.10	<0.10
Field Blank	11/4/2011	<0.10	<0.10	R	<0.10	<0.10	<0.10
Equipment Blank	10/31/2011	<0.10	0.08	R	<0.10	<0.10	<0.10
MDL		0.01	0.01		0.02	0.01	0.01
QL		0.10	0.10		0.10	0.10	0.10
Detection in samples		2/39	21/39		0/39	0/39	0/39
Concentration min		0.05	0.10		<0.10	<0.10	<0.10
Concentration max		0.07	0.30		<0.10	<0.10	<0.10

Table A7. Low Molecular Weight Acid Blanks

Sample ID	Date Collected	Lactate (50-21-5)	Formate (64-18-6)	Acetate (64-19-7)	Propionate (79-09-4)	Isobutyrate (79-31-2)	Butyrate (107-92-6)
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
April 2012							
Field Blank	4/24/2012	<0.10	0.06	<0.10	<0.10	<0.10	<0.10
Field Blank	4/25/2012	<0.10	0.10	<0.10	<0.10	<0.10	<0.10
Field Blank	4/26/2012	<0.10	0.05	<0.10	<0.10	<0.10	<0.10
Field Blank	4/27/2012	<0.10	0.05	<0.10	<0.10	<0.10	<0.10
Field Blank	4/28/2012	<0.10	0.05	<0.10	<0.10	<0.10	<0.10
Field Blank	4/30/2012	<0.10	0.05	<0.10	<0.10	<0.10	<0.10
Field Blank	5/1/2012	<0.10	0.07	<0.10	<0.10	<0.10	<0.10
Equipment Blank	4/26/2012	<0.10	0.09	<0.10	<0.10	<0.10	<0.10
Equipment Blank	4/30/2012	<0.10	0.05	<0.10	<0.10	<0.10	<0.10
QL		0.10	0.10	0.10	0.10	0.10	0.10
MDL		0.01	0.01	0.01	0.02	0.01	0.01
Detection in samples		2/30	23/30	3/30	0/30	0/30	0/30
Concentration min		0.05	0.12	0.10	<0.10	<0.10	<0.10
Concentration max		0.07	1.13	0.15	<0.10	<0.10	<0.10

Table A7. Low Molecular Weight Acid Blanks

Sample ID	Date Collected	Lactate (50-21-5)	Formate (64-18-6)	Acetate (64-19-7)	Propionate (79-09-4)	Isobutyrate (79-31-2)	Butyrate (107-92-6)
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
May 2013							
Field Blank1	5/9/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Field Blank2	5/10/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Field Blank3	5/11/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Field Blank4	5/13/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Field Blank5	5/14/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Field Blank6	5/15/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Equipment Blank1	5/9/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Equipment Blank2	5/10/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Equipment Blank3	5/11/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Equipment Blank4	5/13/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Equipment Blank5	5/14/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
Equipment Blank6	5/15/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
QL		0.10		0.10	0.10	0.10	0.10
MDL		0.021		0.014	0.020	0.022	0.024
Detection in samples		0/25		0/25	0/25	0/25	0/25
Concentration min		<0.10		<0.10	<0.10	<0.10	<0.10
Concentration max		<0.10		<0.10	<0.10	<0.10	<0.10

Table A8. Dissolved Gas Blanks

Sample	Date Collected	Methane (74-82-8)	Ethane (74-84-0)	Propane (74-98-6)	Butane (106-97-8)
Units		mg/L	mg/L	mg/L	mg/L
October 2011					
Field Blank	10/25/2011	<0.0014	<0.0028	<0.0038	<0.0048
Field Blank	10/26/2011	<0.0014	<0.0028	<0.0038	<0.0048
Field Blank	10/27/2011	<0.0014	<0.0028	<0.0038	<0.0048
Field Blank	10/28/2011	0.0009	0.0022	0.0030	0.0010
Field Blank	10/29/2011	<0.0014	0.0011	0.0014	0.0012
Field Blank	10/31/2011	0.0010	<0.0028	<0.0038	<0.0048
Field Blank	11/1/2011	<0.0014	<0.0028	<0.0038	<0.0048
Field Blank	11/2/2011	0.0011	<0.0028	<0.0038	<0.0048
Field Blank	11/3/2011	<0.0014	<0.0028	<0.0038	<0.0048
Field Blank	11/4/2011	<0.0014	<0.0028	<0.0038	<0.0048
Equipment Blank	10/31/2011	0.0020	0.0037	0.0070	0.0053
Trip Blank	10/25/2011	0.0013	0.0020	0.0045	0.0031
Trip Blank	10/26/2011	0.0019	0.0036	0.0073	0.0055
Trip Blank	10/27/2011	<0.0014	0.0008	0.0018	<0.0048
Trip Blank	10/28/2011	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank	10/29/2011	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank	10/31/2011	<0.0014	<0.0028	0.0021	0.0012
Trip Blank	11/1/2011	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank	11/2/2011	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank	11/3/2011	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank	11/4/2011	<0.0014	<0.0028	<0.0038	<0.0048
MDL		0.0002	0.0007	0.0008	0.0010
QL		0.0014	0.0028	0.0038	0.0048
Detection in samples		29/39	17/39	0/39	0/39
Concentration min		0.0020	0.0009	<0.0038	<0.0048
Concentration max		40.7	0.2800	<0.0038	<0.0048

Table A8. Dissolved Gas Blanks

Sample	Date Collected	Methane (74-82-8)	Ethane (74-84-0)	Propane (74-98-6)	Butane (106-97-8)
Units		mg/L	mg/L	mg/L	mg/L
April 2012					
Field Blank	4/24/2012	<0.0014	<0.0028	<0.0039	<0.0048
Field Blank	4/25/2012	<0.0014	<0.0028	<0.0039	<0.0048
Field Blank	4/26/2012	<0.0014	<0.0028	<0.0039	<0.0048
Field Blank	4/27/2012	<0.0014	<0.0028	<0.0039	<0.0048
Field Blank	4/28/2012	<0.0014	<0.0028	<0.0039	<0.0048
Field Blank	4/30/2012	<0.0014	<0.0028	<0.0039	<0.0048
Field Blank	5/1/5012	<0.0014	<0.0028	<0.0039	<0.0048
Trip Blank	4/24/2012	<0.0014	<0.0028	<0.0039	<0.0048
Trip Blank	4/25/2012	<0.0014	<0.0028	<0.0039	<0.0048
Trip Blank	4/29/2012	<0.0014	<0.0028	<0.0039	<0.0048
Trip Blank	5/1/2012	<0.0014	<0.0028	<0.0039	<0.0048
Equipment Blank	4/30/2012	<0.0014	<0.0028	<0.0039	<0.0048
QL		0.0014	0.0028	0.0039	0.0048
MDL		0.0003	0.0005	0.0007	0.0007
Detection in samples		23/30	20/30	5/30	0/30
Concentration min		0.0011	0.0012	0.0022	<0.0048
Concentration max		40.4	0.4970	0.0043	<0.0048

Table A8. Dissolved Gas Blanks

Sample	Date Collected	Methane (74-82-8)	Ethane (74-84-0)	Propane (74-98-6)	Butane (106-97-8)
Units		mg/L	mg/L	mg/L	mg/L
May 2013					
Field Blank1	5/9/2013	<0.0014	<0.0028	<0.0038	<0.0048
Field Blank2	5/10/2013	<0.0014	<0.0028	<0.0038	<0.0048
Field Blank3	5/11/2013	<0.0014	<0.0028	<0.0038	<0.0048
Field Blank4	5/13/2013	<0.0014	<0.0028	<0.0038	<0.0048
Field Blank5	5/14/2013	<0.0014	<0.0028	<0.0038	<0.0048
Field Blank6	5/15/2013	<0.0014	<0.0028	<0.0038	<0.0048
Equipment Blank1	5/9/2013	<0.0014	<0.0028	<0.0038	<0.0048
Equipment Blank2	5/10/2013	<0.0014	<0.0028	<0.0038	<0.0048
Equipment Blank3	5/11/2013	<0.0014	<0.0028	<0.0038	<0.0048
Equipment Blank4	5/13/2013	<0.0014	<0.0028	<0.0038	<0.0048
Equipment Blank5	5/14/2013	<0.0014	<0.0028	<0.0038	<0.0048
Equipment Blank6	5/15/2013	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank1	5/9/2013	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank2	5/10/2013	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank3	5/11/2013	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank4	5/13/2013	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank5	5/14/2013	<0.0014	<0.0028	<0.0038	<0.0048
Trip Blank6	5/15/2013	<0.0014	<0.0028	<0.0038	<0.0048
QL		0.0014	0.0028	0.0038	0.0048
MDL		0.0002	0.0007	0.0008	0.0010
Detection in samples		17/25	9/25	0/25	0/25
Concentration min		0.0061	0.0088	<0.0038	<0.0048
Concentration max		56.1	0.4280	<0.0038	<0.0048

Table A9. Glycol Blanks

Sample ID	Date Collected	2-butoxyethanol (111-76-2)	Diethylene glycol (111-46-6)	Triethylene glycol (112-27-6)	Tetraethylene glycol (112-60-7)
Units		µg/L	µg/L	µg/L	µg/L
Field Blank	10/25/2011	<5.0	<25.0	<25.0	<25.0
Field Blank	10/26/2011	<5.0	<25.0	<25.0	<25.0
Field Blank	10/27/2011	<5.0	<25.0	<25.0	<25.0
Field Blank	10/28/2011	<5.0	<25.0	<25.0	<25.0
Field Blank	10/29/2011	<5.0	<25.0	<25.0	<25.0
Field Blank	10/31/2011	<5.0	<25.0	<25.0	<25.0
Field Blank	11/1/2011	<5.0	<25.0	<25.0	<25.0
Field Blank	11/2/2011	<5.0	<25.0	<25.0	<25.0
Field Blank	11/3/2011	<5.0	<25.0	<25.0	<25.0
Field Blank	11/4/2011	<5.0	<25.0	<25.0	<25.0
Equipment Blank	10/31/2011	<5.0	<25.0	<25.0	<25.0
QL		5.0	25.0	25.0	25.0
Detection in samples		0/39	0/39	0/39	0/39
Concentration min		<5.0	<25.0	<25.0	<25.0
Concentration max		<5.0	<25.0	<25.0	<25.0
April 2012					
Field Blank	4/24/2012	<5.0	<5.0	<25.0	<25.0
Field Blank	4/25/2012	<5.0	<5.0	<25.0	<25.0
Field Blank	4/26/2012	<5.0	<5.0	<25.0	<25.0
Field Blank	4/27/2012	<5.0	<5.0	<25.0	<25.0
Field Blank	4/28/2012	<5.0	<5.0	<25.0	<25.0
Field Blank	4/30/2012	<5.0	<5.0	<25.0	<25.0
Field Blank	5/1/2012	<5.0	<5.0	<25.0	<25.0
Equipment Blank	4/26/2012	<5.0	<5.0	<25.0	<25.0
Equipment Blank	4/30/2012	<5.0	<5.0	<25.0	<25.0
QL		5.0	5.0	25.0	25.0
Detection in samples		0/30	0/30	0/30	0/30
Concentration min		<5.0	<5.0	<25.0	<25.0
Concentration max		<5.0	<5.0	<25.0	<25.0

Table A9. Glycol Blanks

Sample ID	Date Collected	2-butoxyethanol (111-76-2)	Diethylene glycol (111-46-6)	Triethylene glycol (112-27-6)	Tetraethylene glycol (112-60-7)
Units		µg/L	µg/L	µg/L	µg/L
May 2013					
Field Blank1	5/9/2013	<10.0	<10.0	<10.0	<10.0
Field Blank2	5/10/2013	<10.0	<10.0	<10.0	<10.0
Field Blank3	5/11/2013	<10.0	<10.0	<10.0	<10.0
Field Blank4	5/13/2013	<10.0	<10.0	<10.0	<10.0
Field Blank5	5/14/2013	<10.0	<10.0	<10.0	<10.0
Field Blank6	5/15/2013	<10.0	<10.0	<10.0	<10.0
Equipment Blank1	5/9/2013	<10.0	<10.0	<10.0	<10.0
Equipment Blank2	5/10/2013	<10.0	<10.0	<10.0	<10.0
Equipment Blank3	5/11/2013	<10.0	<10.0	<10.0	<10.0
Equipment Blank4	5/13/2013	<10.0	<10.0	<10.0	<10.0
Equipment Blank5	5/14/2013	<10.0	<10.0	<10.0	<10.0
Equipment Blank6	5/15/2013	<10.0	<10.0	<10.0	<10.0
QL		10.0	10.0	10.0	10.0
Detection in samples		0/25	0/25	0/25	0/25
Concentration min		<10.0	<10.0	<10.0	<10.0
Concentration max		<10.0	<10.0	<10.0	<10.0

Table A10. sVOC Blanks

Sample ID	Date Collected	R-(+)-limonene (5989-27-5)	1,2,4-trichlorobenzene (120-82-1)	1,2-dichlorobenzene (95-50-1)	1,2-dinitrobenzene (528-29-0)	1,3-dichlorobenzene (541-73-1)	1,3-dimethyladamantane (702-79-4)	1,3 -dinitrobenzene (99-65-0)	1,4-dichlorobenzene (106-46-7)	1,4-dinitrobenzene (100-25-4)	1-methylnaphthalene (90-12-0)	2,3,4,6-tetrachlorophenol (58-90-2)	2,3,5,6-tetrachlorophenol (935-95-5)	2,4,5-trichlorophenol (95-95-4)	2,4,6-trichlorophenol (88-06-2)	2,4-dichlorophenol (120-83-2)	2,4-dimethylphenol (105-67-9)	2,4-dinitrophenol (51-28-5)	2,4-dinitrotoluene (121-14-2)	2,6-dinitrotoluene (606-20-2)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011																				
Field Blank	10/25/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Field Blank	10/26/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Field Blank	10/27/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Field Blank	10/28/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Field Blank	10/29/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Field Blank	10/31/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Field Blank	11/1/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Field Blank	11/2/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Field Blank	11/3/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Field Blank	11/4/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Equipment Blank	10/31/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
QL		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	5.00	0.50	0.50
Detection in samples		0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39
Concentration min		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
Concentration max		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50
April 2012																				
Field Blank	4/24/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Field Blank	4/25/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Field Blank	4/26/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Field Blank	4/27/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Field Blank	4/28/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Field Blank	4/30/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Field Blank	5/1/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Equipment Blank	4/26/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
QL		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	3.00	1.00	1.00
Detection in samples		0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30
Concentration min		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Concentration max		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
May 2013																				
Field Blank1	5/9/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00

Table A10. sVOC Blanks

Sample ID	Date Collected	R-(+)-limonene (5989-27-5)	1,2,4-trichlorobenzene (120-82-1)	1,2-dichlorobenzene (95-50-1)	1,2-dinitrobenzene (528-29-0)	1,3-dichlorobenzene (541-73-1)	1,3-dimethyladamantane (702-79-4)	1,3 -dinitrobenzene (99-65-0)	1,4-dichlorobenzene (106-46-7)	1,4-dinitrobenzene (100-25-4)	1-methylnaphthalene (90-12-0)	2,3,4,6-tetrachlorophenol (58-90-2)	2,3,5,6-tetrachlorophenol (935-95-5)	2,4,5-trichlorophenol (95-95-4)	2,4,6-trichlorophenol (88-06-2)	2,4-dichlorophenol (120-83-2)	2,4-dimethylphenol (105-67-9)	2,4-dinitrophenol (51-28-5)	2,4-dinitrotoluene (121-14-2)	2,6-dinitrotoluene (606-20-2)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Field Blank2	5/10/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Field Blank3	5/11/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Field Blank4	5/13/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Field Blank5	5/14/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Field Blank6	5/15/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Equipment Blank1	5/9/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Equipment Blank2	5/10/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Equipment Blank3	5/11/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Equipment Blank4	5/13/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Equipment Blank5	5/14/2013	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Equipment Blank6	5/15/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
QL		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	3.00	1.00	1.00
Detection in samples		0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25
Concentration min		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00
Concentration max		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00

Table A10. sVOC Blanks

Sample ID	Date Collected	2-butoxyethanol (111-76-2)	2-chloronaphthalene (91-58-7)	2-chlorophenol (95-57-8)	2-methylnaphthalene (91-57-6)	2-methylphenol (95-48-7)	2-nitroaniline (88-74-4)	2-nitrophenol (88-75-5)	3&4-methylphenol (108-39-4 & 106-44-5)	3,3'-dichlorobenzidine (91-94-1)	3-nitroaniline (99-09-2)	4,6-dinitro-2-methylphenol (534-52-1)	4-bromophenyl phenyl ether (101-55-3)	4-chloro-3-methylphenol (59-50-7)	4-chloroaniline (106-47-8)	4-chlorophenyl phenyl ether (7005-72-3)	4-nitroaniline (100-01-6)	4-nitrophenol (100-02-7)	Acenaphthene (83-32-9)	Acenaphthylene (208-96-8)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011																				
Field Blank	10/25/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Field Blank	10/26/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Field Blank	10/27/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Field Blank	10/28/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Field Blank	10/29/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Field Blank	10/31/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Field Blank	11/1/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Field Blank	11/2/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Field Blank	11/3/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Field Blank	11/4/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Equipment Blank	10/31/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
QL		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50		0.50	0.50	0.50	0.50	1.00	0.50	0.50	2.50	0.50	0.50
Detection in samples		0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39		0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39
Concentration min		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50		<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
Concentration max		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50		<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50
April 2012																				
Field Blank	4/24/2012	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Field Blank	4/25/2012	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Field Blank	4/26/2012	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Field Blank	4/27/2012	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Field Blank	4/28/2012	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Field Blank	4/30/2012	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Field Blank	5/1/2012	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Equipment Blank	4/26/2012	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
QL		1.00	1.00	2.00	1.00	2.00	1.00	2.00	5.00	1.00	3.00	2.00	1.00	2.00	3.00	1.00	3.00	3.00	1.00	1.00
Detection in samples		0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30
Concentration min		<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Concentration max		<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
May 2013																				
Field Blank1	5/9/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00

Table A10. sVOC Blanks

Sample ID	Date Collected	2-butoxyethanol (111-76-2)	2-chloronaphthalene (91-58-7)	2-chlorophenol (95-57-8)	2-methylnaphthalene (91-57-6)	2-methylphenol (95-48-7)	2-nitroaniline (88-74-4)	2-nitrophenol (88-75-5)	3&4-methylphenol (108-39-4 & 106-44-5)	3,3'-dichlorobenzidine (91-94-1)	3-nitroaniline (99-09-2)	4,6-dinitro-2-methylphenol (534-52-1)	4-bromophenyl phenyl ether (101-55-3)	4-chloro-3-methylphenol (59-50-7)	4-chloroaniline (106-47-8)	4-chlorophenyl phenyl ether (7005-72-3)	4-nitroaniline (100-01-6)	4-nitrophenol (100-02-7)	Acenaphthene (83-32-9)	Acenaphthylene (208-96-8)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Field Blank2	5/10/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Field Blank3	5/11/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Field Blank4	5/13/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Field Blank5	5/14/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Field Blank6	5/15/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Equipment Blank1	5/9/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Equipment Blank2	5/10/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Equipment Blank3	5/11/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Equipment Blank4	5/13/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Equipment Blank5	5/14/2013	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Equipment Blank6	5/15/2013	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
QL		1.00	1.00	2.00	1.00	2.00	1.00	2.00	5.00	1.00	3.00	2.00	1.00	2.00	3.00	1.00	3.00	3.00	1.00	1.00
Detection in samples		0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25
Concentration min		<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00
Concentration max		<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00

Table A10. sVOC Blanks

Sample ID	Date Collected	Adamantane (281-23-2)	Aniline (62-53-3)	Anthracene (120-12-7)	Azobenzene (103-33-3)	Benzo(a)anthracene (56-55-3)	Benzo(a)pyrene (50-32-8)	Benzo(b)fluoranthene (205-99-2)	Benzo(g,h,i)perylene (191-24-2)	Benzo(k)fluoranthene (207-08-9)	Benzoic Acid (65-85-0)	Benzyl alcohol (100-51-6)	Bis-(2-chloroethoxy)methane (111-91-1)	Bis-(2-chloroethyl)ether (111-44-4)	Bis-(2-chloroisopropyl)ether (108-60-1)	Bis-(2-ethylhexyl) adipate (103-23-1)	Bis-(2-ethylhexyl) phthalate (117-81-7)	Butyl benzyl phthalate (85-68-7)	Carbazole (86-74-8)	Chrysene (218-01-9)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011																				
Field Blank	10/25/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	4.10	<1.00	<0.50	<0.50	<0.50
Field Blank	10/26/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	3.72	<1.00	<0.50	<0.50	<0.50
Field Blank	10/27/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	3.53	<1.00	<0.50	<0.50	<0.50
Field Blank	10/28/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	3.73	<1.00	<0.50	<0.50	<0.50
Field Blank	10/29/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<1.00	<1.00	<0.50	<0.50	<0.50
Field Blank	10/31/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<1.00	<1.00	<0.50	<0.50	<0.50
Field Blank	11/1/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<1.00	<1.00	<0.50	<0.50	<0.50
Field Blank	11/2/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<1.00	<1.00	<0.50	<0.50	<0.50
Field Blank	11/3/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<1.00	<1.00	<0.50	<0.50	<0.50
Field Blank	11/4/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<1.00	<1.00	<0.50	<0.50	<0.50
Equipment Blank	10/31/2011	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	3.35	<1.00	<0.50	<0.50	<0.50
QL		0.50	1.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	5.00	0.50	0.50	0.50	0.50	1.00	1.00	0.50	0.50	0.50
Detection in samples		0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	16/39	0.15	0/39	0/39	0/39
Concentration min		<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	2.34	1.21	<0.50	<0.50	<0.50
Concentration max		<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	4.04	4.10	<0.50	<0.50	<0.50
April 2012																				
Field Blank	4/24/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Field Blank	4/25/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Field Blank	4/26/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Field Blank	4/27/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Field Blank	4/28/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Field Blank	4/30/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Field Blank	5/1/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Equipment Blank	4/26/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
QL		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	3.00	1.00
Detection in samples		0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	2/30	0/30	0/30	0/30
Concentration min		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	3.02	<1.00	<3.00	<1.00
Concentration max		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	36.7	<1.00	<3.00	<1.00
May 2013																				
Field Blank1	5/9/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	4.43	<1.00	<3.00	<1.00

Table A10. sVOC Blanks

Sample ID	Date Collected	Adamantane (281-23-2)	Aniline (62-53-3)	Anthracene (120-12-7)	Azobenzene (103-33-3)	Benzo(a)anthracene (56-55-3)	Benzo(a)pyrene (50-32-8)	Benzo(b)fluoranthene (205-99-2)	Benzo(g,h,i)perylene (191-24-2)	Benzo(k)fluoranthene (207-08-9)	Benzoic Acid (65-85-0)	Benzyl alcohol (100-51-6)	Bis-(2-chloroethoxy)methane (111-91-1)	Bis-(2-chloroethyl)ether (111-44-4)	Bis-(2-chloroisopropyl)ether (108-60-1)	Bis-(2-ethylhexyl) adipate (103-23-1)	Bis-(2-ethylhexyl) phthalate (117-81-7)	Butyl benzyl phthalate (85-68-7)	Carbazole (86-74-8)	Chrysene (218-01-9)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Field Blank2	5/10/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	2.00	<1.00	<3.00	<1.00
Field Blank3	5/11/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Field Blank4	5/13/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Field Blank5	5/14/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Field Blank6	5/15/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Equipment Blank1	5/9/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	3.86	<1.00	<3.00	<1.00
Equipment Blank2	5/10/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Equipment Blank3	5/11/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Equipment Blank4	5/13/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
Equipment Blank5	5/14/2013	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Equipment Blank6	5/15/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00
QL		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	3.00	1.00
Detection in samples		0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	4/25	0/25	0/25	0/25
Concentration min		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	3.82	<1.00	<3.00	<1.00
Concentration max		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	18.3	<1.00	<3.00	<1.00

Table A10. sVOC Blanks

Sample ID	Date Collected	Dibenz(a,h)anthracene (53-70-3)	Dibenzofuran (132-64-9)	Diethyl phthalate (84-66-2)	Dimethyl phthalate (131-11-3)	Di-n-butyl phthalate (84-74-2)	Di-n-octyl phthalate (117-84-0)	Diphenylamine (122-39-4)	Fluoranthene (206-44-0)	Fluorene (86-73-7)	Hexachlorobenzene (118-74-1)	Hexachlorobutadiene (87-68-3)	Hexachlorocyclopentadiene (77-47-4)	Hexachloroethane (67-72-1)	Indeno(1,2,3-cd)pyrene (193-39-5)	Isophorone (78-59-1)	Naphthalene (91-20-3)	Nitrobenzene (98-95-3)	N-nitrosodimethylamine (62-75-9)	N-nitrosodi-n-propylamine (621-64-7)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011																				
Field Blank	10/25/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Field Blank	10/26/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Field Blank	10/27/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Field Blank	10/28/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Field Blank	10/29/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Field Blank	10/31/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Field Blank	11/1/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Field Blank	11/2/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Field Blank	11/3/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Field Blank	11/4/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Equipment Blank	10/31/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
QL		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.00	0.50	1.00	0.50	0.50	0.50	0.50	0.50	0.50
Detection in samples		0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39
Concentration min		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Concentration max		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
April 2012																				
Field Blank	4/24/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Field Blank	4/25/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Field Blank	4/26/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Field Blank	4/27/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Field Blank	4/28/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Field Blank	4/30/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Field Blank	5/1/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Equipment Blank	4/26/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
QL		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Detection in samples		0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30
Concentration min		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Concentration max		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
May 2013																				
Field Blank1	5/9/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

Table A10. sVOC Blanks

Sample ID	Date Collected	Dibenz(a,h)anthracene (53-70-3)	Dibenzofuran (132-64-9)	Diethyl phthalate (84-66-2)	Dimethyl phthalate (131-11-3)	Di-n-butyl phthalate (84-74-2)	Di-n-octyl phthalate (117-84-0)	Diphenylamine (122-39-4)	Fluoranthene (206-44-0)	Fluorene (86-73-7)	Hexachlorobenzene (118-74-1)	Hexachlorobutadiene (87-68-3)	Hexachlorocyclopentadiene (77-47-4)	Hexachloroethane (67-72-1)	Indeno(1,2,3-cd)pyrene (193-39-5)	Isophorone (78-59-1)	Naphthalene (91-20-3)	Nitrobenzene (98-95-3)	N-nitrosodimethylamine (62-75-9)	N-nitrosodi-n-propylamine (621-64-7)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Field Blank2	5/10/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Field Blank3	5/11/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Field Blank4	5/13/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Field Blank5	5/14/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Field Blank6	5/15/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Equipment Blank1	5/9/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Equipment Blank2	5/10/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Equipment Blank3	5/11/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Equipment Blank4	5/13/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Equipment Blank5	5/14/2013	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Equipment Blank6	5/15/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
QL		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Detection in samples		0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25
Concentration min		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Concentration max		<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

Table A10. sVOC Blanks

Sample ID	Date Collected	Pentachlorophenol (87-86-5)	Phenanthrene (85-01-8)	Phenol (108-95-2)	Pyrene (129-00-0)	Pyridine (110-86-1)	Squalene (111-02-4)	Terpiniol (98-55-5)	tri-(2-butoxyethyl) phosphate (78-51-3)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011									
Field Blank	10/25/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Field Blank	10/26/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Field Blank	10/27/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Field Blank	10/28/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Field Blank	10/29/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Field Blank	10/31/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Field Blank	11/1/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Field Blank	11/2/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Field Blank	11/3/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Field Blank	11/4/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Equipment Blank	10/31/2011	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
QL		1.00	0.50	0.50	0.50	0.50	1.00	0.50	1.00
Detection in samples		0/39	0/39	0/39	0/39	0/39	0/39	0/39	0/39
Concentration min		<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
Concentration max		<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
April 2012									
Field Blank	4/24/2012	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Field Blank	4/25/2012	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Field Blank	4/26/2012	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Field Blank	4/27/2012	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Field Blank	4/28/2012	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Field Blank	4/30/2012	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Field Blank	5/1/2012	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Equipment Blank	4/26/2012	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
QL		2.00	1.00	2.00	1.00	1.00	2.00	1.00	1.00
Detection in samples		0/30	0/30	0/30	0/30	0/30	0/30	0/30	0/30
Concentration min		<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Concentration max		<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
May 2013									
Field Blank1	5/9/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00

Table A10. sVOC Blanks

Sample ID	Date Collected	Pentachlorophenol (87-86-5)	Phenanthrene (85-01-8)	Phenol (108-95-2)	Pyrene (129-00-0)	Pyridine (110-86-1)	Squalene (111-02-4)	Terpiniol (98-55-5)	tri-(2-butoxyethyl) phosphate (78-51-3)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Field Blank2	5/10/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Field Blank3	5/11/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Field Blank4	5/13/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Field Blank5	5/14/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Field Blank6	5/15/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Equipment Blank1	5/9/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Equipment Blank2	5/10/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Equipment Blank3	5/11/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Equipment Blank4	5/13/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Equipment Blank5	5/14/2013	R	R	R	R	R	R	R	R
Equipment Blank6	5/15/2013	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
QL		2.00	1.00	2.00	1.00	1.00	2.00	1.00	1.00
Detection in samples		0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25
Concentration min		<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
Concentration max		<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00

Table A11. DRO/GRO Blanks

Sample ID	Date Collected	GRO/TPH	DRO
Units		µg/L	µg/L
Field Blank	10/25/2011	<20	<20
Field Blank	10/26/2011	<20	<20
Field Blank	10/27/2011	<20	<20
Field Blank	10/28/2011	<20	<20
Field Blank	10/29/2011	<20	<20
Field Blank	10/31/2011	<20	<20
Field Blank	11/1/2011	<20	<20
Field Blank	11/2/2011	<20	<20
Field Blank	11/3/2011	<20	<20
Field Blank	11/4/2011	<20	<20
Equipment Blank	10/31/2011	<20	<20
QL		20	20
Detection in samples		0/39	3/39
Concentration min		<20	23.1
Concentration max		<20	25.1
April 2012			
Field Blank	4/24/2012	<20.0	<20.0
Field Blank	4/25/2012	<20.0	<20.0
Field Blank	4/26/2012	<20.0	<20.0
Field Blank	4/27/2012	<20.0	<20.0
Field Blank	4/28/2012	<20.0	<20.0
Field Blank	4/30/2012	<20.0	<20.0
Field Blank	5/1/2012	<20.0	20.0
Equipment Blank	4/26/2012	<20.0	<20.0
Equipment Blank	4/30/2012	<20.0	NR
QL		20.0	20.0
Detection in samples		0/30	10/30
Concentration min		<20.0	21.1
Concentration max		<20.0	273

Table A11. DRO/GRO Blanks

Sample ID	Date Collected	GRO/TPH	DRO
Units		µg/L	µg/L
May 2013			
Field Blank1	5/9/2013	<20.0	<20.0
Field Blank2	5/10/2013	<20.0	<20.0
Field Blank3	5/11/2013	<20.0	<20.0
Field Blank4	5/13/2013	<20.0	<20.0
Field Blank5	5/14/2013	<20.0	22.5
Field Blank6	5/15/2013	<20.0	25.3
Equipment Blank1	5/9/2013	<20.0	26.8
Equipment Blank2	5/10/2013	<20.0	47.8
Equipment Blank3	5/11/2013	<20.0	74.8
Equipment Blank4	5/13/2013	<20.0	50.8
Equipment Blank5	5/14/2013	<20.0	53.0
Equipment Blank6	5/15/2013	<20.0	37.3
QL		20.0	20.0
Detection in samples		1/25	1/25
Concentration min		24.2	27.7
Concentration max		24.2	27.7

Table A12. Gross Alpha, Gross Beta, Ra-226, and Ra-228 Blanks

Sample ID	Date Collected	Gross Alpha	Gross Beta	Ra-226	Ra-228
Units		pCi/L	pCi/L	pCi/L	pCi/L
October 2011					
Field Blank		NA	NA	NA	NA
Field Blank		NA	NA	NA	NA
April 2012					
Field Blank	4/24/2012	<3.0	<4.0	<1.00	<1.00
Field Blank	4/25/2012	<3.0	<4.0	<1.00	<1.00
Field Blank	4/26/2012	<3.0	<4.0	<1.00	<1.00
Field Blank	4/27/2012	<3.0	<4.0	<1.00	<1.00
Field Blank	4/28/2012	<3.0	<4.0	<1.00	<1.00
Field Blank	4/30/2012	<3.0	<4.0	<1.00	<1.00
Field Blank	5/1/2012	<3.0	<4.0	<1.00	<1.00
Equipment Blank	4/26/2012	<3.0	<4.0	<1.00	<1.00
Equipment Blank	4/30/2012	<3.0	<4.0	<1.00	<1.00
RL		3.0	4.0	1.00	1.00
Detection in samples		5/30	4/30	5/30	2/30
Concentration min		<3.0	<4.0	<1.00	<1.00
Concentration max		6.1	7.4	4.40	2.88

Table A12. Gross Alpha, Gross Beta, Ra-226, and Ra-228 Blanks

Sample ID	Date Collected	Gross Alpha	Gross Beta	Ra-226	Ra-228
Units		pCi/L	pCi/L	pCi/L	pCi/L
May 2013					
Field Blank1	5/9/2013	NS	NS	NS	NS
Field Blank2	5/10/2013	NS	NS	NS	NS
Field Blank3	5/11/2013	NS	NS	NS	NS
Field Blank4	5/13/2013	NS	NS	NS	NS
Field Blank5	5/14/2013	NS	NS	NS	NS
Field Blank6	5/15/2013	NS	NS	NS	NS
Equipment Blank1	5/9/2013	NS	NS	NS	NS
Equipment Blank2	5/10/2013	NS	NS	NS	NS
Equipment Blank3	5/11/2013	NS	NS	NS	NS
Equipment Blank4	5/13/2013	NS	NS	NS	NS
Equipment Blank5	5/14/2013	NS	NS	NS	NS
Equipment Blank6	5/15/2013	NS	NS	NS	NS
RL		3.0	4.0	1.00	1.00
Detection in samples		8/25	4/25	3/25	0/25
Concentration min		<3.0	<4.0	<1.00	<1.00
Concentration max		5.9	5.7	2.70	<1.00

Table A13. DOC, DIC, Ammonia, and Anion Duplicates

Sample ID	Date Collected	DOC	DIC	NO_3 + NO_2	NH_3	Br	Cl	SO_4^{2-}	F
Units		mg /L	mg /L	mg /L	mg /L	mg /L	mg /L	mg /L	mg /L
October 2011									
5X QL		1.25	5.00	0.50	0.50	5.00	5.00	5.00	1.00
NEPAGW02	10/25/2011	<0.25	56.5	<0.10	0.94	<1.00	23.8	0.14	0.18
NEPAGW02 DUP	10/25/2011	<0.25	56.5	<0.10	0.82	<1.00	23.8	0.14	0.17
RPD (%)		NC	0.0	NC	13.0	NC	0.0	NC	NC
5X QL		1.25	5.00	0.50	0.50	5.00	5.00	5.00	1.00
NEPAGW06	10/26/2011	0.31	31.8	2.74	<0.10	<1.00	19.1	15.0	<0.20
NEPAGW06 DUP	10/26/2011	0.28	31.8	2.73	<0.10	<1.00	19.1	14.8	<0.20
RPD (%)		NC	0.0	0.4	NC	NC	0.0	1.3	NC
5X QL		1.25	5.00	0.50	0.50	5.00	5.00	5.00	1.00
NEPASW01	10/29/2011	1.29	51.2	<0.10	<0.10	<1.00	0.82	13.3	0.11
NEPASW01 DUP	10/29/2011	1.30	51.2	<0.10	<0.10	<1.00	0.75	13.0	0.17
RPD (%)		0.8	0.0	NC	NC	NC	NC	2.3	NC
5X QL		1.25	5.00	0.50	0.50	5.00	5.00	5.00	1.00
NEPAGW25	11/2/2011	0.29	55.5	1.09	<0.10	<1.00	8.86	17.6	0.04
NEPAGW25 DUP	11/2/2011	0.34	55.6	1.07	<0.10	<1.00	8.69	17.2	<0.20
RPD (%)		NC	0.2	1.9	NC	NC	1.9	2.3	NC

Table A13. DOC, DIC, Ammonia, and Anion Duplicates

Sample ID	Date Collected	DOC	DIC	NO_3 + NO_2	NH_3	Br	Cl	SO_4^{2-}	F
Units		mg /L	mg /L	mg /L	mg /L	mg /L	mg /L	mg /L	mg /L
April 2012									
5X QL		1.25	5.00	0.25	0.50	5.00	5.00	5.00	1.00
NEPAGW16	4/30/2012	<0.25	37.5	<0.05	<0.10	0.40	53.2	1.07	0.08
NEPAGW16 DUP	4/30/2012	<0.25	37.6	<0.05	<0.10	0.41	54.0	1.10	0.12
RPD (%)		NC	0.3	NC	NC	NC	1.5	NC	NC
5X QL		1.25	5.00	0.25	0.50	5.00	5.00	5.00	1.00
NEPAGW20	4/28/2012	<0.25	34.0	0.07	<0.10	<1.00	9.78	7.41	0.12
NEPAGW20 DUP	4/28/2012	<0.25	34.0	0.07	<0.10	<1.00	9.79	7.36	0.14
RPD (%)		NC	0.0	NC	NC	NC	0.1	0.7	NC
5X QL		1.25	5.00	0.25	0.50	5.00	5.00	5.00	1.00
NEPASW04	4/25/2012	7.19	7.75	0.06	<0.10	0.87	230	17.6	<0.20
NEPASW04 DUP	4/25/2012	7.48	7.76	0.06	<0.10	0.97	225	16.1	<0.20
RPD (%)		4.0	0.1	NC	NC	NC	2.2	8.9	NC

Table A13. DOC, DIC, Ammonia, and Anion Duplicates

Sample ID	Date Collected	DOC	DIC	NO_3 + NO_2	NH_3	Br	Cl	SO_4^{2-}	F
Units		mg /L	mg /L	mg /L	mg /L	mg /L	mg /L	mg /L	mg /L
May 2013									
5X QL		1.25	5.00	0.50	0.50	5.00	5.00	5.00	1.00
NEPAGW27	5/9/2013	<0.25	66.6	<0.10	0.13	<1.00	3.60	10.0	0.66
NEPAGW27 dup	5/9/2013	<0.25	66.5	<0.10	0.12	<1.00	3.56	9.88	0.64
RPD (%)		NC	0.2	NC	NC	NC	NC	1.2	NC
5X QL		1.25	5.00	0.50	0.50	5.00	5.00	5.00	1.00
NEPAGW28	5/15/2013	<0.25	45.3	0.92	<0.10	<1.00	6.92	20.1	0.14
NEPAGW28 dup	5/15/2013	<0.25	45.3	0.92	<0.10	<1.00	6.95	20.1	0.13
RPD (%)		NC	0.0	0.1	NC	NC	0.4	0.0	NC
5X QL		1.25	5.00	0.50	0.50	5.00	5.00	5.00	1.00
NEPAGW38	5/10/2013	0.42	33.9	0.02	<0.10	<1.00	7.15	7.15	0.13
NEPAGW38 dup	5/10/2013	0.22	34.4	0.01	<0.10	<1.00	7.10	7.16	0.15
RPD (%)		NC	1.5	NC	NC	NC	0.7	0.1	NC

Table A14. Dissolved Metal Duplicates

Sample ID	Date Collected	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	mg/L
October 2011																					
5X QL		70	2470	100	1665	20	50	1.44	20	20	35	100	335	1.77		0.50	70	85	8.55	420	0.30
NEPAGW02	10/25/2011	<14	<494	<20	508	1620	<10	27.4	<4	<4	<7	<20	232	2.14	NA	6.70	25	<17	74.7	<84	<0.06
NEPAGW02 DUP	10/25/2011	<14	<494	<20	508	1600	<10	26.9	<4	<4	<7	<20	227	2.11	NA	6.53	25	11	73.5	<84	<0.06
RPD (%)		NC	NC	NC	NC	1.2	NC	1.8	NC	NC	NC	NC	NC	1.4	NC	2.6	NC	NC	1.6	NC	NC
5X QL		70	2470	100	1665	20	50	1.44	20	20	35	100	335	1.77		0.50	70	85	8.55	420	0.30
NEPAGW06	10/26/2011	<14	<494	<20	<333	396	<10	47.1	<4	<4	<7	<20	<67	1.54	NA	5.64	<14	<17	10.5	<84	<0.06
NEPAGW06 DUP	10/26/2011	<14	<494	<20	<333	396	<10	47.1	<4	<4	<7	<20	<67	1.55	NA	5.66	<14	<17	10.5	<84	<0.06
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	0.4	NC	NC	0.0	NC	NC
5X QL		70	2470	100	1665	20	50	1.44	20	20	35	100	335	1.77		0.50	70	85	8.55	420	0.30
NEPASW01	10/29/2011	<14	<494	<20	<333	30	<10	70.5	<4	<4	<7	<20	190	0.83	NA	5.62	224	<17	2.95	<84	<0.06
NEPASW01 DUP	10/29/2011	<14	<494	<20	<333	30	<10	70.5	<4	<4	<7	<20	191	0.84	NA	5.66	225	<17	2.94	<84	<0.06
RPD (%)		NC	NC	NC	NC	0.0	NC	0.0	NC	NC	NC	NC	NC	NC	NC	0.7	0.4	NC	NC	NC	NC
5X QL		70	2470	100	1665	20	50	1.44	20	20	35	100	335	1.77		0.50	70	85	8.55	420	0.30
NEPAGW25	11/2/2011	<14	<494	<20	196	347	<10	36.9	<4	<4	<7	<20	<67	3.16	NA	10.7	10	<17	46.1	<84	<0.06
NEPAGW25 DUP	11/2/2011	<14	<494	<20	197	340	<10	36.4	<4	<4	<7	<20	<67	3.22	NA	10.3	9	<17	47.1	<84	<0.06
RPD (%)		NC	NC	NC	NC	2.0	NC	1.4	NC	NC	NC	NC	NC	1.9	NC	3.8	NC	NC	2.1	NC	NC

Table A14. Dissolved Metal Duplicates

Sample ID	Date Collected	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	mg/L
April 2012																					
5X QL		70	100	5.00	1665	20	50	1.44	5.00	20	10.0	10.0	335	1.77	50	0.50	70	85	8.55	5.00	0.30
NEPAGW16	4/30/2012	<14	<20.0	1.0	129	1610	<10	36.7	<1.0	<4	<2.0	3.6	204	1.69	64.7	8.23	83	<17	40.4	<1.0	<0.06
NEPAGW16 DUP	4/30/2012	<14	<20.0	<1.0	130	1590	<10	36.5	<1.0	<4	<2.0	3.9	196	1.70	63.2	8.19	83	<17	40.8	<1.0	<0.06
RPD (%)		NC	NC	NC	NC	1.3	NC	0.5	NC	NC	NC	NC	NC	NC	2.3	0.5	0.0	NC	1.0	NC	NC
5X QL		70	100	5.00	1665	20	50	1.44	5.00	20	10.0	10.0	335	1.77	50	0.50	70	85	8.55	5.00	0.30
NEPAGW20	4/28/2012	<14	<20.0	<1.0	<333	179	<10	31.6	<1.0	<4	<2.0	<2.0	<67	1.14	32.0	5.41	6	<17	20.8	<1.0	<0.06
NEPAGW20 DUP	4/28/2012	<14	<20.0	1.1	<333	180	<10	31.9	<1.0	<4	<2.0	<2.0	<67	1.17	34.9	5.45	6	<17	21.6	<1.0	<0.06
RPD (%)		NC	NC	NC	NC	0.6	NC	0.9	NC	NC	NC	NC	NC	NC	NC	0.7	NC	NC	3.8	NC	NC
5X QL		70	100	5.00	1665	20	50	1.44	5.00	20	10.0	10.0	335	1.77	50	0.50	70	85	8.55	5.00	0.30
NEPASW04	4/25/2012	<14	<20.0	<1.0	<333	663	<10	36.0	<1.0	3	<2.0	<2.0	59	3.38	14.5	19.6	2400	<17	76.1	2.9	<0.06
NEPASW04 DUP	4/25/2012	<14	<20.0	<1.0	<333	656	<10	35.7	<1.0	3	<2.0	<2.0	58	3.42	15.9	19.6	2440	<17	75.6	2.7	<0.06
RPD (%)		NC	NC	NC	NC	1.1	NC	0.8	NC	NC	NC	NC	NC	1.2	NC	0.0	1.7	NC	0.7	NC	NC
May 2013																					
5X QL		50	100	1.00	200	25	25	0.50	1.00	25	10.0	2.50	500	2.50	50	0.25	25	2.50	1.25	1.00	250
NEPAGW27	5/9/2013	<10	<20	4.7	416	909	<5	19.7	<0.2	<5	<2	<0.5	<100	2.57	172	3.56	45.7	<0.5	103	0.64	<50
NEPAGW27 DUP	5/9/2013	<10	<20	4.4	408	905	0.12	19.9	<0.2	<5	0.45	<0.5	<100	2.57	172	3.63	45.3	<0.5	103	0.67	<50
RPD (%)		NC	NC	6.6	1.9	0.4	NC	1.0	NC	NC	NC	NC	NC	0.0	0.0	1.9	0.9	NC	0.0	NC	NC
5X QL		50	100	1.00	200	25	25	0.50	1.00	25	10.0	2.50	500	2.50	50	0.25	25	2.50	1.25	1.00	250
NEPAGW28	5/15/2013	<10	<20	0.71	47.4	160	<5	49.2	<0.2	<5	<2	9.4	<100	1.66	23.9	16.3	<5	<0.5	15.2	2.10	<50
NEPAGW28 DUP	5/15/2013	<10	<20	0.65	47.6	156	<5	47.3	<0.2	<5	<2	8.5	<100	1.58	22.9	15.6	<5	<0.5	14.7	1.70	<50
RPD (%)		NC	NC	NC	NC	2.5	NC	3.9	NC	NC	NC	10.1	NC	NC	NC	4.4	NC	NC	3.3	21.1	NC
5X QL		50	100	1.00	200	25	25	0.50	1.00	25	10.0	2.50	500	2.50	50	0.25	25	2.50	1.25	1.00	250
NEPAGW38	5/10/2013	<10	<20	2.3	70.4	176	<5	29.6	<0.2	<5	<2	0.26	149	1.25	41.2	4.90	289	2.90	29.7	1.10	<50
NEPAGW38 DUP	5/10/2013	<10	<20	2.3	69.4	178	<5	30.3	<0.2	<5	<2	<0.5	184	1.24	40.9	4.99	297	3.00	29.1	1.10	<50
RPD (%)		NC	NC	0.0	NC	1.1	NC	2.3	NC	NC	NC	NC	NC	NC	NC	1.8	2.7	3.4	2.0	0.0	NC

Table A14. Dissolved Metal Duplicates

Sample ID	Date Collected	Pb	S	Sb	Se	Si	Sr	Th	Ti	Tl	U	V	Zn
Units		µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011													
5X QL		85	2.30		150	2.17	20		35	85		50	250
NEPAGW02	10/25/2011	<17	2.29	R	11	5.57	3060	NA	<7	<17	R	<10	<50
NEPAGW02 DUP	10/25/2011	<17	2.16	R	14	5.50	3020	NA	<7	<17	R	<10	<50
RPD (%)		NC	NC	NC	NC	1.3	1.3	NC	NC	NC	NC	NC	NC
5X QL		85	2.30		150	2.17	20		35	85		50	250
NEPAGW06	10/26/2011	<17	5.15	R	<30	6.12	1370	NA	<7	<17	R	<10	<50
NEPAGW06 DUP	10/26/2011	<17	4.96	R	<30	5.93	1370	NA	<7	<17	R	<10	<50
RPD (%)		NC	3.8	NC	NC	3.2	0.0	NC	NC	NC	NC	NC	NC
5X QL		85	2.30		150	2.17	20		35	85		50	250
NEPASW01	10/29/2011	<17	4.24	R	9	5.57	79	NA	<7	<17	R	<10	<50
NEPASW01 DUP	10/29/2011	<17	4.23	R	<30	5.63	79	NA	<7	<17	R	<10	<50
RPD (%)		NC	0.2	NC	NC	1.1	0.0	NC	NC	NC	NC	NC	NC
5X QL		85	2.30		150	2.17	20		35	85		50	250
NEPAGW25	11/2/2011	<17	5.98	R	<30	5.42	2500	NA	<7	<17	R	<10	<50
NEPAGW25 DUP	11/2/2011	<17	5.68	R	<30	5.34	2470	NA	<7	<17	R	<10	<50
RPD (%)		NC	5.1	NC	NC	1.5	1.2	NC	NC	NC	NC	NC	NC

Table A14. Dissolved Metal Duplicates

Sample ID	Date Collected	Pb	S	Sb	Se	Si	Sr	Th	Ti	Tl	U	V	Zn
Units		µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
April 2012													
5X QL		5.00	2.30	10.0	25	2.17	20		35	5.00	5.00	50	250
NEPAGW16	4/30/2012	<1.0	<0.46	<2.0	1.5	6.06	2930	R	<7	<1.0	R	<10	<50
NEPAGW16 DUP	4/30/2012	<1.0	<0.46	<2.0	1.4	6.05	2910	R	<7	<1.0	R	<10	<50
RPD (%)		NC	NC	NC	NC	0.2	0.7	NC	NC	NC	NC	NC	NC
5X QL		5.00	2.30	10.0	25	2.17	20		35	5.00	5.00	50	250
NEPAGW20	4/28/2012	<1.0	<0.46	<2.0	<5.0	5.11	779	R	<7	<1.0	2.3	<10	<50
NEPAGW20 DUP	4/28/2012	<1.0	<0.46	<2.0	<5.0	5.12	787	R	<7	<1.0	2.3	<10	<50
RPD (%)		NC	NC	NC	NC	0.2	1.0	NC	NC	NC	NC	NC	NC
5X QL		5.00	2.30	10.0	25	2.17	20		35	5.00	5.00	50	250
NEPASW04	4/25/2012	<1.0	6.30	<2.0	2.1	0.79	1280	R	<7	<1.0	R	<10	<50
NEPASW04 DUP	4/25/2012	<1.0	6.33	<2.0	2.1	0.80	1270	R	<7	<1.0	R	<10	<50
RPD (%)		NC	0.5	NC	NC	NC	0.8	NC	NC	NC	NC	NC	NC
May 2013													
5X QL		1.00		1.00	10.0	0.50	10.0	1.00	25	1.00	1.00	1.00	25
NEPAGW27	5/9/2013	<0.2	NR	<0.2	<2	5.45	2430	<0.2	<5	<0.2	<0.2	<0.02	<5
NEPAGW27 DUP	5/9/2013	<0.2	NR	<0.2	<2	5.47	2450	<0.2	<5	<0.2	<0.2	<0.02	<5
RPD (%)		NC	NC	NC	NC	0.4	0.8	NC	NC	NC	NC	NC	NC
5X QL		1.00		1.00	10.0	0.50	10.0	1.00	25	1.00	1.00	1.00	25
NEPAGW28	5/15/2013	0.20	NR	<0.2	<2	4.94	1010	<0.2	<5	<0.2	1.4	0.06	12.1
NEPAGW28 DUP	5/15/2013	0.21	NR	<0.2	<2	4.72	983	<0.2	<5	<0.2	1.4	0.05	9.3
RPD (%)		NC	NC	NC	NC	4.6	2.7	NC	NC	NC	0.0	NC	NC
5X QL		1.00		1.00	10.0	0.50	10.0	1.00	25	1.00	1.00	1.00	25
NEPAGW38	5/10/2013	0.06	NR	0.13	0.45	4.06	511	<0.2	<5	<0.2	2.4	0.03	<5
NEPAGW38 DUP	5/10/2013	<0.2	NR	0.12	<2	4.06	496	<0.2	<5	<0.2	2.3	0.03	<5
RPD (%)		NC	NC	NC	NC	0.0	3.0	NC	NC	NC	4.3	NC	NC

Table A15. Total Metal Duplicates

Sample ID	Date Collected	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	mg/L
October 2011																					
5X QL		80	2740	110	1850	20	55	1.60	20	20	40	110	370	1.97		0.56	80	95	9.50	465	0.34
NEPAGW02	10/25/2011	<16	<548	<22	499	1720	<11	28.5	<4	<4	<8	<22	308	2.17	NA	6.85	26	<19	73.0	<93	< 0.07
NEPAGW02 DUP	10/25/2011	<16	<548	<22	487	1740	<11	28.9	<4	<4	<8	15	307	2.20	NA	6.93	26	<19	73.8	<93	< 0.07
RPD (%)		NC	NC	NC	NC	1.2	NC	1.4	NC	NC	NC	NC	NC	1.4	NC	1.2	NC	NC	1.1	NC	NC
5X QL		80	2740	110	1850	20	55	1.60	20	20	40	110	370	1.97		0.56	80	95	9.50	465	0.34
NEPAGW06	10/26/2011	<16	<548	<22	<370	410	<11	49.0	<4	<4	<8	<22	<74	1.55	NA	5.70	<16	<19	10.7	<93	0.07
NEPAGW06 DUP	10/26/2011	<16	<548	<22	<370	408	<11	48.1	<4	<4	<8	<22	<74	1.57	NA	5.63	<16	<19	10.6	<93	0.07
RPD (%)		NC	NC	NC	NC	0.5	NC	1.9	NC	NC	NC	NC	NC	NC	NC	1.2	NC	NC	0.9	NC	NC
5X QL		80	2740	110	1850	20	55	1.60	20	20	40	110	370	1.97		0.56	80	95	9.50	465	0.34
NEPASW01	10/29/2011	<16	<548	<22	<370	30	<11	72.0	<4	<4	<8	<22	300	0.85	NA	5.87	223	<19	3.04	<93	0.03
NEPASW01 DUP	10/29/2011	<16	<548	<22	<370	30	<11	71.6	<4	<4	<8	<22	294	0.86	NA	5.80	221	<19	3.03	<93	< 0.07
RPD (%)		NC	NC	NC	NC	0.0	NC	0.6	NC	NC	NC	NC	NC	NC	NC	1.2	0.9	NC	NC	NC	NC
5X QL		80	2740	110	1850	20	55	1.60	20	20	40	110	370	1.97		0.56	80	95	9.50	465	0.34
NEPAGW25	11/2/2011	<16	<548	<22	178	317	<11	39.0	<4	<4	<8	<22	26	3.22	NA	12.0	22	<19	46.0	<93	< 0.07
NEPAGW25 DUP	11/2/2011	<16	<548	<22	195	336	<11	36.4	<4	<4	<8	<22	<74	3.36	NA	10.3	15	<19	49.8	<93	< 0.07
RPD (%)		NC	NC	NC	NC	5.8	NC	6.9	NC	NC	NC	NC	NC	4.3	NC	15.2	NC	NC	7.9	NC	NC

Table A15. Total Metal Duplicates

Sample ID	Date Collected	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	mg/L
April 2012																					
5X QL		80	100	5.00	1850	20	55	1.60	5.00	20	10.0	10.0	370	1.97	50	0.56	80	95	9.50	5.00	0.34
NEPAGW16	4/30/2012	<16	34.3	1.0	124	1590	<11	36.5	<1.0	<4	<2.0	6.8	276	2.07	73.3	8.21	84	<19	45.2	<1.0	<0.07
NEPAGW16 DUP	4/30/2012	<16	32.2	1.1	124	1590	<11	36.5	<1.0	<4	<2.0	7.3	280	2.05	70.5	8.28	84	<19	45.3	<1.0	<0.07
RPD (%)		NC	NC	NC	NC	0.0	NC	0.0	NC	NC	NC	NC	NC	1.0	3.9	0.8	0.0	NC	0.2	NC	NC
5X QL		80	100	5.00	1850	20	55	1.60	5.00	20	10.0	10.0	370	1.97	50	0.56	80	95	9.50	5.00	0.34
NEPAGW20	4/28/2012	<16	89.4	1.1	<370	186	<11	32.3	<1.0	<4	<2.0	<2.0	77	1.55	38.2	5.64	11	<19	25.0	<1.0	<0.07
NEPAGW20 DUP	4/28/2012	<16	80.6	<1.0	<370	186	<11	32.2	<1.0	<4	<2.0	<2.0	66	1.54	41.0	5.61	10	<19	25.2	<1.0	<0.07
RPD (%)		NC	NC	NC	NC	0.0	NC	0.3	NC	NC	NC	NC	NC	NC	NC	0.5	NC	NC	0.8	NC	NC
5X QL		80	100	5.00	1850	20	55	1.60	5.00	20	10.0	10.0	370	1.97	50	0.56	80	95	9.50	5.00	0.34
NEPASW04	4/25/2012	<16	25.1	<1.0	<370	683	<11	37.4	<1.0	2	<2.0	<2.0	320	3.32	19.8	21.2	2520	<19	77.3	2.7	<0.07
NEPASW04 DUP	4/25/2012	<16	24.5	<1.0	<370	689	<11	37.3	<1.0	2	<2.0	2.3	319	3.33	20.7	21.2	2500	<19	78.0	2.6	<0.07
RPD (%)		NC	NC	NC	NC	0.9	NC	0.3	NC	NC	NC	NC	NC	0.3	NC	0.0	0.8	NC	0.9	NC	NC
May 2013																					
5X QL		50	100	1.00	100	12.5	12.5	0.25	1.00	12.5	10.0	2.50	250	1.25	25	0.13	12.5	2.50	0.63	1.00	125
NEPAGW27	5/9/2013	<10	23.1	4.4	426	869	<2.5	19.2	<0.2	<2.5	<2	1.7	92.6	2.46	164	3.61	46.7	0.78	99.0	1.10	<25
NEPAGW27 DUP	5/9/2013	<10	91.1	4.8	431	875	<2.5	20.0	<0.2	<2.5	0.80	12.5	338	2.48	165	3.62	49.9	0.88	98.8	1.40	<25
RPD (%)		NC	NC	8.7	1.2	0.7	NC	4.1	NC	NC	NC	NC	NC	0.8	0.6	0.3	6.6	NC	0.2	24.0	NC
5X QL		50	100	1.00	100	12.5	12.5	0.25	1.00	12.5	10.0	2.50	250	1.25	25	0.13	12.5	2.50	0.63	1.00	125
NEPAGW28	5/15/2013	<10	<20	0.91	50.2	155	<2.5	46.5	<0.2	<2.5	<2	6.3	61.2	1.58	22.2	15.7	<2.5	<0.5	14.2	2.30	<25
NEPAGW28 DUP	5/15/2013	<10	<20	0.95	51.8	156	<2.5	46.8	<0.2	<2.5	<2	6.1	55.5	1.57	21.9	15.7	<2.5	<0.5	14.2	1.80	<25
RPD (%)		NC	NC	NC	NC	0.6	NC	0.6	NC	NC	NC	3.2	NC	0.6	NC	0.0	NC	NC	0.0	24.4	NC
5X QL		50	100	1.00	100	12.5	12.5	0.25	1.00	12.5	10.0	2.50	250	1.25	25	0.13	12.5	2.50	0.63	1.00	125
NEPAGW38	5/10/2013	<10	1550	5.0	81.0	217	<2.5	29.1	<0.2	0.88	1.8	3.9	4720	1.53	44.4	5.11	327	2.8	30.1	2.90	48.0
NEPAGW38 DUP	5/10/2013	<10	1490	5.1	81.3	218	<2.5	29.3	<0.2	0.84	1.6	3.8	4670	1.49	44.6	5.11	327	2.8	30.3	2.80	45.2
RPD (%)		NC	3.9	2.0	NC	0.5	NC	0.7	NC	NC	NC	2.6	1.1	2.6	0.4	0.0	0.0	0.0	0.7	3.5	NC

Table A15. Total Metal Duplicates

Sample ID	Date Collected	Pb	S	Sb	Se	Si	Sr	Th	Ti	Tl	U	V	Zn
Units		µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011													
5X QL		95	2.56		165	2.41	20		40	95		55	280
NEPAGW02	10/25/2011	<19	<0.51	R	<33	5.23	3140	NA	<8	<19	R	<11	<56
NEPAGW02 DUP	10/25/2011	<19	<0.51	R	<33	5.18	3170	NA	<8	<19	R	<11	<56
RPD (%)		NC	NC	NC	NC	1.0	1.0	NC	NC	NC	NC	NC	NC
5X QL		95	2.56		165	2.41	20		40	95		55	280
NEPAGW06	10/26/2011	<19	4.43	R	<33	5.64	1380	NA	<8	<19	R	<11	<56
NEPAGW06 DUP	10/26/2011	<19	4.37	R	<33	5.63	1360	NA	<8	<19	R	<11	<56
RPD (%)		NC	1.4	NC	NC	0.2	1.5	NC	NC	NC	NC	NC	NC
5X QL		95	2.56		165	2.41	20		40	95		55	280
NEPASW01	10/29/2011	<19	3.69	R	<33	5.19	79	NA	<8	<19	R	<11	<56
NEPASW01 DUP	10/29/2011	<19	3.65	R	<33	5.21	79	NA	<8	<19	R	<11	<56
RPD (%)		NC	1.0	NC	NC	0.4	0.0	NC	NC	NC	NC	NC	NC
5X QL		95	2.56		165	2.41	20		40	95		55	280
NEPAGW25	11/2/2011	<19	5.39	R	<33	5.02	2230	NA	<8	<19	R	<11	<56
NEPAGW25 DUP	11/2/2011	<19	4.78	R	<33	4.96	2430	NA	<8	<19	R	<11	<56
RPD (%)		NC	12.0	NC	NC	1.2	8.6	NC	NC	NC	NC	NC	NC

Table A15. Total Metal Duplicates

Sample ID	Date Collected	Pb	S	Sb	Se	Si	Sr	Th	Ti	Tl	U	V	Zn
Units		µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
April 2012													
5X QL		5.00	2.56	10.0	25	2.41	20		40	5.00	5.00	55	280
NEPAGW16	4/30/2012	<1.0	0.41	<2.0	<5.0	5.55	2870	R	<8	<1.0	R	<11	<56
NEPAGW16 DUP	4/30/2012	<1.0	0.42	<2.0	<5.0	5.55	2880	R	<8	<1.0	R	<11	<56
RPD (%)		NC	NC	NC	NC	0.0	0.3	NC	NC	NC	NC	NC	NC
5X QL		5.00	2.56	10.0	25	2.41	20		40	5.00	5.00	55	280
NEPAGW20	4/28/2012	<1.0	2.13	<2.0	<5.0	4.78	765	R	<8	<1.0	2.3	<11	<56
NEPAGW20 DUP	4/28/2012	<1.0	2.14	<2.0	<5.0	4.78	776	R	4	<1.0	2.3	<11	<56
RPD (%)		NC	NC	NC	NC	0.0	1.4	NC	NC	NC	NC	NC	NC
5X QL		5.00	2.56	10.0	25	2.41	20		40	5.00	5.00	55	280
NEPASW04	4/25/2012	1.30	4.97	<2.0	2.0	0.79	1320	R	<8	<1.0	<1.0	<11	<56
NEPASW04 DUP	4/25/2012	<1.0	4.97	<2.0	2.5	0.81	1330	R	<8	<1.0	<1.0	<11	<56
RPD (%)		NC	0.0	NC	NC	NC	0.8	NC	NC	NC	NC	NC	NC
May 2013													
5X QL		1.00		1.00	10.0	0.25	10.0	1.00	12.5	1.00	1.00	1.00	12.5
NEPAGW27	5/9/2013	<0.2	NR	<0.2	<2	5.26	2400	<0.2	<2.5	<0.2	0.07	0.30	5.4
NEPAGW27 DUP	5/9/2013	0.14	NR	0.16	<2	5.47	2470	0.33	<2.5	<0.2	0.08	0.42	19.5
RPD (%)		NC	NC	NC	NC	3.9	2.9	NC	NC	NC	NC	NC	NC
5X QL		1.00		1.00	10.0	0.25	10.0	1.00	12.5	1.00	1.00	1.00	12.5
NEPAGW28	5/15/2013	0.26	NR	<0.2	<2	4.72	995	<0.2	0.54	<0.2	1.4	0.46	7.4
NEPAGW28 DUP	5/15/2013	0.28	NR	<0.2	<2	4.73	986	<0.2	0.38	<0.2	1.4	0.44	6.4
RPD (%)		NC	NC	NC	NC	0.21	0.9	NC	NC	NC	0.0	NC	NC
5X QL		1.00		1.00	10.0	0.25	10.0	1.00	12.5	1.00	1.00	1.00	12.5
NEPAGW38	5/10/2013	1.7	NR	0.16	<2	7.00	541	0.38	21.4	<0.2	2.3	2.7	7.8
NEPAGW38 DUP	5/10/2013	1.7	NR	0.15	<2	7.11	532	0.42	20.7	<0.2	2.3	2.7	7.8
RPD (%)		0.0	NC	NC	NC	1.6	1.7	NC	3.3	NC	0.0	0.0	NC

Table A16. Volatile Organic Compound Duplicates

Sample ID	Date Collected	ethanol (64-17-5)	isopropanol (67-63-0)	acrylonitrile (107-13-1)	styrene (100-42-5)	acetone (67-64-1)	tert-butyl alcohol (75-65-0)	methyl tert butyl ether (1634-04-4)	diisopropyl ether (108-20-3)	ethyl tert butyl ether (637-92-3)	tert-amyl methyl ether (994-05-8)	vinyl chloride (75-01-4)	1,1-dichloroethene (75-35-4)	carbon disulfide (75-15-0)	methylene chloride (75-09-2)	trans-1,2-dichloroethene (156-60-5)	1,1-dichloroethane (75-34-3)	cis-1,2-dichoroethene (156-59-2)	chloroform (67-66-3)	1,1,1-trichloroethane (71-55-6)	carbon tetrachloride (56-23-5)
Units		µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L
October 2011																					
5X QL		500	125	125	2.50	5.00	25	5.00	5.00	5.00	5.00	2.50		2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW02	10/25/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW02 DUP	10/25/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		500	125	125	2.50	5.00	25	5.00	5.00	5.00	5.00	2.50		2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW06	10/26/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW06 DUP	10/26/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		500	125	125	2.50	5.00	25	5.00	5.00	5.00	5.00	2.50		2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50
NEPASW01	10/29/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPASW01 DUP	10/29/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		500	125	125	2.50	5.00	25	5.00	5.00	5.00	5.00	2.50		2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW25	11/2/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW25 DUP	11/2/2011	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
April 2012																					
5X QL		500	125	125	2.50	5.00	25	5.00	5.00	5.00	5.00	2.50		2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW16	4/30/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW16 DUP	4/30/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		500	125	125	2.50	5.00	25	5.00	5.00	5.00	5.00	2.50		2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW20	4/28/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW20 DUP	4/28/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		500	125	125	2.50	5.00	25	5.00	5.00	5.00	5.00	2.50		2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50
NEPASW04	4/25/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPASW04 DUP	4/25/2012	<100	<25.0	<25.0	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0	<1.0	<0.5	R	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A16. Volatile Organic Compound Duplicates

Sample ID	Date Collected	ethanol (64-17-5)	isopropanol (67-63-0)	acrylonitrile (107-13-1)	styrene (100-42-5)	acetone (67-64-1)	tert-butyl alcohol (75-65-0)	methyl tert butyl ether (1634-04-4)	diisopropyl ether (108-20-3)	ethyl tert butyl ether (637-92-3)	tert-amyl methyl ether (994-05-8)	vinyl chloride (75-01-4)	1,1-dichloroethene (75-35-4)	carbon disulfide (75-15-0)	methylene chloride (75-09-2)	trans-1,2-dichloroethene (156-60-5)	1,1-dichloroethane (75-34-3)	cis-1,2-dichoroethene (156-59-2)	chloroform (67-66-3)	1,1,1-trichloroethane (71-55-6)	carbon tetrachloride (56-23-5)
Units		µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L
May 2013																					
5X QL		500	50	5.00	2.50	5.00	50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW27	5/9/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW27 DUP	5/9/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		500	50	5.00	2.50	5.00	50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW28	5/15/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW28 DUP	5/15/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		500	50	5.00	2.50	5.00	50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW38	5/10/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW38 DUP	5/10/2013	<100	<10	<1	<0.5	<1	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A16. Volatile Organic Compound Duplicates

Sample ID	Date Collected	benzene (71-43-2)	1,2-dichloroethane (107-06-2)	trichloroethene (79-01-6)	toluene (108-88-3)	1,1,2-trichloroethane (79-00-5)	tetrachloroethene (127-18-4)	chlorobenzene (108-90-7)	ethylbenzene (100-41-4)	m+p xylene (108-38-3, 106-42-3)	o-xylene (95-47-6)	isopropylbenzene (98-82-8)	1,3,5-trimethylbenzene (108-67-8)	1,2,4-trimethylbenzene (95-63-6)	1,3-dichlorobenzene (541-73-1)	1,4-dichlorobenzene (106-46-7)	1,2,3-trimethylbenzene (526-73-8)	1,2-dichlorobenzene (95-50-1)	naphthalene (91-20-3)
Units		µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L
October 2011																			
5X QL		2.50	2.50	2.50	2.50		2.50	2.50	5.00	10.0	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW02	10/25/2011	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW02 DUP	10/25/2011	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50		2.50	2.50	5.00	10.0	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW06	10/26/2011	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW06 DUP	10/26/2011	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50		2.50	2.50	5.00	10.0	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPASW01	10/29/2011	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	0.38	<0.5	<0.5	<0.5	<0.5	<0.5
NEPASW01 DUP	10/29/2011	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	0.39	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50		2.50	2.50	5.00	10.0	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW25	11/2/2011	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW25 DUP	11/2/2011	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
April 2012																			
5X QL		2.50	2.50	2.50	2.50		2.50	2.50	5.00	10.0	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW16	4/30/2012	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW16 DUP	4/30/2012	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50		2.50	2.50	5.00	10.0	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW20	4/28/2012	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW20 DUP	4/28/2012	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50		2.50	2.50	5.00	10.0	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPASW04	4/25/2012	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPASW04 DUP	4/25/2012	<0.5	<0.5	<0.5	<0.5	R	<0.5	<0.5	<1.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A16. Volatile Organic Compound Duplicates

Sample ID	Date Collected	benzene (71-43-2)	1,2-dichloroethane (107-06-2)	trichloroethene (79-01-6)	toluene (108-88-3)	1,1,2-trichloroethane (79-00-5)	tetrachloroethene (127-18-4)	chlorobenzene (108-90-7)	ethylbenzene (100-41-4)	m+p xylene (108-38-3, 106-42-3)	o-xylene (95-47-6)	isopropylbenzene (98-82-8)	1,3,5-trimethylbenzene (108-67-8)	1,2,4-trimethylbenzene (95-63-6)	1,3-dichlorobenzene (541-73-1)	1,4-dichlorobenzene (106-46-7)	1,2,3-trimethylbenzene (526-73-8)	1,2-dichlorobenzene (95-50-1)	naphthalene (91-20-3)
Units		µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L	µg /L
May 2013																			
5X QL		2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW27	5/9/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW27 DUP	5/9/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW28	5/15/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW28 DUP	5/15/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.2	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW38	5/10/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NEPAGW38 DUP	5/10/2013	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A17. Low Molecular Weight Acid Duplicates

Sample ID	Date Collected	Lactate (50-21-5)	Formate (64-18-6)	Acetate (64-19-7)	Propionate (79-09-4)	Isobutyrate (79-31-2)	Butyrate (107-92-6)
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
October 2011							
5X QL		0.50	0.50		0.50	0.50	0.50
NEPAGW02	10/25/2011	<0.10	<0.10	R	<0.10	< 0.10	<0.10
NEPAGW02 DUP	10/25/2011	<0.10	<0.10	R	<0.10	< 0.10	<0.10
RPD (%)		NC	NC	NC	NC	NC	NC
5X QL		0.50	0.50		0.50	0.50	0.50
NEPAGW06	10/26/2011	<0.10	<0.10	R	<0.10	< 0.10	<0.10
NEPAGW06 DUP	10/26/2011	<0.10	<0.10	R	<0.10	< 0.10	<0.10
RPD (%)		NC	NC	NC	NC	NC	NC
5X QL		0.50	0.50		0.50	0.50	0.50
NEPASW01	10/29/2011	<0.10	<0.10	R	<0.10	< 0.10	<0.10
NEPASW01 DUP	10/29/2011	<0.10	0.12	R	<0.10	< 0.10	<0.10
RPD (%)		NC	NC	NC	NC	NC	NC
5X QL		0.50	0.50		0.50	0.50	0.50
NEPAGW25	11/2/2011	<0.10	0.26	R	<0.10	< 0.10	<0.10
NEPAGW25 DUP	11/2/2011	<0.10	0.26	R	<0.10	< 0.10	<0.10
RPD (%)		NC	NC	NC	NC	NC	NC

Table A17. Low Molecular Weight Acid Duplicates

Sample ID	Date Collected	Lactate (50-21-5)	Formate (64-18-6)	Acetate (64-19-7)	Propionate (79-09-4)	Isobutyrate (79-31-2)	Butyrate (107-92-6)
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
April 2012							
5X QL		0.50	0.50	0.50	0.50	0.50	0.50
NEPAGW16	4/30/2012	<0.10	0.28	<0.10	<0.10	<0.10	<0.10
NEPAGW16 DUP	4/30/2012	<0.10	0.27	<0.10	<0.10	<0.10	<0.10
RPD (%)		NC	NC	NC	NC	NC	NC
5X QL		0.50	0.50	0.50	0.50	0.50	0.50
NEPAGW20	4/28/2012	<0.10	0.17	<0.10	<0.10	<0.10	<0.10
NEPAGW20 DUP	4/28/2012	<0.10	0.18	<0.10	<0.10	<0.10	<0.10
RPD (%)		NC	NC	NC	NC	NC	NC
5X QL		0.50	0.50	0.50	0.50	0.50	0.50
NEPASW04	4/25/2012	0.07	0.17	0.14	<0.10	<0.10	<0.10
NEPASW04 DUP	4/25/2012	0.05	0.13	0.15	<0.10	<0.10	<0.10
RPD (%)		NC	NC	NC	NC	NC	NC

Table A17. Low Molecular Weight Acid Duplicates

Sample ID	Date Collected	Lactate (50-21-5)	Formate (64-18-6)	Acetate (64-19-7)	Propionate (79-09-4)	Isobutyrate (79-31-2)	Butyrate (107-92-6)
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
May 2013							
5X QL		0.50		0.50	0.50	0.50	0.50
NEPAGW27	5/9/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
NEPAGW27 DUP	5/9/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
RPD (%)		NC	NC	NC	NC	NC	NC
5X QL		0.50		0.50	0.50	0.50	0.50
NEPAGW28	5/15/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
NEPAGW28 DUP	5/15/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
RPD (%)		NC	NC	NC	NC	NC	NC
5X QL		0.50		0.50	0.50	0.50	0.50
NEPAGW38	5/10/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
NEPAGW38 DUP	5/10/2013	<0.10	NR	<0.10	<0.10	<0.10	<0.10
RPD (%)		NC	NC	NC	NC	NC	NC

Table A18. Dissolved Gas Duplicates

Sample	Date Collected	Methane (74-82-8)	Ethane (74-84-0)	Propane (74-98-6)	Butane (106-97-8)
Units		mg/L	mg/L	mg/L	mg/L
October 2011					
5X QL		0.0068	0.0139	0.0192	0.0241
NEPAGW02	10/25/2011	40.7	0.0257	<0.0038	<0.0048
NEPAGW02 DUP	10/25/2011	27.9	0.0172	<0.0038	<0.0048
RPD (%)		37.3	39.6	NC	NC
5X QL		0.0068	0.0139	0.0192	0.0241
NEPAGW06	10/26/2011	1.19	0.0212	<0.0038	<0.0048
NEPAGW06 DUP	10/26/2011	1.24	0.0236	<0.0038	<0.0048
RPD (%)		4.1	10.7	NC	NC
5X QL		0.0068	0.0139	0.0192	0.0241
NEPASW01	10/29/2011	0.0244	<0.0028	<0.0038	<0.0048
NEPASW01 DUP	10/29/2011	0.0204	<0.0028	<0.0038	<0.0048
RPD (%)		17.9	NC	NC	NC
5X QL		0.0068	0.0139	0.0192	0.0241
NEPAGW25	11/2/2011	<0.0014	<0.0028	<0.0038	<0.0048
NEPAGW25 DUP	11/2/2011	<0.0014	<0.0028	<0.0038	<0.0048
RPD (%)		NC	NC	NC	NC

Table A18. Dissolved Gas Duplicates

Sample	Date Collected	Methane (74-82-8)	Ethane (74-84-0)	Propane (74-98-6)	Butane (106-97-8)
Units		mg/L	mg/L	mg/L	mg/L
April 2012					
5X QL		0.0069	0.0140	0.0193	0.0240
NEPAGW16	4/30/2012	8.19	0.1090	0.0022	<0.0048
NEPAGW16 DUP	4/30/2012	7.67	0.1040	0.0043	<0.0048
RPD (%)		6.6	4.7	NC	NC
5X QL		0.0069	0.0140	0.0193	0.0240
NEPAGW20	4/28/2012	18.4	0.4140	0.0023	<0.0048
NEPAGW20 DUP	4/28/2012	18.0	0.4010	0.0022	<0.0048
RPD (%)		2.2	3.2	NC	NC
5X QL		0.0069	0.0140	0.0193	0.0240
NEPASW04	1/0/1900	NA	NA	NA	NA
NEPASW04 DUP	1/0/1900	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC

Table A18. Dissolved Gas Duplicates

Sample	Date Collected	Methane (74-82-8)	Ethane (74-84-0)	Propane (74-98-6)	Butane (106-97-8)
Units		mg/L	mg/L	mg/L	mg/L
May 2013					
5X QL		0.0068	0.0139	0.0192	0.0241
NEPAGW27	5/9/2013	0.6300	<0.0028	<0.0038	<0.0048
NEPAGW27 DUP	5/9/2013	0.6460	<0.0028	<0.0038	<0.0048
RPD (%)		2.5	NC	NC	NC
5X QL		0.0068	0.0139	0.0192	0.0241
NEPAGW28	5/15/2013	<0.0014	<0.0028	<0.0038	<0.0048
NEPAGW28 DUP	5/15/2013	<0.0014	<0.0028	<0.0038	<0.0048
RPD (%)		NC	NC	NC	NC
5X QL		0.0068	0.0139	0.0192	0.0241
NEPAGW38	5/10/2013	17.5	0.4280	<0.0038	<0.0048
NEPAGW38 DUP	5/10/2013	16.9	0.4150	<0.0038	<0.0048
RPD (%)		3.5	3.1	NC	NC

Table A19. Glycol Duplicates

Sample ID	Date Collected	2-butoxyethanol (111-76-2)	Diethylene glycol (111-46-6)	Triethylene glycol (112-27-6)	Tetraethylene glycol (112-60-7)
Units		µg/L	µg/L	µg/L	µg/L
October 2011					
5X QL		25	125	125	125
NEPAGW02	10/25/2011	<5.0	<25.0	<25.0	<25.0
NEPAGW02 DUP	10/25/2011	<5.0	<25.0	<25.0	<25.0
RPD (%)		NC	NC	NC	NC
5X QL		25	125	125	125
NEPAGW06	10/26/2011	<5.0	<25.0	<25.0	<25.0
NEPAGW06 DUP	10/26/2011	<5.0	<25.0	<25.0	<25.0
RPD (%)		NC	NC	NC	NC
5X QL		25	125	125	125
NEPASW01	10/29/2011	<5.0	<25.0	<25.0	<25.0
NEPASW01 DUP	10/29/2011	<5.0	<25.0	<25.0	<25.0
RPD (%)		NC	NC	NC	NC
5X QL		25	125	125	125
NEPAGW25	11/2/2011	<5.0	<25.0	<25.0	<25.0
NEPAGW25 DUP	11/2/2011	<5.0	<25.0	<25.0	<25.0
RPD (%)		NC	NC	NC	NC

Table A19. Glycol Duplicates

Sample ID	Date Collected	2-butoxyethanol (111-76-2)	Diethylene glycol (111-46-6)	Triethylene glycol (112-27-6)	Tetraethylene glycol (112-60-7)
Units		µg/L	µg/L	µg/L	µg/L
April 2012					
5X QL		25	25	125	125
NEPAGW16	4/30/2012	<5.0	<5.0	<25.0	<25.0
NEPAGW16 DUP	4/30/2012	<5.0	<5.0	<25.0	<25.0
RPD (%)		NC	NC	NC	NC
5X QL		25	25	125	125
NEPAGW20	4/28/2012	<5.0	<5.0	<25.0	<25.0
NEPAGW20 DUP	4/28/2012	<5.0	<5.0	<25.0	<25.0
RPD (%)		NC	NC	NC	NC
5X QL		25	25	125	125
NEPASW04	4/25/2012	<5.0	<5.0	<25.0	<25.0
NEPASW04 DUP	4/25/2012	<5.0	<5.0	<25.0	<25.0
RPD (%)		NC	NC	NC	NC

Table A19. Glycol Duplicates

Sample ID	Date Collected	2-butoxyethanol (111-76-2)	Diethylene glycol (111-46-6)	Triethylene glycol (112-27-6)	Tetraethylene glycol (112-60-7)
Units		µg/L	µg/L	µg/L	µg/L
May 2013					
5X QL		50	50	50	50
NEPAGW27	5/9/2013	<10.0	<10.0	<10.0	<10.0
NEPAGW27 DUP	5/9/2013	<10.0	<10.0	<10.0	<10.0
RPD (%)		NC	NC	NC	NC
5X QL		50	50	50	50
NEPAGW28	5/15/2013	<10.0	<10.0	<10.0	<10.0
NEPAGW28 DUP	5/15/2013	<10.0	<10.0	<10.0	<10.0
RPD (%)		NC	NC	NC	NC
5X QL		50	50	50	50
NEPAGW38	5/10/2013	<10.0	<10.0	<10.0	<10.0
NEPAGW38 DUP	5/10/2013	<10.0	<10.0	<10.0	<10.0
RPD (%)		NC	NC	NC	NC

Table A20. Semi-Volatile Organic Compound Duplicates

Sample ID	Date Collected	R-(+)-limonene (5989-27-5)	1,2,4-trichlorobenzene (120-82-1)	1,2-dichlorobenzene (95-50-1)	1,2-dinitrobenzene (528-29-0)	1,3-dichlorobenzene (541-73-1)	1,3-dimethyladamantane (702-79-4)	1,3 -dinitrobenzene (99-65-0)	1,4-dichlorobenzene (106-46-7)	1,4-dinitrobenzene (100-25-4)	1-methylnaphthalene (90-12-0)	2,3,4,6-tetrachlorophenol (58-90-2)	2,3,5,6-tetrachlorophenol (935-95-5)	2,4,5-trichlorophenol (95-95-4)	2,4,6-trichlorophenol (88-06-2)	2,4-dichlorophenol (120-83-2)	2,4-dimethylphenol (105-67-9)	2,4-dinitrophenol (51-28-5)	2,4-dinitrotoluene (121-14-2)	2,6-dinitrotoluene (606-20-2)	2-butoxyethanol (111-76-2)	2-chloronaphthalene (91-58-7)	2-chlorophenol (95-57-8)	2-methylnaphthalene (91-57-6)	2-methylphenol (95-48-7)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011																									
5X QL		2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	25	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW02	10/25/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
NEPAGW02 DUP	10/25/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	25	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW06	10/26/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
NEPAGW06 DUP	10/26/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	25	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPASW01	10/29/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
NEPASW01 DUP	10/29/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	25	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NEPAGW25	11/2/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
NEPAGW25 DUP	11/2/2011	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A20. Semi-Volatile Organic Compound Duplicates

Sample ID	Date Collected	R-(+)-limonene (5989-27-5)	1,2,4-trichlorobenzene (120-82-1)	1,2-dichlorobenzene (95-50-1)	1,2-dinitrobenzene (528-29-0)	1,3-dichlorobenzene (541-73-1)	1,3-dimethyladamantane (702-79-4)	1,3 -dinitrobenzene (99-65-0)	1,4-dichlorobenzene (106-46-7)	1,4-dinitrobenzene (100-25-4)	1-methylnaphthalene (90-12-0)	2,3,4,6-tetrachlorophenol (58-90-2)	2,3,5,6-tetrachlorophenol (935-95-5)	2,4,5-trichlorophenol (95-95-4)	2,4,6-trichlorophenol (88-06-2)	2,4-dichlorophenol (120-83-2)	2,4-dimethylphenol (105-67-9)	2,4-dinitrophenol (51-28-5)	2,4-dinitrotoluene (121-14-2)	2,6-dinitrotoluene (606-20-2)	2-butoxyethanol (111-76-2)	2-chloronaphthalene (91-58-7)	2-chlorophenol (95-57-8)	2-methylnaphthalene (91-57-6)	2-methylphenol (95-48-7)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
April 2012																									
5X QL		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.0	10.0	10.0	10.0	10.0	10.0	15.0	5.00	5.00	5.00	5.00	10.0	5.00	10.0
NEPAGW16	4/30/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
NEPAGW16 DUP	4/30/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.0	10.0	10.0	10.0	10.0	10.0	15.0	5.00	5.00	5.00	5.00	10.0	5.00	10.0
NEPAGW20	4/28/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
NEPAGW20 DUP	4/28/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.0	10.0	10.0	10.0	10.0	10.0	15.0	5.00	5.00	5.00	5.00	10.0	5.00	10.0
NEPASW04	4/25/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
NEPASW04 DUP	4/25/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
May 2013																									
5X QL		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.0	10.0	10.0	10.0	10.0	10.0	15.0	5.00	5.00	5.00	5.00	10.0	5.00	10.0
NEPAGW27	5/9/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
NEPAGW27 dup	5/9/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.0	10.0	10.0	10.0	10.0	10.0	15.0	5.00	5.00	5.00	5.00	10.0	5.00	10.0
NEPAGW28	5/15/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
NEPAGW28 dup	5/15/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.0	10.0	10.0	10.0	10.0	10.0	15.0	5.00	5.00	5.00	5.00	10.0	5.00	10.0
NEPAGW38	5/10/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
NEPAGW38 dup	5/10/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<3.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A20. Semi-Volatile Organic Compound Duplicates

Sample ID	Date Collected	2-nitroaniline (88-74-4)	2-nitrophenol (88-75-5)	3&4-methylphenol (108-39-4 & 106-44-5)	3,3'-dichlorobenzidine (91-94-1)	3-nitroaniline (99-09-2)	4,6-dinitro-2-methylphenol (534-52-1)	4-bromophenyl phenyl ether (101-55-3)	4-chloro-3-methylphenol (59-50-7)	4-chloroaniline (106-47-8)	4-chlorophenyl phenyl ether (7005-72-3)	4-nitroaniline (100-01-6)	4-nitrophenol (100-02-7)	Acenaphthene (83-32-9)	Acenaphthylene (208-96-8)	Adamantane (281-23-2)	Aniline (62-53-3)	Anthracene (120-12-7)	Azobenzene (103-33-3)	Benzo(a)anthracene (56-55-3)	Benzo(a)pyrene (50-32-8)	Benzo(b)fluoranthene (205-99-2)	Benzo(g,h,i)perylene (191-24-2)	Benzo(k)fluoranthene (207-08-9)	Benzoic Acid (65-85-0)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011																									
5X QL		2.50	2.50	2.50		2.50	2.50	2.50	2.50	5.00	2.50	2.50	12.5	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	25
NEPAGW02	10/25/2011	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00
NEPAGW02 DUP	10/25/2011	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50		2.50	2.50	2.50	2.50	5.00	2.50	2.50	12.5	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	25
NEPAGW06	10/26/2011	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00
NEPAGW06 DUP	10/26/2011	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50		2.50	2.50	2.50	2.50	5.00	2.50	2.50	12.5	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	25
NEPASW01	10/29/2011	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00
NEPASW01 DUP	10/29/2011	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50		2.50	2.50	2.50	2.50	5.00	2.50	2.50	12.5	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	25
NEPAGW25	11/2/2011	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00
NEPAGW25 DUP	11/2/2011	<0.50	<0.50	<0.50	NR	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<2.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A20. Semi-Volatile Organic Compound Duplicates

Sample ID	Date Collected	2-nitroaniline (88-74-4)	2-nitrophenol (88-75-5)	3&4-methylphenol (108-39-4 & 106-44-5)	3,3'-dichlorobenzidine (91-94-1)	3-nitroaniline (99-09-2)	4,6-dinitro-2-methylphenol (534-52-1)	4-bromophenyl phenyl ether (101-55-3)	4-chloro-3-methylphenol (59-50-7)	4-chloroaniline (106-47-8)	4-chlorophenyl phenyl ether (7005-72-3)	4-nitroaniline (100-01-6)	4-nitrophenol (100-02-7)	Acenaphthene (83-32-9)	Acenaphthylene (208-96-8)	Adamantane (281-23-2)	Aniline (62-53-3)	Anthracene (120-12-7)	Azobenzene (103-33-3)	Benzo(a)anthracene (56-55-3)	Benzo(a)pyrene (50-32-8)	Benzo(b)fluoranthene (205-99-2)	Benzo(g,h,i)perylene (191-24-2)	Benzo(k)fluoranthene (207-08-9)	Benzoic Acid (65-85-0)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
April 2012																									
5X QL		5.00	10.0	25	5.00	15.0	10.0	5.00	10.0	15.0	5.00	15.0	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	15.0
NEPAGW16	4/30/2012	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
NEPAGW16 DUP	4/30/2012	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	10.0	25	5.00	15.0	10.0	5.00	10.0	15.0	5.00	15.0	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	15.0
NEPAGW20	4/28/2012	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
NEPAGW20 DUP	4/28/2012	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	10.0	25	5.00	15.0	10.0	5.00	10.0	15.0	5.00	15.0	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	15.0
NEPASW04	4/25/2012	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
NEPASW04 DUP	4/25/2012	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
May 2013																									
5X QL		5.00	10.0	25	5.00	15.0	10.0	5.00	10.0	15.0	5.00	15.0	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	15.0
NEPAGW27	5/9/2013	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
NEPAGW27 dup	5/9/2013	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	10.0	25	5.00	15.0	10.0	5.00	10.0	15.0	5.00	15.0	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	15.0
NEPAGW28	5/15/2013	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
NEPAGW28 dup	5/15/2013	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	10.0	25	5.00	15.0	10.0	5.00	10.0	15.0	5.00	15.0	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	15.0
NEPAGW38	5/10/2013	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
NEPAGW38 dup	5/10/2013	<1.00	<2.00	<5.00	<1.00	<3.00	<2.00	<1.00	<2.00	<3.00	<1.00	<3.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<3.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A20. Semi-Volatile Organic Compound Duplicates

Sample ID	Date Collected	Benzyl alcohol (100-51-6)	Bis-(2-chloroethoxy)methane (111-91-1)	Bis-(2-chloroethyl)ether (111-44-4)	Bis-(2-chloroisopropyl)ether (108-60-1)	Bis-(2-ethylhexyl) adipate (103-23-1)	Bis-(2-ethylhexyl) phthalate (117-81-7)	Butyl benzyl phthalate (85-68-7)	Carbazole (86-74-8)	Chrysene (218-01-9)	Dibenz(a,h)anthracene (53-70-3)	Dibenzofuran (132-64-9)	Diethyl phthalate (84-66-2)	Dimethyl phthalate (131-11-3)	Di-n-butyl phthalate (84-74-2)	Di-n-octyl phthalate (117-84-0)	Diphenylamine (122-39-4)	Fluoranthene (206-44-0)	Fluorene (86-73-7)	Hexachlorobenzene (118-74-1)	Hexachlorobutadiene (87-68-3)	Hexachlorocyclopentadiene (77-47-4)	Hexachloroethane (67-72-1)	Indeno(1,2,3-cd)pyrene (193-39-5)	Isophorone (78-59-1)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011																									
5X QL		2.50	2.50	2.50	2.50	5.00	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	5.00	2.50	5.00	2.50	2.50
NEPAGW02	10/25/2011	<0.50	<0.50	<0.50	<0.50	3.57	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50
NEPAGW02 DUP	10/25/2011	<0.50	<0.50	<0.50	<0.50	2.76	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	5.00	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	5.00	2.50	5.00	2.50	2.50
NEPAGW06	10/26/2011	<0.50	<0.50	<0.50	<0.50	2.89	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50
NEPAGW06 DUP	10/26/2011	<0.50	<0.50	<0.50	<0.50	3.92	2.82	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	5.00	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	5.00	2.50	5.00	2.50	2.50
NEPASW01	10/29/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50
NEPASW01 DUP	10/29/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	5.00	5.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	5.00	2.50	5.00	2.50	2.50
NEPAGW25	11/2/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50
NEPAGW25 DUP	11/2/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<1.00	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00	<0.50	<0.50
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A20. Semi-Volatile Organic Compound Duplicates

Sample ID	Date Collected	Benzyl alcohol (100-51-6)	Bis-(2-chloroethoxy)methane (111-91-1)	Bis-(2-chloroethyl)ether (111-44-4)	Bis-(2-chloroisopropyl)ether (108-60-1)	Bis-(2-ethylhexyl) adipate (103-23-1)	Bis-(2-ethylhexyl) phthalate (117-81-7)	Butyl benzyl phthalate (85-68-7)	Carbazole (86-74-8)	Chrysene (218-01-9)	Dibenz(a,h)anthracene (53-70-3)	Dibenzofuran (132-64-9)	Diethyl phthalate (84-66-2)	Dimethyl phthalate (131-11-3)	Di-n-butyl phthalate (84-74-2)	Di-n-octyl phthalate (117-84-0)	Diphenylamine (122-39-4)	Fluoranthene (206-44-0)	Fluorene (86-73-7)	Hexachlorobenzene (118-74-1)	Hexachlorobutadiene (87-68-3)	Hexachlorocyclopentadiene (77-47-4)	Hexachloroethane (67-72-1)	Indeno(1,2,3-cd)pyrene (193-39-5)	Isophorone (78-59-1)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
April 2012																									
5X QL		5.00	5.00	5.00	5.00	5.00	10.0	5.00	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
NEPAGW16	4/30/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
NEPAGW16 DUP	4/30/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	5.00	10.0	5.00	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
NEPAGW20	4/28/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
NEPAGW20 DUP	4/28/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	5.00	10.0	5.00	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
NEPASW04	4/25/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
NEPASW04 DUP	4/25/2012	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
May 2013																									
5X QL		5.00	5.00	5.00	5.00	5.00	10.0	5.00	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
NEPAGW27	5/9/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
NEPAGW27 dup	5/9/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	5.00	10.0	5.00	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
NEPAGW28	5/15/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
NEPAGW28 dup	5/15/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	5.00	10.0	5.00	15.0	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
NEPAGW38	5/10/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
NEPAGW38 dup	5/10/2013	<1.00	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A20. Semi-Volatile Organic Compound Duplicates

Sample ID	Date Collected	Naphthalene (91-20-3)	Nitrobenzene (98-95-3)	N-nitrosodimethylamine (62-75-9)	N-nitrosodi-n-propylamine (621-64-7)	Pentachlorophenol (87-86-5)	Phenanthrene (85-01-8)	Phenol (108-95-2)	Pyrene (129-00-0)	Pyridine (110-86-1)	Squalene (111-02-4)	Terpiniol (98-55-5)	tri-(2-butoxyethyl) phosphate (78-51-3)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
October 2011													
5X QL		2.50	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	5.00	2.50	5.00
NEPAGW02	10/25/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
NEPAGW02 DUP	10/25/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	5.00	2.50	5.00
NEPAGW06	10/26/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
NEPAGW06 DUP	10/26/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	5.00	2.50	5.00
NEPASW01	10/29/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
NEPASW01 DUP	10/29/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		2.50	2.50	2.50	2.50	5.00	2.50	2.50	2.50	2.50	5.00	2.50	5.00
NEPAGW25	11/2/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
NEPAGW25 DUP	11/2/2011	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50	<1.00	<0.50	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A20. Semi-Volatile Organic Compound Duplicates

Sample ID	Date Collected	Naphthalene (91-20-3)	Nitrobenzene (98-95-3)	N-nitrosodimethylamine (62-75-9)	N-nitrosodi-n-propylamine (621-64-7)	Pentachlorophenol (87-86-5)	Phenanthrene (85-01-8)	Phenol (108-95-2)	Pyrene (129-00-0)	Pyridine (110-86-1)	Squalene (111-02-4)	Terpiniol (98-55-5)	tri-(2-butoxyethyl) phosphate (78-51-3)
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
April 2012													
5X QL		5.00	5.00	5.00	5.00	10.0	5.00	10.0	5.00	5.00	10.0	5.00	5.00
NEPAGW16	4/30/2012	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
NEPAGW16 DUP	4/30/2012	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	10.0	5.00	10.0	5.00	5.00	10.0	5.00	5.00
NEPAGW20	4/28/2012	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
NEPAGW20 DUP	4/28/2012	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	10.0	5.00	10.0	5.00	5.00	10.0	5.00	5.00
NEPASW04	4/25/2012	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
NEPASW04 DUP	4/25/2012	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
May 2013													
5X QL		5.00	5.00	5.00	5.00	10.0	5.00	10.0	5.00	5.00	10.0	5.00	5.00
NEPAGW27	5/9/2013	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
NEPAGW27 dup	5/9/2013	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	10.0	5.00	10.0	5.00	5.00	10.0	5.00	5.00
NEPAGW28	5/15/2013	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
NEPAGW28 dup	5/15/2013	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
5X QL		5.00	5.00	5.00	5.00	10.0	5.00	10.0	5.00	5.00	10.0	5.00	5.00
NEPAGW38	5/10/2013	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
NEPAGW38 dup	5/10/2013	<1.00	<1.00	<1.00	<1.00	<2.00	<1.00	<2.00	<1.00	<1.00	<2.00	<1.00	<1.00
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A21. Diesel Range Organic Compounds and Gasoline Range Organic Compounds Duplicates

Sample ID	Date Collected	GRO/TPH	DRO
Units		µg/L	µg/L
October 2011			
5X QL		100	100
NEPAGW02	10/25/2011	<20	<20
NEPAGW02 DUP	10/25/2011	<20	<20
RPD (%)		NC	NC
5X QL		100	100
NEPAGW06	10/26/2011	<20	<20
NEPAGW06 DUP	10/26/2011	<20	<20
RPD (%)		NC	NC
5X QL		100	100
NEPASW01	10/29/2011	<20	23.1
NEPASW01 DUP	10/29/2011	<20	25.1
RPD (%)		NC	NC
5X QL		100	100
NEPAGW25	11/2/2011	<20	<20
NEPAGW25 DUP	11/2/2011	<20	<20
RPD (%)		NC	NC

Table A21. Diesel Range Organic Compounds and Gasoline Range Organic Compounds Duplicates

Sample ID	Date Collected	GRO/TPH	DRO
Units		µg/L	µg/L
April 2012			
5X QL		100	100
NEPAGW16	4/30/2012	<20.0	<20.0
NEPAGW16 DUP	4/30/2012	<20.0	<20.0
RPD (%)		NC	NC
5X QL		100	100
NEPAGW20	4/28/2012	<20.0	<20.0
NEPAGW20 DUP	4/28/2012	<20.0	<20.0
RPD (%)		NC	NC
5X QL		100	100
NEPASW04	4/25/2012	<20.0	273
NEPASW04 DUP	4/25/2012	<20.0	267
RPD (%)		NC	2.2

Table A21. Diesel Range Organic Compounds and Gasoline Range Organic Compounds Duplicates

Sample ID	Date Collected	GRO/TPH	DRO
Units		µg/L	µg/L
May 2013			
5X QL		100	100
NEPAGW27	5/9/2013	<20.0	<20.0
NEPAGW27 DUP	5/9/2013	<20.0	<20.0
RPD (%)		NC	NC
5X QL		100	100
NEPAGW27	5/9/2013	<20.0	<20.0
NEPAGW27 DUP	5/9/2013	<20.0	<20.0
RPD (%)		NC	NC
5X QL		100	100
NEPAGW38	5/10/2013	<20.0	<20.0
NEPAGW38 DUP	5/10/2013	<20.0	<20.0
RPD (%)		NC	NC

Table A22. O and H Stable Isotopes of Water Duplicates

Sample ID	Date Collected	δ2H	δ18 O
Units		‰	‰
October 2011			
NEPAGW02	10/25/2011	-67.41	-10.37
NEPAGW02 DUP	10/25/2011	-66.60	-10.37
RPD (%)		1.2	0.0
NEPAGW06	10/26/2011	-63.24	-9.56
NEPAGW06 DUP	10/26/2011	-62.76	-9.70
RPD (%)		0.8	1.5
NEPASW01	10/29/2011	-60.67	-8.98
NEPASW01 DUP	10/29/2011	-61.41	-9.10
RPD (%)		1.2	1.3
NEPAGW25	11/2/2011	-59.99	-8.98
NEPAGW25 DUP	11/2/2011	-60.56	-9.07
RPD (%)		0.9	1.0
April 2012			
NEPAGW16	4/30/2012	-64.72	-9.58
NEPAGW16 DUP	4/30/2012	-64.59	-9.69
RPD (%)		0.2	1.1
NEPAGW20	4/28/2012	-62.90	-9.45
NEPAGW20 DUP	4/28/2012	-62.53	-9.56
RPD (%)		0.6	1.2
NEPASW04	4/25/2012	-63.54	-8.86
NEPASW04 DUP	4/25/2012	-63.44	-8.85
RPD (%)		0.2	0.1

Table A22. O and H Stable Isotopes of Water Duplicates

Sample ID	Date Collected	δ2H	δ18 O
Units		‰	‰
May 2013			
NEPAGW27	5/9/2013	-63.6	-9.64
NEPAGW27 dup	5/9/2013	-63.9	-9.81
RPD (%)		0.5	1.7
NEPAGW28	5/15/2013	-64.1	-9.85
NEPAGW28 dup	5/15/2013	-64.0	-9.79
RPD (%)		0.1	0.6
NEPAGW38	5/10/2013	-63.5	-9.47
NEPAGW38 dup	5/10/2013	-63.5	-9.50
RPD (%)		0.1	0.3

Table A23. Carbon and Hydrogen Isotopes of DIC and Methane Duplicates

Sample ID	Date Collected	Helium	Hydrogen	Argon	Oxygen	Carbon dioxide	Nitrogen	Carbon monoxide	Methane	Ethane	Ethene	Propane	Propylene	Isobutane	Normal Butane	Isopentane	Normal Pentane	Hexane Plus
Units		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
October 2011																		
NEPAGW02	10/25/2011	0.0037	ND	0.111	1.94	0.17	5.03	ND	92.72	0.0233	ND	ND	0.0001	ND	ND	ND	ND	ND
NEPAGW02 DUP		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
NEPAGW06		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NEPAGW06 DUP		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
NEPASW01		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NEPASW01 DUP		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
NEPAGW25		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NEPAGW25 DUP		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table A23. Carbon and Hydrogen Isotopes of DIC and Methane Duplicates

Sample ID	Date Collected	Helium	Hydrogen	Argon	Oxygen	Carbon dioxide	Nitrogen	Carbon monoxide	Methane	Ethane	Ethene	Propane	Propylene	Isobutane	Normal Butane	Isopentane	Normal Pentane	Hexane Plus
Units		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
April 2012																		
NEPAGW16	4/30/2012	NR	ND	1.19	2.03	0.42	59.81	ND	36.33	0.215	ND	0.0034	ND	ND	ND	ND	ND	ND
NEPAGW16 DUP	4/30/2012	NR	ND	1.17	2.00	0.37	61.42	ND	34.83	0.207	ND	0.0031	ND	ND	ND	ND	ND	ND
RPD (%)		NC	NC	1.7	1.5	12.7	2.7	NC	4.2	3.8	NC	9.2	NC	NC	NC	NC	NC	NC
NEPAGW20	4/28/2012	NR	ND	0.659	1.69	0.35	30.00	ND	66.58	0.714	ND	0.0026	ND	ND	ND	ND	ND	ND
NEPAGW20 DUP	4/28/2012	NR	ND	0.662	1.87	0.40	29.70	ND	66.63	0.731	ND	0.0025	ND	ND	ND	ND	ND	ND
RPD (%)		NC	NC	0.5	10.1	13.3	1.0	NC	0.1	2.4	NC	3.9	NC	NC	NC	NC	NC	NC
NEPASW04	4/25/2012	NR	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NEPASW04 DUP	4/25/2012	NR	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
May 2013																		
NEPAGW27	5/9/2013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NEPAGW27 DUP	5/9/2013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
NEPAGW28	5/15/2013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NEPAGW28 DUP	5/15/2013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
NEPAGW38	5/10/2013	NR	ND	0.742	1.23	0.26	37.73	ND	59.24	0.791	ND	0.0025	ND	ND	ND	ND	ND	ND
NEPAGW38 DUP	5/10/2013	NR	ND	0.753	1.28	0.26	38.27	ND	58.65	0.781	ND	0.0023	ND	ND	ND	ND	ND	ND
RPD (%)		NC	NC	1.5	4.0	0.0	1.4	NC	1.0	1.3	NC	8.3	NC	NC	NC	NC	NC	NC

Table A23. Carbon and Hydrogen Isotopes of DIC and Methane Duplicates

Sample ID	Date Collected	δ13C1	δDC1	δ13C2	δ13C DIC	Specific Gravity	BTU	Helium dilution
Units		‰	‰	‰	‰	0.00	0.00	factor
October 2011								
NEPAGW02	10/25/2011	-38.43	-206.7	-32.0	-15.34	0.588	940	NR
NEPAGW02 DUP		NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC
NEPAGW06		NA	NA	NA	NA	NA	NA	NA
NEPAGW06 DUP		NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC
NEPASW01		NA	NA	NA	NA	NA	NA	NA
NEPASW01 DUP		NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC
NEPAGW25		NA	NA	NA	NA	NA	NA	NA
NEPAGW25 DUP		NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC

Table A23. Carbon and Hydrogen Isotopes of DIC and Methane Duplicates

Sample ID	Date Collected	δ13C1	δDC1	δ13C2	δ13C DIC	Specific Gravity	BTU	Helium dilution
Units		‰	‰	‰	‰	0.00	0.00	factor
April 2012								
NEPAGW16	4/30/2012	-39.41	-170.4	-37.7	-16.26	0.827	372	0.64
NEPAGW16 DUP	4/30/2012	-39.36	-171.5	-37.7	-16.39	0.833	356	0.60
RPD (%)		0.1	0.6	0.0	0.8	0.7	4.4	6.5
NEPAGW20	4/28/2012	-33.32	-173.7	-36.4	-17.62	0.700	687	0.53
NEPAGW20 DUP	4/28/2012	-33.30	-171.0	-36.96	-18.07	0.700	688	0.52
RPD (%)		0.1	1.6	1.5	2.5	0.0	0.1	1.9
NEPASW04	4/25/2012	NA	NA	NA	NA	NA	NA	NA
NEPASW04 DUP	4/25/2012	NA	NA	NA	NA	NA	NA	NA
RPD (%)		NC	NC	NC	NC	NC	NC	NC
May 2013								
NEPAGW27	5/9/2013	NA	NA	NA	-15.1	NA	NA	NA
NEPAGW27 DUP	5/9/2013	NA	NA	NA	-15.1	NA	NA	NA
RPD (%)		NC	NC	NC	0.0	NC	NC	NC
NEPAGW28	5/15/2013	NA	NA	NA	-13.2	NA	NA	NA
NEPAGW28 DUP	5/15/2013	NA	NA	NA	-13.2	NA	NA	NA
RPD (%)		NC	NC	NC	0.0	NC	NC	NC
NEPAGW38	5/10/2013	-32.22	-163.9	-37.4	-17.7	0.729	614	0.47
NEPAGW38 DUP	5/10/2013	-32.19	-162.3	-37.4	-17.8	0.732	608	0.48
RPD (%)		0.1	1.0	0.0	0.6	0.4	1.0	2.1

Table A24. Strontium Isotope Duplicates

Sample ID	Date Collected	Sr	Rb	87Sr/86Sr	1/Sr	Rb/Sr
Units		µg/L	µg/L	Atom Ratio	L/µg	Weight Ratio
October 2011						
NEPASW01-1011	10/29/2011	84	<0.5	0.711886	0.01190	NR
NEPASW01-1011 DUP	10/29/2011	82	<0.5	0.711274	0.01220	NR
RPD (%)		2.4	NC	0.09	2.4	NC
NEPAGW25-1111	11/2/2011	2500	3.2	0.712869	0.00040	0.0013
NEPAGW25-1111 DUP	11/2/2011	2440	3.2	0.712859	0.00041	0.0013
RPD (%)		2.4	0.0	0.001	2.4	2.4
April 2012						
NEPAGW16	4/30/2012	2990	2.0	0.713470	0.00033	0.0007
NEPAGW16 DUP	4/30/2012	2990	2.0	0.713464	0.00033	0.0007
RPD (%)		0.0	0.0	0.0008	0.0	0.0
NEPAGW20	4/28/2012	877	0.8	0.713097	0.00114	0.000912
NEPAGW20 DUP	4/28/2012	878	0.8	0.713121	0.00114	0.000911
RPD (%)		0.11	0.0	0.003	0.11	0.11
NEPASW04	4/25/2012	1490	2.8	0.710105	0.00067	0.0019
NEPASW04 DUP	4/25/2012	1470	2.7	0.710045	0.00068	0.0018
RPD (%)		1.4	3.6	0.008	1.4	2.3

Table A24. Strontium Isotope Duplicates

Sample ID	Date Collected	Sr	Rb	87Sr/86Sr	1/Sr	Rb/Sr
Units		µg/L	µg/L	Atom Ratio	L/µg	Weight Ratio
May 2013						
NEPAGW27	5/9/2013	2570	3.2	0.712770	0.00039	0.0012
NEPAGW27 DUP	5/9/2013	2570	3.1	0.712756	0.00039	0.0012
RPD (%)		0.0	3.2	0.002	0.0	3.2
NEPAGW28	5/15/2013	934	<1.0	0.712246	0.00107	NR
NEPAGW28 DUP	5/15/2013	934	<1.0	0.712245	0.00107	NR
RPD (%)		0.0	NC	0.0001	0.0	NC
NEPAGW38	5/10/2013	482	<1.0	0.713145	0.00207	NR
NEPAGW38 DUP	5/10/2013	491	<1.0	0.713137	0.00204	NR
RPD (%)		1.8	NC	0.001	1.8	NC

Table A25. Gross Alpha, Gross Beta, and Radium Isotope Duplicates

Sample ID	Date Collected	Gross Alpha	Gross Beta	Ra-226	Ra-228
Units		pCi/L	pCi/L	pCi/L	pCi/L
October 2011					
5X RL					
NEPAGW02		NA	NA	NA	NA
NEPAGW02 DUP		NA	NA	NA	NA
RPD (%)					
5X RL					
NEPAGW06		NA	NA	NA	NA
NEPAGW06 DUP		NA	NA	NA	NA
RPD (%)					
5X RL					
NEPASW01		NA	NA	NA	NA
NEPASW01 DUP		NA	NA	NA	NA
RPD (%)					
5X RL					
NEPAGW25		NA	NA	NA	NA
NEPAGW25 DUP		NA	NA	NA	NA
RPD (%)					

Table A25. Gross Alpha, Gross Beta, and Radium Isotope Duplicates

Sample ID	Date Collected	Gross Alpha	Gross Beta	Ra-226	Ra-228
Units		pCi/L	pCi/L	pCi/L	pCi/L
April 2012					
5X RL		15.0	20	5.00	5.00
NEPAGW16	4/30/2012	<3.0	<4.0	<1.00	<1.00
NEPAGW16 DUP	4/30/2012	<3.0	<4.0	1.09	<1.00
RPD (%)		NC	NC	NC	NC
5X RL		15.0	20	5.00	5.00
NEPAGW20	4/28/2012	<3.0	<4.0	<1.00	<1.00
NEPAGW20 DUP	4/28/2012	<3.0	<4.0	<1.00	<1.00
RPD (%)		NC	NC	NC	NC
5X RL		15.0	20	5.00	5.00
NEPASW04	4/25/2012	<3.0	<4.0	<1.00	<1.00
NEPASW04 DUP	4/25/2012	<3.0	<4.0	<1.00	<1.00
RPD (%)		NC	NC	NC	NC

Table A25. Gross Alpha, Gross Beta, and Radium Isotope Duplicates

Sample ID	Date Collected	Gross Alpha	Gross Beta	Ra-226	Ra-228
Units		pCi/L	pCi/L	pCi/L	pCi/L
May 2013					
5X RL		15.0	20	5.00	5.00
NEPAGW27	5/9/2013	<3.0	<4.0	<1.00	<1.00
NEPAGW27 DUP	5/9/2013	<3.0	4.2	<1.00	<1.00
RPD (%)		NC	NC	NC	NC
5X RL		15.0	20	5.00	5.00
NEPAGW28	5/15/2013	<3.0	<4.0	<1.00	<1.00
NEPAGW28 DUP	5/15/2013	<3.0	<4.0	<1.00	<1.00
RPD (%)		NC	NC	NC	NC
5X RL		15.0	20	5.00	5.00
NEPAGW38	5/10/2013	3.7	4.9	<1.00	<1.00
NEPAGW38 DUP	5/10/2013	4.7	5.7	<1.00	<1.00
RPD (%)		NC	NC	NC	NC

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
October/November 2011 Sampling Event		
Field Parameters/EPA on-site	Results for ferrous iron and sulfide are considered screening values as they were measured on site with field kits. A YSI instrument performance check for pH, conductivity, and ORP was either not recorded or conducted at the end of the day on 11/4/2011.	All detected results are qualified with "J" as estimated. Data usability is unaffected as this is normal for these measurements. The YSI field instrument was calibrated and a performance check was conducted on the morning of 11/4/2011; all other YSI performance checks conducted over the course of the entire study were within acceptable limits; and pH, conductivity, and ORP values for affected samples NEPAGW32 and NEPAGW33 collected end-of-day 11/4/2011 were consistent with values for samples collected at same locations in subsequent two rounds. Thus, the YSI data for affected samples NEPASW02, NEPAGW31, NEPAGW32, and NEPAGW33 are considered usable without qualification.
Dissolved gases/ Shaw Environmental	Dissolved gases: Methane, ethane, propane, and butane were detected in trip blanks for 10/25/11 and 10/26/11 and equipment blank for 10/31/11 due to carryover in the analytical process from standards analyzed prior to the blanks. Relative percent difference of a field duplicate was outside acceptance criteria of 30% for methane and ethane in NEPAGW02 at 37.2% and 39.6%, respectively.	The "B" qualifier was applied to affected samples NEPAGW05, NEPAGW07, and NEPAGW19 for methane and NEPAGW06 and NEPAGW06dup for ethane. Methane results for the affected samples are too close to blank results; data is unusable. Ethane results are ~6x the blank and may be usable with caution. The "*" qualifier was applied to NEPAGW02 indicating precision was outside the acceptance limit. Lower value for methane in field duplicate is still >25 mg/L confirming dissolved gas concentrations at location are high. Dissolved gas data from subsequent two sampling rounds from same location were consistent with first round original sample indicating field duplicate result was likely below true value. Data for original sample is usable.
DOC/ORD/NRMRL- Ada	Equipment blank on 10/26/2011 had a concentration above QL.	Affected samples (NEPAGW05, NEPAGW06, NEPAGW06Dup, and NEPAGW07) are qualified with a "B". All values for affected samples are similar to the blank value and therefore the data is unusable.
DIC/ORD/NRMRL- Ada	All QA/QC criteria were met.	Meets project requirements.

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
Anions/ Ammonia ORD/NRMRL- Ada	Bromide: High chloride concentrations interfered with analysis of samples NEPAGW04, NEPAGW08, NEPAGW17, and NEPAGW22 for bromide using RSKSOP-276v3 (EPA Method 6500).	Bromide data for NEPAGW04, NEPAGW08, NEPAGW17, and NEPAGW22 were qualified with "R" and rejected as unusable.
Dissolved Metals/ Shaw Environmental	ICP-MS: All ICP-MS results were rejected and replaced with ICP-OES results. The reasons stated were potential interferences and that interference check standards were not run. ICP-OES: Dissolved Sb and U are rejected due to potential spectral interference. Continuing calibration checks were analyzed at appropriate intervals, however some metals (B, Ba, K, Na, Ag, Si, S, P, and U) were not always included in the check standards at the required intervals	ICP-MS: The ICP-MS data were replaced with ICP-OES data. Detection and quantitation limits are higher than desirable. The ICP-OES data cannot be compared with the subsequent ICP-MS data for trace metals from the last two sampling events. ICP-OES: Dissolved Sb and U results data for all samples are qualified with "R" and rejected as unusable. All samples with detected quantities for these metals are qualified "J" as estimated. Data for B, Ba, K, Na, Ag, Si, S, and P are usable as positive identifications with estimated concentrations.
Total Metals/ Shaw Environmental	ICP-MS: All ICP-MS results were rejected and replaced with ICP-OES results. The reasons stated were potential interferences and that interference check standards were not run. ICP-OES: Total Sb and U results are subject to potential spectral interference. Continuing calibration checks were being analyzed at appropriate intervals, however some metals (B, Ba, K, Na, Ag, Si, S, P, and U) were not always included in the check standards at the required intervals. Digestion: It was determined that all parameters were not adhered to in EPA Method 3015A.	ICP-MS: The ICP-MS data were replaced with ICP-OES data. Detection and quantitation limits are higher than desirable. The ICP-OES data cannot be compared with the subsequent ICP-MS data for trace metals from the last two sampling events. ICP-OES: Total Sb and U results for all samples are qualified with "R" and rejected as unusable. All samples with detected quantities for these metals are qualified "J" as estimated. Data for B, Ba, K, Na, Ag, Si, S, and P are usable as positive identifications with estimated concentrations. The "J" qualifier was applied to detections above the QL for digested samples. Data are usable as positive identifications with estimated concentrations.

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
Charge Balance	The calculated charge balance error ranged from 0.67 to 15.6% based on the cations Ca, Mg, Na, K, Sr, Ba, Mn, and Fe; and the anions Cl, SO_4, HCO_3, and F.	Affected sample NEPAGW22 with an ion balance of 15.6% is excluded from use in water typing and construction of Piper and Durov diagrams. Individual cation and anion concentration data for NEPAGW22 are considered usable in development of summary statistics. One other value >10% (10.2%) for NEPAGW10 is considered usable with caution.
Measured versus calculated values of Specific Conductance (SPC)	The error in measured SPC versus calculated SPC ranged from 0.0 to 19.9%	Sample NEPAGW22 was outside of the acceptance criterion of 15%; SPC data for this sample are used with caution.
VOC/ Shaw Environmental	The matrix spike results for 1,1-dichloroethene and 1,1,2-trichloroethane are significantly outside the control limits. These compounds are known to be affected by base hydrolysis. The preservative, trisodium phosphate (TSP), is a base and elevated temperatures (heated headspace sample introduction) will accelerate the hydrolysis of 1,1,2-trichloroethane to 1,1-dichloroethene. Although samples were initially analyzed within the 14-day holding time, instrument sensitivity issues required that the samples be reanalyzed. The data reported is from the reanalysis which exceeded the 14-day holding time by up to 48 hours. Acrylonitrile and styrene were originally analyzed within the 14 day hold-time; but, due to instrument losing sensitivity between the ICAL and the first Continuing Calibration Check, reanalysis was required. The data reported is from the reanalysis, which exceeded the 14-day holding time by more than 65 days. The matrix spike and matrix spike duplicate recoveries for carbon	All data for 1,1-dichloroethene and 1,1,2-trichloroethane are qualified with "R" and rejected as unusable. The "H" qualifier was applied to all analytes for the affected samples NEPAGW21 through NEPAGW30 and field blanks and trip blanks collected on 11/1/2011, 11/2/2011, and 11/3/2011 (see Appendix B). Holding time exceedance is considered a potential negative bias. However, since the holding time exceedance was limited and samples were preserved, impact on data usability is considered minimal. The "H" qualifier was applied to the affected samples NEPAGW11 through NEPAGW20 and NEPASW01 for styrene and acrylonitrile (see Appendix B). Holding time exceedance is considered a potential negative bias. Due to this exceedance, this data is considered unusable. Note that in the subsequent sampling rounds, these analytes were not detected. The "J-" qualifier was applied to NEPAGW08 through NEPAGW20,

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
	disulfide were low in a number of samples.	NEPASW01; field and trip blanks collected on 10/27/2011, 10/28/2011, 10/29/2011, and 10/31/2011; and the equipment blank collected on 10/31/2011 (see Appendix B). There is a potential negative bias that is taken into account for data usability.
Low Molecular Weight Acids/ Shaw Environmental	All field blanks and the equipment blank contained acetate above the QL. (It was later determined that the TSP preservative was the source of the acetate contamination.) The field blanks collected on 10/31/2011, 11/2/2011, and 11/3/2011 also contained formate above the QL. Low recovery (0%) for isobutyrate in matrix spikes.	All acetate data are qualified with "R" and rejected as unusable. For formate, the "B" qualifier was applied to NEPAGW18 and NEPAGW19; and NEPAGW25 through NEPAGW30. Formate detections in field samples are similar to detections in the field blank; thus data for the affected samples are unusable. Samples were qualified with a "J-" . There is a potential negative bias to data. As there were no detections it is possible the negative bias may be a factor (note the 0% recovery for the matrix spike). Data should be considered unusable.
Glycols/ EPA Region 3 Laboratory	The method for glycols was under development. The Laboratory Control Spike was within the limits with the exception for 2-butyoxyethanol (77% recovery) in the batch prepared and analyzed on 11/08/2011.	The QAPP stated these are to be considered screening values until method was validated. The data are usable as on-going QC checks provide confidence that the method can detect glycols. Samples NEPAGW21 through NEPAGW33, NEPASW02, and the field blanks collected on 11/1/2011, 11/2/2011, 11/3/2011, and 11/4/2011 were qualified with "J-" (see Appendix B). There is a potential negative bias that is taken into account for data usability.
SVOC/ EPA Region 8 Laboratory	Sample NEPAGW22 and sample NEPAGW24 had "bad extractions". Both of the bottle lids for sample NEPAGW25 were received broken. Bis-(2-ethylhexyl) phthalate and bis-(2-ethylhexyl) adipate were detected above QL in laboratory method blanks.	Samples were qualified with a "J-". There is a potential negative bias that is taken into account for data usability. There is a potential impact (positive or negative) that is taken into account for data usability. All results are <QL Affected samples for bis-(2-ethylhexyl) phthalate and bis-(2-ethylhexyl) adipate are qualified with "B" (see Appendix B); because values are similar to method blank

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
		values, data is not usable.
	Recoveries of limonene, adamantane, and 1,3-dimethyl adamantine were low in some matrix spikes.	Affected samples NEPAGW18 through NEPAGW33 (with exception of NEPAGW25), five field blanks, and an equipment blank were qualified with J- for these three compounds (see Appendix B). There is a potential negative bias that is taken into account for data usability.
DRO/GRO/ EPA Region 8 Laboratory	DRO: Both bottle lids of sample NEPAGW26 were received broken at the laboratory. GRO: All QA/QC criteria were met.	DRO: There is a potential impact (positive or negative) that is taken into account for data usability. Result is <QL. GRO: Meets project requirements.
O, H Stable Isotopes of Water/ Shaw Environmental	All QA/QC criteria were met.	Meets project requirements.
Sr Isotopes/ USGS Laboratory- Denver	All QA/QC criteria were met.	Meets project requirements.
Isotech Gas Isotopes	All QA/QC criteria were met.	Meets project requirements.
April/May 2012 Sampling Event		
Field Parameters/EPA on-site	All QA/QC criteria were met. Results for ferrous iron and sulfide are considered screening values as they were measured on site with field kits.	Meets project requirements. All detected results are qualified with "J" as estimated. Data usability is unaffected.
Dissolved gases/ Shaw Environmental	All QA/QC criteria were met.	Meets project requirements.
DOC/ ORD/NRMRL- Ada	Two equipment blanks had DOC detections above QL.	Affected samples NEPASW05, NEPASW06, NEPAGW36, and NEPAGW29 are less than 10x associated equipment blank values and thus qualified with "B". Concentrations in NEPASW05 and NEPASW06 were almost 10x the equipment blank value and are considered usable with caution. Values for NEPAGW29 and NEPAGW36 were near associated equipment blank value and are considered unusable.
DIC/ ORD/NRMRL- Ada	All QA/QC criteria were met.	Meets project requirements.
Anions/ Ammonia ORD/NRMRL- Ada	Bromide was initially analyzed using RSKSOP-276, Rev. 4 but was rejected due to chloride interference problems.	All bromide results are qualified "H" to indicate samples exceeded 28-day holding time. Holding time exceedance is

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
	Bromide data reported is from re-analysis of samples using RSKSOP-288, Rev.3 outside of the holding time by up to 26 days.	considered a potential negative bias which is taken into account for data usability. However, because bromide is relatively stable under these conditions in aqueous solution and holding time exceedance was not excessive, data is considered usable with caution.
Dissolved Metals/ Shaw Environmental	ICP-MS: All ICP-MS results were rejected due to potential interferences and because interference check standards were not run. Samples were re-analyzed using a CLP lab. ICP-OES: Continuing calibration checks were analyzed at appropriate intervals, however these metals (B, Ba, K, Na, Ag, Si, S, and P) were not always included in the check standards at the required intervals. Matrix spike issues occurred on the analytical run from 5/7/12; silicon had 121% recovery in one matrix spike and 136% recovery in another while Ag had 77% recovery (outside SOP Revision 5 limits of 80-120%).	ICP-MS: CLP lab ICP-MS data were used. ICP-OES: All samples with detected quantities for these metals are qualified "J" as estimated (see Appendix B). Data for B, Ba, K, Na, Ag, Si, S, and P are usable as positive identifications with estimated concentrations. Affected samples NEPAGW27, NEPAGW26, NEPAGW10, NEPAGW14, NEPAGW01, NEPAGW02, NEPAGW03, NEPASW03, NEPASW04, NEPASW04dup, NEPAGW36, NEPASW05, NEPASW06, NEPAGW09, NEPAGW08, and NEPAGW11 were qualified with J- for dissolved Ag and J+ for dissolved Si. Data for Si are usable in cases of positive identifications with concentrations being biased slightly high. Potential negative bias applies to Ag data although matrix spike recovery was only 3% lower than acceptable limit of 80%. There is a potential negative bias that is taken into account for data usability.
Total Metals/ Shaw Environmental	ICP-MS: All ICP-MS results were rejected due to potential interferences and that interference check standards were not run. Samples re-analyzed using CLP lab. ICP-OES Digestion: It was determined that all parameters were not adhered to in EPA Method 3015A. For batch analyzed on 5/14/12, the	ICP-MS: CLP ICP-MS data were used. Digestion: The "J" qualifier has been applied to detections above the QL for all ICP-OES total metal results. Data is usable as positive identifications with estimated concentrations. Affected samples NEPAGW27, NEPAGW26,

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
	pre-digestion matrix spike for Si had 131% recovery, and the post-digestion matrix spike had 135% recovery.	NEPAGW10, NEPAGW14, NEPAGW01, NEPAGW02, NEPAGW03, NEPASW03, NEPASW04, NEPASW04dup, NEPAGW36, NEPASW05, NEPASW06, NEPAGW09, NEPAGW08, and NEPAGW11 were qualified with "J+" for total Si. Data for Si are usable in cases of positive identifications with concentrations being biased slightly high.
	For batch analyzed on 5/15/12, pre-digestion matrix spike for Ag had only 73% recovery.	Affected samples NEPAGW04, NEPAGW18, NEPAGW13, NEPAGW20, NEPAGW20dup, NEPAGW06, NEPAGW15, NEPASW01, NEPAGW16, NEPAGW16dup, NEPAGW17, NEPAGW33, NEPAGW32, and NEPAGW29 were qualified with "J-" for total Ag indicating a potential negative bias for the data, although recovery was only 7% lower than the acceptable limit of 80%. There is a potential negative bias that is taken into account for data usability.
	ICP-OES: Continuing calibration checks were analyzed at appropriate intervals, however these metals (B, Ba, K, Na, Ag, Si, S, and P) were not always included in the check standards at the required intervals.	ICP-OES: All samples with detected quantities for these metals are qualified "J" as estimated (see Appendix B). Data for B, Ba, K, Na, Ag, Si, S, and P are usable as positive identifications with estimated concentrations.
	ICP-OES: Total sulfur was detected above the QL in a field blank collected on 4/30/2012.	The "B" qualifier was applied to affected samples NEPAGW15, NEPASW01, and NEPAGW32. Results for affected samples were close to field blank; data is thus unusable.
Total and Dissolved by ICP-MS/CLP	*The ICP-MS metals analyzed by the CLP lab are total & dissolved: Al, As, Cd, Cr, Cu, Pb, Li, Ni, Sb, Se, Th, Tl, and U.*	
	The serial dilution in sample set SDG MQ0021 exceeded the limits for copper. The copper results were greater than 50x MDL and the percent difference with the serial dilution was 17%, which is above the limit.	Affected total Cu field blanks (all), dissolved Cu equipment blanks (all), and sample NEPAGW06 for total Cu were qualified with "J-". There is a potential negative bias that is taken into account for data usability.
	For sample set SDG MQ0021, total Ni results were not within control limits for analysis of lab duplicate NEPAGW03.	The "*" qualifier was applied to affected samples NEPAGW03, NEPASW03, NEPAGW13, and NEPAGW14. Positive identifications may lack precision; data are usable with caution.

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
	Dissolved and total Th and some dissolved and total U results are rejected due to interference check standard problem. For total Ni, a number of samples were identified as having a potential low bias during the CLP data validation.	All dissolved and total Th results are qualified with "R" as rejected and are unusable. For dissolved and total U, see Appendix B for samples qualified with "R" and rejected as unusable. See Appendix B for samples qualified with "J-". There is a potential negative bias that is taken into account for data usability.
Charge Balance	The calculated charge balance ranged from 0.01 to 5.35% based on the cations Ca, Mg, Na, K, Sr, Ba, Mn, Fe, and Li; and the anions Cl, SO_4, HCO_3, and F.	Meets project requirements.
Measured versus calculated values of Specific Conductance (SPC)	The error in measured SPC versus calculated SPC ranged from 1.0 to 11.1%	Meets project requirements.
VOC/ Shaw Environmental	The matrix spike results for 1,1-dichloroethene and 1,1,2-trichloroethane were significantly outside the control limits. These compounds are known to be affected by base hydrolysis. The preservative, trisodium phosphate (TSP), is a base and elevated temperatures (heated headspace sample introduction) will accelerate the hydrolysis of 1,1,2-trichloroethane to 1,1-dichloroethene. Acrylonitrile, ethanol, and carbon disulfide matrix spikes had low recoveries.	All data for 1,1-dichloroethene and 1,1,2-trichloroethane are qualified with "R" and rejected as unusable. The "J-" qualifier was applied to all samples for acrylonitrile; the "J-" qualifier was applied for ethanol to affected samples NEPAGW14, NEPAGW16, NEPAGW16dup, NEPAGW17, NEPAGW29, NEPAGW32, NEPAGW33, NEPASW01, field blanks collected on 4/30/2012 and 5/1/2012, trip blanks collected on 4/29/2012 and 5/1/2012, and equipment blank collected on 4/30/2012; and the "J-" qualifier was applied for carbon disulfide to affected samples NEPAGW04, NEPAGW06, NEPAGW08, NEPAGW09, NEPAGW11, NEPAGW13, NEPAGW16, NEPAGW16dup, NEPAGW17 NEPAGW18, NEPAGW20 NEPAGW20dup, NEPAGW29, NEPAGW32, NEPAGW33, NEPAGW36, NEPASW01, NEPASW05, NEPASW06, all equipment blanks, 5 of 7 field blanks, and 2 of 4 trip

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
		blanks (see Appendix B). There is a potential negative bias that is taken into account for data usability.
Low Molecular Weight Acids/ Shaw Environmental	Isobutyrate recovery in the matrix spike and matrix spike duplicate was below the acceptable range due to matrix interference. Formate was detected in a field blank at the QL.	The "J-" qualifier was applied to all samples for isobutyrate. There is a potential negative bias that is taken into account for data usability. Affected samples NEPAGW02, NEPAGW03, NEPASW04 and NEPASW04dup were qualified with "B". Values for NEPAGW03, NEPASW04 and NEPASW04dup are near the values of the field blank; data is thus unusable. Value for NEPAGW02 is nearly 10x that of field blank; data is usable with caution.
Glycols/ EPA Region 3 Laboratory	The method for glycols was under development.	The QAPP stated these are to be considered screening values until method was validated. The data are usable as on-going QC checks provide confidence that the method can detect glycols.
SVOC/ EPA Region 8 Laboratory	Sample NEPAGW36: the initial extraction went dry. The sample was re-extracted the next day but was 4 hours past holding time. The field blank collected on 4/30/2012 was extracted 20 minutes past holding time. Sample NEPASW04 matrix spike associated with batch 1200245 was low for 4-nitroaniline, diphenyl amine and high for carbazole.	The "H" qualifier was applied to the affected sample NEPAGW36. Holding time exceedance is considered a potential negative bias. However, the holding time exceedance was minor, and the data is considered usable. The "H" qualifier was applied to the field blank. Holding time exceedance is considered a potential negative bias. However, holding time exceedance was minor, so impact on data usability is considered minimal. Affected samples for nitroaniline and diphenylamine were qualified with "J-" indicating a potential negative bias (see Appendix B). There were no detections for carbazole in samples and the data for carbazole are thus usable. For 4-nitroaniline and diphenylamine there is a potential negative bias that is taken into account for data usability.

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
	Sample NEPAGW20 matrix spike associated with batch 1200246 and blank spike associated with batch 1200245 were low for adamantane, 1,3 dimethyl adamantane, and limonene. Sample NEPAGW16 matrix spike associated with batch 1200247 was low for 2-butoxyethanol, limonene, adamantane, 1,3 dimethyl adamantane, diphenylamine, squalene, benzyl alcohol, hexachloroethane, terpiniol, 2-chloronapthalene, dibenzofuran, and 2-butoxyethanol phosphate. Sample NEPAGW09 had a relatively high level of bis(2-ethylhexyl)phthalate (36.7 μg/L) which was attributed to laboratory contamination of the extract based on an investigation conducted by the laboratory. The laboratory found no corresponding peak for this phthalate in the DRO chromatogram.	Affected samples for these compounds were qualified with "J-" indicating a negative bias. There is a potential negative bias that is taken into account for data usability. Affected samples for these compounds were qualified with "J-" (see Appendix B) indicating a negative bias. There is a potential negative bias that is taken into account for data usability. Data for sample NEPAGW09 for bis(2-ethylhexyl)phthalate is unusable.
DRO/GRO/ EPA Region 8 Laboratory	DRO: A field blank collected on May 1, 2012, had a detectable concentration equal to the QL. DRO: Matrix spike dup for NEPASW04 was below percent recovery limits with 44.6% and the surrogate recovery for field blank collected on 4/24/12 was low at 46.7%. GRO: All QA/QC criteria were met.	DRO concentration in affected field sample (NEPAGW29) was <QL. No impact on data quality or usability. The J- qualifier was applied to all DRO samples indicating a negative bias. There is a potential negative bias that is taken into account for data usability. GRO: Meets project requirements.
O, H Stable Isotopes of Water/ Shaw Environmental	All QA/QC criteria were met.	Meets project requirements.
Sr Isotopes/ USGS Laboratory- Denver	All QA/QC criteria were met.	Meets project requirements.
Isotech Gas Isotopes	All QA/QC criteria were met.	Meets project requirements.
ALS Radionuclides	All QA/QC criteria were met.	Meets project requirements.

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
May 2013 Sampling Event		
Field Parameters/EPA on-site	All QA/QC criteria were met. Results for ferrous iron and sulfide are considered screening values as they were measured on site with field kits.	Meets project requirements. All detected results are qualified with "J" as estimated. Data usability is unaffected.
Dissolved gases/ Shaw Environmental	Methane contamination was observed in some laboratory argon blanks during analysis. In some cases, a field sample was run directly after an argon blank with detectable methane. The only case of an impact of an argon blank on a field sample was in sample set 6918 involving sample NEPAGW03.	The "B" qualifier was applied to the methane result for affected sample NEPAGW03 since it was below 10x argon blank. The value for NEPAGW03 was close to the argon blank; the data is thus unusable.
DOC/ ORD/NRMRL- Ada	All QA/QC criteria were met.	Meets project requirements.
DIC/ ORD/NRMRL-Ada	All QA/QC criteria were met.	Meets project requirements.
Anions/ Ammonia ORD/NRMRL-Ada	All QA/QC criteria were met.	Meets project requirements.
Dissolved Metals/ Southwest Research Institute	Dissolved arsenic was detected above the QL in an equipment blank collected on 5/14/2013. Dissolved Cu was detected above the QL in a field blank collected on 5/15/2013 and in two equipment blanks collected on 5/11/2013 and 5/14/2013.	The "B" qualifier was applied to affected samples NEPASW01, NEPAGW15, NEPAGW16, and NEPAGW29. Results for affected samples were sufficiently close to equipment blank making data unusable. The "B" qualifier was applied to affected samples NEPAGW06, NEPAGW10, NEPAGW12, NEPAGW16, NEPAGW28, and NEPAGW28dup. Results for affected samples were either less than (NEPAGW06 and NEPAGW16) or sufficiently close to equipment blank making data unusable.
Total Metals/ Southwest Research Institute	Total Cu, ICP-MS: Laboratory duplicate results for NEPAGW27 were <5x RL and difference was greater than the acceptance limit (=RL) with an RPD of 33. Total Ni, ICP-MS: Laboratory duplicate	Affected samples NEPAGW06, NEPAGW08, NEPAGW09, NEPAGW10, NEPAGW11, NEPAGW12, NEPAGW14, NEPAGW27, NEPAGW27d, NEPAGW32, NEPAGW33, NEPAGW37, NEPAGW38, and NEPAGW38dup, NEPA Field Blank 1, NEPA Equipment Blank 1, NEPA Equipment Blank 2, and NEPA Equipment Blank 3 were qualified with "*" indicating potential precision issues with the data for these samples. Data is usable with caution. Affected samples NEPAGW06, NEPAGW08,

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
	results for NEPAGW27 were <5x RL and difference was greater than the acceptance limit (=RL) with an RPD of 25.1.	NEPAGW09, NEPAGW10, NEPAGW11, NEPAGW12, NEPAGW14, NEPAGW27, NEPAGW27d, NEPAGW32, NEPAGW33, NEPAGW37, NEPAGW38, and NEPAGW38dup were qualified with a "*" indicating potential precision issues with the data for these samples. Data is usable with caution.
	Total V, ICP-MS: Preparation blanks in SDG 523088 and SDG 523212 had total V above the QL at 0.37 ug/L and 0.30 ug/L, respectively.	The "B" qualifier was applied to all samples with detections above the QL for total V (see Appendix B). Detected quantities in samples were all close to preparation blank with exception of samples NEPAGW38 and NEPAGW38dup which were about 7x the blank. Data for samples NEPAGW38 and NEPAGW38dup are usable with caution; data for other affected samples are unusable.
	Total arsenic was detected above the QL in equipment blanks collected on 5/13/2013 and 5/15/2013.	The "B" qualifier was applied to affected samples NEPAGW01, NEPAGW03, NEPAGW28, and NEPAGW28dup, and NEPAGW36. Results for affected samples were sufficiently close to equipment blank making data unusable.
	Total Cu was detected above the QL in an equipment blank collected on 5/10/2013.	The "B" qualifier was applied to affected samples NEPAGW32, NEPAGW33, NEPAGW37, and NEPAGW38, and NEPAGW38dup. Results for affected samples were either less than or sufficiently close to equipment blank making data unusable.
	Total Mo was detected above the QL in a field blank collected on 5/11/2013 and an equipment blank collected on 5/10/2013.	The "B" qualifier was applied to affected samples NEPAGW06, NEPAGW08, NEPAGW10, and NEPAGW32, NEPAGW33 NEPAGW37, NEPAGW38, and NEPAGW38dup. Results for affected samples were close to equipment blank; data are unusable.
	Total Ni was detected above the QL in an equipment blank collected on 5/15/2013.	The "B" qualifier was applied to affected samples NEPAGW26 and NEPAGW28dup. The results were close to 10x the equipment blank; the data is considered usable with caution.

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
	Total Pb was detected above the QL in two equipment blanks collected on 5/10/2013 and 5/14/2013. Total Zn was detected above the QL in a field blank collected on 5/11/2013.	The "B" qualifier was applied to affected samples NEPASW01, NEPAGW15, NEPAGW29, NEPAGW32, NEPAGW37, NEPAGW38, and NEPAGW38dup. Results for affected samples were sufficiently close to equipment blank making data unusable. The "B" qualifier was applied to affected samples NEPAGW06, NEPAGW10, and NEPAGW12. Results for NEPAGW06 and NEPAGW10 were sufficiently close to equipment blank making data unusable. NEPAGW12 is ~5x the blank value and should be used with caution.
Charge Balance	The calculated charge balance ranged from 0.03 to 8.11% based on the cations Ca, Mg, Na, K, Sr, Ba, Mn, Fe, and Li; and the anions Cl, SO_4, HCO_3, and F.	Meets project requirements.
Measured versus calculated values of Specific Conductance (SPC)	The error in measured SPC versus calculated SPC ranged from 0.2 to 8.2%	Meets project requirements.
VOC/ Southwest Research Institute	All QA/QC criteria were met.	Meets project requirements.
Low Molecular Weight Acids/ Shaw Environmental	Isobutyrate recovery in the matrix spike and matrix spike duplicate was below the acceptable range due to matrix interference.	The "J-" qualifier was applied to all isobutyrate samples. There is a potential negative bias that is taken into account for data usability.
Glycols/EPA Region 3	The method for glycols was under development.	The QAPP stated these are to be considered screening values until method was validated. The data are usable as on-going QC checks provide confidence that the method can detect glycols.
SVOC/ EPA Region 8 Laboratory	Equipment blank 5 had low internal standard responses for all but one compound (1,4-dichlorobenzene). All surrogates were well below the acceptable range. The note on the raw data sheet noted that the sample had "dried up during extraction". Bis-2(ethylhexyl) phthalate was detected in a method blank (batch 1300167) above the QL at 2.82 ug/L.	All data for Equipment blank 5 were qualified with "R" and rejected as unusable. The "B" qualifier was applied to affected samples NEPAGW14, field blanks collected on 5/9/2013 and 5/10/2013, and an equipment blank collected on 5/9/2013.

Table A26 Data Usability Summary[1]

Analysis/Lab	Summary of QA/QC Results	Impact on Data/Usability
	Low matrix spike recoveries were observed as follows: MSD1 (batch 1300167): low recovery 1,3 dimethyl adamantine; MS1 (batch 1300169): low recovery adamantine; MSD1 (batch 1300169): low recovery limonene.	Data from these samples are close to method blank result making data unusable. "J-"qualifiers were applied to affected samples indicating a negative bias. There is a potential negative that is taken into account for data usability.
DRO/GRO/ EPA Region 8 Laboratory	DRO: Field blanks collected 5/14 and 5/15/13 and all six equipment blanks had detections above the QL (20 ug/L). GRO: All QA/QC criteria were met.	DRO was detected above QL in only one sample (NEPASW01); a "B" qualifier was applied to this sample. The detections in the equipment blanks and field blanks are attributed to peristaltic pump tubing used to facilitate collection of the blanks. Although this tubing was not used for collection of sample NEPASW01, the DRO value for NEPASW01 is considered unusable as a precaution. GRO: Meets project requirements.
O, H Stable Isotopes of Water/ Shaw Environmental	All QA/QC criteria were met.	Meets project requirements.
Sr Isotopes/ USGS Laboratory- Denver	All QA/QC criteria were met.	Meets project requirements.
Isotech Gas Isotopes	All QA/QC criteria were met.	Meets project requirements.
ALS Radionuclides	All laboratory QA/QC criteria were met. Field and equipment blanks were not collected.	Meets project requirements. On each day samples were collected, samples from at least two sampling locations showed Ra-226, Ra-228, gross alpha, and gross beta values below RLs. These samples with values <RLs can be considered in place of field and equipment blanks; sample data above RLs are thus valid and usable.

[1] QA/QC criteria and project requirements were met with exceptions as listed.

Table A27 Field QC Data for YSI Electrode Measurements.

Parameter	Electrode Reading	Acceptance Range	Performance Evaluation
October/November 2011			
October 25, 2011 initial			
Specific Conductance	7768	7630-7970	Acceptable
ORP	226.1	222-252	Acceptable
pH	6.94	6.8-7.2	Acceptable
October 25, 2011 mid-day			
Specific Conductance	7664	7630-7970	Acceptable
ORP	223.6	222-252	Acceptable
pH	7.00	6.8-7.2	Acceptable
October 25, 2011 end-of-day			
Specific Conductance	7960	7630-7970	Acceptable
ORP	225.9	222-252	Acceptable
pH	6.97	6.8-7.2	Acceptable
October 26, 2011 initial			
Specific Conductance	7687	7630-7970	Acceptable
ORP	229.8	222-252	Acceptable
pH	6.97	6.8-7.2	Acceptable
October 26, 2011 end-of-day			
Specific Conductance	7702	7600-7970	Acceptable
ORP	232.7	229-281	Acceptable
pH	7.04	6.8-7.2	Acceptable
October 27, 2011 initial			
Specific Conductance	7695	7600-7970	Acceptable
ORP	237.3	229-261	Acceptable
pH	6.96	6.8-7.2	Acceptable
October 27, 2011 mid-day			
Specific Conductance	7623	7600-7950	Acceptable
ORP	238.3	238-268	Acceptable
pH	6.97	6.8-7.2	Acceptable
October 27, 2011 end-of-day			
Specific Conductance	7807	7600-7950	Acceptable
ORP	246.9	238-268	Acceptable
pH	6.92	6.8-7.2	Acceptable
October 28, 2011 initial			
Specific Conductance	7634	7630-7970	Acceptable
ORP	231.3	222-252	Acceptable
pH	6.97	6.8-7.2	Acceptable
October 28, 2011 end-of-day			
Specific Conductance	7687	7600-7950	Acceptable
ORP	247.5	238-268	Acceptable
pH	7.05	6.8-7.2	Acceptable

Table A27 Field QC Data for YSI Electrode Measurements.

Parameter	Electrode Reading	Acceptance Range	Performance Evaluation
October 29, 2011 initial			
Specific Conductance	7753	7630-8010	Acceptable
ORP	232.7	212-242	Acceptable
pH	6.97	6.8-7.2	Acceptable
October 29, 2011 end-of-day			
Specific Conductance	7828	7600-7950	Acceptable
ORP	238.5	238-268	Acceptable
pH	7.00	6.8-7.2	Acceptable
October 31, 2011 initial			
Specific Conductance	7961	7630-7970	Acceptable
ORP	226.5	222-252	Acceptable
pH	6.96	6.8-7.2	Acceptable
October 31, 2011 end-of-day			
Specific Conductance	7939	7600-7950	Acceptable
ORP	261.1	236-268	Acceptable
pH	7.06	6.8-7.2	Acceptable
November 1, 2011 initial			
Specific Conductance	7828	7630-7970	Acceptable
ORP	242.6	222-252	Acceptable
pH	6.96	6.8-7.2	Acceptable
November 1, 2011 mid-day			
Specific Conductance	7870	7600-7970	Acceptable
ORP	249.9	229-261	Acceptable
pH	6.98	6.8-7.2	Acceptable
November 1, 2011 end-of-day			
Specific Conductance	7839	7600-7970	Acceptable
ORP	237.4	229-261	Acceptable
pH	6.99	6.8-7.2	Acceptable
November 2, 2011 initial			
Specific Conductance	7807	7630-7970	Acceptable
ORP	229.4	222-252	Acceptable
pH	6.97	6.8-7.2	Acceptable
November 2, 2011 end-of-day			
Specific Conductance	7964	7600-7970	Acceptable
ORP	254.6	229-261	Acceptable
pH	7.00	6.8-7.2	Acceptable
November 3, 2011 initial			
Specific Conductance	7735	7630-7970	Acceptable
ORP	234.1	222-252	Acceptable
pH	6.96	6.8-7.2	Acceptable

Table A27 Field QC Data for YSI Electrode Measurements.

Parameter	Electrode Reading	Acceptance Range	Performance Evaluation
November 3, 2011 end-of-day			
Specific Conductance	7863	7630-7970	Acceptable
ORP	241.0	222-252	Acceptable
pH	7.01	6.8-7.2	Acceptable
November 4, 2011 initial			
Specific Conductance	7861	7630-8010	Acceptable
ORP	214.7	212-242	Acceptable
pH	6.98	6.8-7.2	Acceptable
April/May 2012			
April 24, 2012 initial			
Specific Conductance	7728	7600-7950	Acceptable
ORP	258.9	238-268	Acceptable
pH	7.07	6.8-7.2	Acceptable
April 24, 2012 mid-day			
Specific Conductance	7672	7600-7950	Acceptable
ORP	252.6	238-268	Acceptable
pH	7.07	6.8-7.2	Acceptable
April 24, 2012 end-of-day			
Specific Conductance	7724	7600-7950	Acceptable
ORP	252.9	238-268	Acceptable
pH	7.08	6.8-7.2	Acceptable
April 25, 2012 initial			
Specific Conductance	7729	7600-7970	Acceptable
ORP	245.0	229-261	Acceptable
pH	7.03	6.8-7.2	Acceptable
April 25, 2012 end-of-day			
Specific Conductance	7797	7600-7970	Acceptable
ORP	246.3	229-261	Acceptable
pH	7.00	6.8-7.2	Acceptable
April 26, 2012 initial			
Specific Conductance	7696	7630-7970	Acceptable
ORP	234.9	222-252	Acceptable
pH	6.99	6.8-7.2	Acceptable
April 26, 2012 mid-day			
Specific Conductance	7770	7600-7950	Acceptable
ORP	237.1	222-252	Acceptable
pH	7.17	6.8-7.2	Acceptable
April 26, 2012 end-of-day			
Specific Conductance	7757	7600-7950	Acceptable
ORP	232.8	222-252	Acceptable
pH	7.03	6.8-7.2	Acceptable

Table A27 Field QC Data for YSI Electrode Measurements.

Parameter	Electrode Reading	Acceptance Range	Performance Evaluation
April 27, 2012 initial			
Specific Conductance	7684	7630-7970	Acceptable
ORP	234.1	222-252	Acceptable
pH	6.96	6.8-7.2	Acceptable
April 27, 2012 mid-day			
Specific Conductance	7894	7600-7970	Acceptable
ORP	242.7	229-261	Acceptable
pH	6.98	6.8-7.2	Acceptable
April 27, 2012 end-of-day			
Specific Conductance	7644	7600-7950	Acceptable
ORP	241.5	238-268	Acceptable
pH	6.96	6.8-7.2	Acceptable
April 28, 2012 initial			
Specific Conductance	7696	7630-7970	Acceptable
ORP	235.1	222-252	Acceptable
pH	6.98	6.8-7.2	Acceptable
April 28, 2012 mid-day			
Specific Conductance	7735	7600-7970	Acceptable
ORP	240.4	229-261	Acceptable
pH	7.01	6.8-7.2	Acceptable
April 28, 2012 end-of-day			
Specific Conductance	7691	7600-7970	Acceptable
ORP	239.1	229-261	Acceptable
pH	7.00	6.8-7.2	Acceptable
April 30, 2012 initial			
Specific Conductance	7876	7630-7970	Acceptable
ORP	235.8	222-252	Acceptable
pH	6.97	6.8-7.2	Acceptable
April 30, 2012 mid-day			
Specific Conductance	7808	7630-7970	Acceptable
ORP	236.8	222-252	Acceptable
pH	7.01	6.8-7.2	Acceptable
April 30, 2012 end-of-day			
Specific Conductance	7810	7630-7970	Acceptable
ORP	236.1	222-252	Acceptable
pH	6.94	6.8-7.2	Acceptable
May 1, 2012 initial			
Specific Conductance	7790	7630-7970	Acceptable
ORP	235.5	222-252	Acceptable
pH	6.99	6.8-7.2	Acceptable

Table A27 Field QC Data for YSI Electrode Measurements.

Parameter	Electrode Reading	Acceptance Range	Performance Evaluation
May 1, 2012 end-of-day			
Specific Conductance	7775	7630-7970	Acceptable
ORP	235.5	222-252	Acceptable
pH	7.05	6.8-7.2	Acceptable
May 2013			
May 9, 2013 initial			
Specific Conductance	1405	1272-1554	Acceptable
ORP	220.2	197-241	Acceptable
pH	7.07	6.8-7.2	Acceptable
May 9, 2013 mid-day			
Specific Conductance	7936	7630-7970	Acceptable
ORP	230.8	222-252	Acceptable
pH	7.01	6.8-7.2	Acceptable
May 9, 2013 end-of-day			
Specific Conductance	7925	7630-8010	Acceptable
ORP	227.1	212-242	Acceptable
pH	7.02	6.8-7.2	Acceptable
May 10, 2013 initial			
Specific Conductance	7803	7630-8010	Acceptable
ORP	225.6	212-242	Acceptable
pH	7.02	6.8-7.2	Acceptable
May 10, 2013 mid-day			
Specific Conductance	7980	7630-8010	Acceptable
ORP	225.7	212-242	Acceptable
pH	7.03	6.8-7.2	Acceptable
May 10, 2013 end-of-day			
Specific Conductance	7933	7630-8010	Acceptable
ORP	223.9	212-242	Acceptable
pH	6.98	6.8-7.2	Acceptable
May 11, 2013 initial			
Specific Conductance	7764	7630-8010	Acceptable
ORP	223.4	212-242	Acceptable
pH	7.01	6.8-7.2	Acceptable
May 11, 2013 mid-day			
Specific Conductance	7833	7630-8010	Acceptable
ORP	228.1	212-242	Acceptable
pH	6.96	6.8-7.2	Acceptable
May 11, 2013 end-of-day			
Specific Conductance	7790	7630-8010	Acceptable
ORP	226.0	212-242	Acceptable
pH	7.00	6.8-7.2	Acceptable

Table A27 Field QC Data for YSI Electrode Measurements.

Parameter	Electrode Reading	Acceptance Range	Performance Evaluation
May 13, 2013 initial			
Specific Conductance	7808	7630-8010	Acceptable
ORP	228.6	212-242	Acceptable
pH	7.00	6.8-7.2	Acceptable
May 13, 2013 mid-day			
Specific Conductance	7952	7630-7970	Acceptable
ORP	232.7	222-252	Acceptable
pH	7.01	6.8-7.2	Acceptable
May 13, 2013 end-of-day			
Specific Conductance	7895	7600-7970	Acceptable
ORP	235.6	229-261	Acceptable
pH	7.00	6.8-7.2	Acceptable
May 14, 2013 initial			
Specific Conductance	7768	7630-7970	Acceptable
ORP	229.5	222-252	Acceptable
pH	6.98	6.8-7.2	Acceptable
May 14, 2013 mid-day			
Specific Conductance	7853	7630-7970	Acceptable
ORP	229.1	222-252	Acceptable
pH	7.05	6.8-7.2	Acceptable
May 14, 2013 end-of-day			
Specific Conductance	7840	7630-7970	Acceptable
ORP	232.7	222-252	Acceptable
pH	7.00	6.8-7.2	Acceptable
May 15, 2013 initial			
Specific Conductance	7813	7630-7970	Acceptable
ORP	227.1	222-252	Acceptable
pH	7.02	6.8-7.2	Acceptable
May 15, 2013 end-of-day			
Specific Conductance	7715	7630-7970	Acceptable
ORP	227.1	222-252	Acceptable
pH	7.02	6.8-7.2	Acceptable

Table A28 Data Qualifiers and Data Descriptors

Qualifier	Definition
U	The analyte was analyzed for, but was not detected above the reported quantitation limit (QL).
J	The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the QL).
J+	The result is an estimated quantity, but the result may be biased high.
J-	For both detected and non-detected results, there may be a low bias due to low spike recoveries or sample preservation issues.
B	The analyte is found in a blank sample above the QL and the concentration found in the sample is less than 10 times the concentration found in the blank.
H	The sample was prepared or analyzed beyond the specified holding time. Sample results may be biased low.
*	Relative percent difference of a field or lab duplicate is outside acceptance criteria.
R	The data are unusable. The sample results are rejected due to serious deficiencies in the ability to analyze the sample and/or meet quality control criteria. Sample results are not reported. The analyte may or may not be present in the sample.

Data Descriptors

Descriptor	Definition
NA	Not Applicable (See QAPP)
NR	Not Reported by Laboratory or Field Sampling Team
ND	Not Detected
NS	Not Sampled

Table A29 Tentatively Identified Compounds (TICs) for SVOCs

Sample	Compound (CAS Number)	Estimated Concentration (µg/L)
October 2011 Sampling Event		
NEPASW01-1011	1-ethyl-2-methyl-Benzene (CAS# 611-14-3)	0.39
	1,2,3-trimethyl-Benzene (CAS# 526-73-8)	0.93
	1,3,5-trimethyl-Benzene (CAS# 108-67-8)	0.28
	n-Hexadecanoic acid (CAS# 57-10-3)	0.39
	(Z)- 9-Tricosene (CAS#27519-02-4)	0.29
	Cholesterol (CAS# 57-88-5)	0.39
NEPASW01d-1011	1-ethyl-2-methyl-Benzene (CAS# 611-14-3)	0.42
	1,2,3-trimethyl-Benzene (CAS# 526-73-8)	1.02
	1,3,5-trimethyl-Benzene (CAS# 108-67-8)	0.31
NEPAGW02-1011	Oxacycloheptadecan-2-one (CAS# 1000309-04-5)	0.78
	Bisphenol A (CAS# 80-05-7)	0.41
NEPAGW02d-1011	Oxacycloheptadecan-2-one (CAS# 1000309-04-5)	0.39
NEPASW02-1111	3-Methyl-2-cyclohexenone (CAS# 1193-18-6)	2.74
	Phorone (CAS#504-20-1)	1.66
NEPAGW04-1011	3,4-dimethyl-2-pentene (CAS# 4914-91-4)	3.76
	2-ethyl-1-Hexanol (CAS# 95-16-9)	0.51
	Oxacycloheptadecan-2-one (CAS# 1000309-04-5)	0.25
	Sulfur (CAS# 13798-23-7)	0.38
	p-tert-Octylphenol (CAS# 140-66-9)	0.25
	2-(methylthio)benzothiazol (CAS#615-22-5)	0.29
	N-butyl-Benzenesulfonamide (CAS# 3622-84-2)	0.36
NEPAGW05-1011	Oxacycloheptadecan-2-one (CAS# 1000309-04-5)	0.36
NEPAGW06-1011	Oxacycloheptadecan-2-one (CAS# 1000309-04-5)	0.62
NEPAGW06d-1011	Oxacycloheptadecan-2-one (CAS# 1000309-04-5)	0.42
NEPAGW08-1011	Cyclic octaatomic sulfur (CAS# 10544-50-0)	0.31
NEPAGW09-1011	N,N'-Diphenyl-p-phenylenediamine (CAS# 74-31-7)	0.33
NEPAGW10-1011	Butanoic acid (CAS# 107-92-6)	0.31
NEPAGW13-1011	Tributyl acetylcitrate (CAS# 77-90-7)	0.29
NEPAGW14-1011	Oxacycloheptadecan-2-one (CAS# 1000309-04-5)	0.60
	Mono-2-ethylhexyl phthalate (CAS# 4376-20-9)	0.31
NEPAGW16-1011	Sulfur (CAS# 13798-23-7)	1.21
NEPAGW17-1011	N-butyl-Benzenesulfonamide (CAS# 3622-84-2)	0.34
	Diethyl hexyl adipate (CAS# 103-23-1)	0.27
NEPAGW18-1011	Hexadecanoic acid butyl ester (CAS# 111-06-8)	0.48
	Octadecanoic acid butyl ester (CAS# 123-95-5)	1.34
	Heptadecane (CAS# 629-78-7)	0.48
	Pentacosane (CAS# 629-99-2)	0.48
	Docosane (CAS# 629-97-0)	0.50

Table A29 Tentatively Identified Compounds (TICs) for SVOCs

Sample	Compound (CAS Number)	Estimated Concentration (µg/L)
	9-octyl-Heptadecane (CAS# 7225-64-1)	0.30
NEPAGW23-1111	Cyclic octaatomic sulfur (CAS# 10544-50-0)	2.59
	Hexadecanoic acid butyl ester (CAS# 111-06-8)	1.58
	Octadecanoic acid butyl ester (CAS# 123-95-5)	1.12
	9-octyl-Heptadecane (CAS# 7225-64-1)	0.35
	Eicosane (CAS#112-95-8)	0.37
	Hexatriacontane (CAS#630-06-8)	0.41
	Pentacosane (CAS# 629-99-2)	0.29
	Tetratriacontane (CAS# 14167-59-0)	0.30
NEPAGW25-1111	Hexadecanoic acid butyl ester (CAS# 111-06-8)	2.03
	Octadecanoic acid butyl ester (CAS# 123-95-5)	1.32
	Triacontane (CAS#638-68-6)	0.34
	Heneicosane (CAS# 629-94-7)	0.35
	Docosane (CAS# 629-97-0)	0.35
NEPAGW25d-1111	Hexadecanoic acid butyl ester (CAS# 111-06-8)	1.90
	Octadecanoic acid butyl ester (CAS# 123-95-5)	1.30
	Triacontane (CAS#638-68-6)	0.39
	Heneicosane (CAS# 629-94-7)	0.41
	Docosane (CAS# 629-97-0)	0.41
NEPAGW29-1111	Cyclic octaatomic sulfur (CAS# 10544-50-0)	4.67
NEPAGW31-1111	1-(2-methyl-1-cyclopentenyl)ethanone (CAS#3168-90-9)	0.34
	Cyclic octaatomic sulfur (CAS# 10544-50-0)	2.39
NEPAGW33-1111	Decanal (CAS# 112-31-2)	0.38
	Diisobutyl phthalate (CAS#84-69-5)	0.29
1110018-01 (Field Blank)	2-Undecanone (CAS# 112-12-9)	1.18
	N,N'-Diphenyl-p-phenylenediamine (CAS# 74-31-7)	0.57
	2-Monostearin (CAS# 621-61-4)	3.29
1110018-02 (Field Blank)	2-Undecanone (CAS# 112-12-9)	1.06
1110018-13 (Field Blank)	2-Undecanone (CAS# 112-12-9)	1.06
1110018-14 (Field Blank)	2-Undecanone (CAS# 112-12-9)	1.17
	N,N'-Diphenyl-p-phenylenediamine (CAS# 74-31-7)	0.35
1110018-23 (Field Blank)	2-Undecanone (CAS# 112-12-9)	0.96
1110018-30 (Field Blank)	2-Undecanone (CAS# 112-12-9)	1.02
1110018-31 (Equipment Blank)	2-Undecanone (CAS# 112-12-9)	0.73
1110018-36 (Field Blank)	2-Undecanone (CAS# 112-12-9)	1.10
1110018-42 (Field Blank)	2-Nonanone (CAS#821-55-6)	0.45
	2-Undecanone (CAS# 112-12-9)	1.82
	Hexadecanoic acid butyl ester (CAS# 111-06-8)	0.34

Table A29 Tentatively Identified Compounds (TICs) for SVOCs

Sample	Compound (CAS Number)	Estimated Concentration (µg/L)
	Octadecanoic acid butyl ester (CAS# 123-95-5)	0.99
	Pentacosane (CAS# 629-99-2)	0.39
	Docosane (CAS# 629-97-0)	0.43
	Heneicosane (CAS# 629-94-7)	0.42
	Tetratriacontane (CAS# 14167-59-0)	0.26
	Hexatriacontane (CAS#630-06-8)	0.27
1110018-48 (Field Blank)	2-Nonanone (CAS#821-55-6)	0.42
	2-Undecanone (CAS# 112-12-9)	1.73
1110018-49 (Field Blank)	2-Nonanone (CAS#821-55-6)	0.42
	2-Undecanone (CAS# 112-12-9)	1.46
April/May 2012 Sampling Event		
NEPAGW01-0412	Nonylphenol (CAS# 25154-52-3)	0.56
NEPAGW02-0412	Propylene glycol (CAS# 57-55-6)	2.79
NEPASW03-0412	Nonylphenol (CAS# 25154-52-3)	3.00
	Tetradecanoic acid (CAS# 544-63-8)	0.70
	n-Hexadecanoic acid (CAS# 57-10-3)	1.41
	Aspidoalbine (CAS# 2122-26-1)	0.74
	Stigmasterol (CAS# 83-48-7)	2.04
NEPAGW04-0412	Cyclic octaatomic sulfur (CAS# 10544-50-0)	6.87
NEPASW04-0412	Nonylphenol (CAS# 25154-52-3)	2.42
	Stigmasterol (CAS# 83-48-7)	1.51
NEPASW04D-0412	Nonylphenol (CAS# 25154-52-3)	1.08
	Stigmasterol (CAS# 83-48-7)	1.53
NEPASW05-0412	Nonylphenol (CAS# 25154-52-3)	4.16
NEPASW06-0412	Nonylphenol (CAS# 25154-52-3)	3.81
NEPAGW08-0412	Nonylphenol (CAS# 25154-52-3)	0.46
	Cyclic octaatomic sulfur (CAS# 10544-50-0)	10.63
NEPAGW09-0412	Nonylphenol (CAS# 25154-52-3)	3.81
	Docosane (CAS# 629-97-0)	0.63
	Pentacosane (CAS# 629-94-7)	0.54
	Heneicosane (CAS# 629-94-7)	0.54
	Tetracosane (CAS# 646-31-1)	0.52
	Hexadecane (CAS# 544-76-3)	1.01
NEPAGW10-0412	Nonylphenol (CAS# 25154-52-3)	5.00
NEPAGW11-0412	Nonylphenol (CAS# 25154-52-3)	3.65
NEPAGW15-0412	Nonylphenol (CAS# 25154-52-3)	6.46
NEPAGW16-0412	Cyclic octaatomic sulfur (CAS# 10544-50-0)	4.36
NEPAGW18-0412	Caprolactam (CAS# 105-60-2)	0.80
NEPAGW26-0412	Nonylphenol (CAS# 25154-52-3)	2.83

Table A29 Tentatively Identified Compounds (TICs) for SVOCs

Sample	Compound (CAS Number)	Estimated Concentration (µg/L)
	Cyclic octaatomic sulfur (CAS# 10544-50-0)	0.67
NEPAGW27-0412	Nonylphenol (CAS# 25154-52-3)	5.00
	Cyclic octaatomic sulfur (CAS# 10544-50-0)	2.62
NWPAGW29-0512	Cyclic octaatomic sulfur (CAS# 10544-50-0)	1.55
NEPAGW33-0412	Cyclic octaatomic sulfur (CAS# 10544-50-0)	0.57
NEPAGW36-0412	Nonylphenol (CAS# 25154-52-3)	4.67
	Cyclic octaatomic sulfur (CAS# 10544-50-0)	1.29
Field Blank 1-0412	2-Nonanone (CAS# 821-55-6)	0.88
	2-Undecanone (CAS# 112-12-9)	4.80
Field Blank 2-0412	2-Nonanone (CAS# 821-55-6)	0.87
	2-Undecanone (CAS# 112-12-9)	4.22
Field Blank 3-0412	2-Undecanone (CAS# 112-12-9)	1.66
Equipment Blank 3-0412	2-Undecanone (CAS# 112-12-9)	1.31
	Nonylphenol (CAS# 25154-52-3)	1.12
Field Blank 4-0412	2-Undecanone (CAS# 112-12-9)	1.68
Field Blank 5-0412	2-Undecanone (CAS# 112-12-9)	0.80
Field Blank 6-0412	2-Undecanone (CAS# 112-12-9)	1.18
Field Blank 7-0412	2-Undecanone (CAS# 112-12-9)	4.30
	2-Nonanone (CAS# 821-55-6)	0.95
May 2013 Sampling Event		
NEPASW01-0513	Benzene, 1-ethyl-2-methyl- (02) (CAS# 000611-14-3)	1.07
	Benzene, 1,2,3-trimethyl- (01) (CAS# 000526-73-8)	2.18
	Cyclic octaatomic sulfur (CAS# 010544-50-0)	0.600
NEPAGW02-0513	Phenol, 4,4'-(1-methylethyl... (CAS# 000080-05-7)	0.530
NEPAGW08-0513	Cyclic octaatomic sulfur (CAS# 010544-50-0)	2.44
NEPAGW11-0513	1,2-Benzenedicarboxylic aci... (CAS# 000084-69-5)	0.550
NEPAGW14-0513	Phthalic acid, decyl isobut... (CAS# 1000308-94-2)	0.520
NEPAGW15-0513	Cyclic octaatomic sulfur (CAS# 010544-50-0)	0.510
NEPAGW16-0513	Cyclic octaatomic sulfur (CAS# 010544-50-0)	6.82
NEPAGW27-0513 DUP	Cyclic octaatomic sulfur (CAS# 010544-50-0)	0.880
NEPAGW29-0513	Cyclic octaatomic sulfur (CAS# 010544-50-0)	3.38
NEPAGW36-0513	n-Hexadecanoic acid (CAS# 000057-10-3)	0.540
	Cyclic octaatomic sulfur (CAS# 010544-50-0)	5.11
NEPA Equipment Blank 1-0513	2-Dodecanone (CAS# 006175-49-1)	1.17
	Benzoic acid, 2,4-dichloro- (CAS# 000050-84-0)	0.910
NEPA Field Blank 2-0513	2-Undecanone (CAS# 000112-12-9)	1.04
NEPA Equipment Blank 2-0513	2-Undecanone (CAS# 000112-12-9)	0.620
	3,5-di-tert-Butyl-4-hydroxy... (CAS# 001620-98-0)	0.520
	Benzoic acid, 2,4-dichloro- (CAS# 000050-84-0)	3.71

Table A29 Tentatively Identified Compounds (TICs) for SVOCs

Sample	Compound (CAS Number)	Estimated Concentration (µg/L)
NEPA Field Blank 3-0513	2-Undecanone (CAS# 000112-12-9)	0.690
NEPA Equipment Blank 3-0513	3,5-di-tert-Butyl-4-hydroxy... (CAS# 001620-98-0)	0.550
	2-Undecanone (CAS# 000112-12-9)	0.570
NEPA Equipment Blank 3-0513	Benzoic acid, 2,4-dichloro- (CAS# 000050-84-0)	21.8
NEPA Field Blank 4-0513	3,5-di-tert-Butyl-4-hydroxy... (CAS# 001620-98-0)	0.630
	2-Undecanone (CAS# 000112-12-9)	0.630
NEPA Equipment Blank 4-0513	2-Undecanone (CAS# 000112-12-9)	2.33
	Benzoic acid, 2,4-dichloro- (CAS# 000050-84-0)	11.4
NEPA Equipment Blank 5-0513	2-Undecanone (CAS# 000112-12-9)	1.11
	Benzoic acid, 2,4-dichloro- (CAS# 000050-84-0)	9.29
NEPA Field Blank 5-0513	2-Undecanone (CAS# 000112-12-9)	2.88
NEPA Field Blank 6-0513	2-Undecanone (CAS# 000112-12-9)	3.19
N EPA Equipment Blank 6-0513	Benzoic acid, 2,4-dichloro- (CAS# 000050-84-0)	8.57
	2-Undecanone (CAS# 000112-12-9)	2.55
	n-Hexadecanoic acid (CAS# 000057-10-3)	1.71
	Dodecanoic acid (CAS# 000143-07-7)	0.500
	Octadecanoic acid (CAS# 000057-11-4)	1.59

Appendix B
Sample Results
Retrospective Case Study in Northeastern Pennsylvania

U.S. Environmental Protection Agency
Office of Research and Development
Washington, DC

May 2015
EPA/600/R-14/088

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Appendix B. Sample Results_ Legend (Northeastern Pennsylvania)

Data Qualifiers

<	The analyte concentration is less than the quantitation limit (QL).
U	The analyte was analyzed for, but was not detected above the reported QL.
J	The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the QL).
J+	The result is an estimated quantity, but the result may be biased high.
J-	For both detected and non-detected results, the result is estimated but may be biased low.
B	The analyte is found in a blank sample above the QL and the concentration found in the sample is less than 10 times the concentration found in the blank.
H	The sample was prepared or analyzed beyond the specified holding time. Sample results may be biased low.
*	Relative percent difference of a field or lab duplicate is outside acceptance criteria.
R	The data are unusable. The sample results are rejected due to serious deficiencies in the ability to analyze the sample and/or meet quality control criteria. Sample results are not reported. The analyte may or may not be present in the sample.

Notes

Table B-1	Total Dissolved Solids (TDS) is estimated based on Specific Conductance (SPC): TDS(mg/L) = SPC(mS/cm) * 650.
	Field-determined concentrations of ferrous iron and hydrogen sulfide are screening values.
Table B-2	R. Bromide data rejected. High chloride interference.
	Round 2 - Br was initially analyzed using RSKSOP-276, Rev. 4 but was rejected due to chloride interference problems. Br data shown is from re-analysis of samples using RSKSOP-288, Rev.3.
Table B-3	R. Data rejected for several metals. Potential spectral (mass or emission) interference or interference check sample problem reported by laboratory.
Table B-4	R. Data rejected for Rounds 1 and 2. 1,1,2-trichloroethane is subject to alkaline hydrolysis to 1,1-dichloroethene. This reaction could be supported by the sample preservative (trisodium phosphate).
Table B-5	R. Acetate data rejected in Round 1. Acetate contamination in samples and blanks is due to the sample preservative (trisodium phosphate).
	The method used for glycol analysis is under development.
Table B-6	Round 2 - † Suspected laboratory contamination (common laboratory contaminant) for bis(2-ethylhexyl)phthalate, in sample NEPAGW09.

Appendix B. Sample Results - Legend (Bradford County, Pennsylvania)

Acronyms

CAS	Chemical Abstracts Service
DIC	Dissolved Inorganic Carbon
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
NA	Not Applicable (See QAPP)
ND	Not Detected
NR	Not Reported by Laboratory or Field Sampling Team
NS	Not Sampled
ORP	Oxidation reduction potential
SPC	Specific Conductance
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
Gross Alpha	Gross alpha particle activity
Gross Beta	Gross beta particle activity

Units

BTU	British thermal unit
^{o}C	Degrees Celsius
µg/L	Micrograms per liter
mg/L	Milligrams per liter
mS/cm	Millisiemens per centimeter at 25^{o}C
pCi/L	Picocuries per liter

Key

GW	Ground water sample
SW	Surface water sample
04	Sampling location
d	Field Duplicate

Appendix B. Sample Results. Legend (Northeastern Pennsylvania)

Metals and Isotopes

Ag	Silver	K	Potassium	Se	Selenium	$\delta^{2}H$	$[(^{2}H/H)$ Sample$/(^{2}H/H)$ Standard$] * 1000$
Al	Aluminum	Li	Lithium	Si	Silicon	$\delta^{18}O$	$[(^{18}O/^{16}O)$ Sample$/(^{18}O/^{16}O)$ Standard$] * 1000$
As	Arsenic	Mg	Magnesium	Sr	Strontium	$\delta^{13}C$	$[(^{13}C/^{12}C)$ Sample$/(^{13}C/^{12}C)$ Standard$] * 1000$
B	Boron	Mn	Manganese	Th	Thorium		
Ba	Barium	Mo	Molybdenum	Ti	Titanium	Ra-226	Radium-226
Be	Beryllium	Na	Sodium	Tl	Thallium	Ra-228	Radium-228
Ca	Calcium	Ni	Nickel	U	Uranium		
Cd	Cadmium	P	Phosphorus	V	Vanadium		
Co	Cobalt	Pb	Lead	Zn	Zinc		
Cr	Chromium	Rb	Rubidium				
Cu	Copper	S	Sulfur				
Fe	Iron	Sb	Antimony				

Table B-1 Sample Results - Field Parameters (Northeastern Pennsylvania)

	Sample	GW01	GW01	GW01	GW02	GW02	GW02	GW03	GW03	GW03
	Sample Date	10/25/11	4/25/12	5/13/13	10/25/11	4/25/12	5/13/13	10/25/11	4/25/12	5/13/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Temperature	^{o}C	12.82	11.80	11.18	10.78	10.16	10.47	12.09	10.55	11.11
SPC	mS/cm	0.633	0.606	0.597	0.515	0.507	0.501	2.477	2.573	2.512
TDS	mg/L	411	394	387	334	330	326	1611	1673	1633
DO	mg/L	0.02	0.03	0.10	0.53	0.08	0.10	0.30	0.97	0.39
pH		8.32	8.50	8.26	7.97	8.15	8.02	6.81	6.89	6.89
ORP	mV	-124	-145	-153	-149	-112	-147	-54	-13	-11
Turbidity	NTU	1.00	0.44	0.17	1.88	3.26	2.38	2.37	1.22	1.05
Alkalinity	mg $CaCO_3$/L	245	244	241	239	243	250	379	382	378
Ferrous Iron	mg Fe^{2+}/L	0.1 J	<0.03 U	<0.03 U	0.03 J	0.22 J	0.15 J	0.7 J	0.4 J	0.95 J
Hydrogen Sulfide	mg S/L	0.03 J	<0.02 U	0.03 J	0.06 J	0.02 J	0.11 J	<0.02 U	<0.02 U	<0.02 U

Table B-1 Sample Results - Field Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW04 10/25/11 Round 1	GW04 4/27/12 Round 2	GW05 10/26/11 Round 1	GW06 10/26/11 Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 10/26/11 Round 1
Temperature	^oC	11.99	9.96	11.14	10.64	10.65	11.61	12.92
SPC	mS/cm	1.605	1.514	0.303	0.352	0.352	0.347	0.329
TDS	mg/L	1043	983	197	229	229	226	214
DO	mg/L	1.28	0.06	1.37	0.08	0.16	0.10	5.09
pH		7.74	7.67	7.47	7.06	7.15	6.91	6.99
ORP	mV	-147	-127	91	83	130	165	94
Turbidity	NTU	22.5	8.73	2.32	0.88	0.28	0.95	6.62
Alkalinity	mg $CaCO_3$/L	204	191	156	126	122	125	139
Ferrous Iron	mg Fe^{2+}/L	0.46 J	0.27 J	0.03 J	<0.03 U	<0.03 U	<0.03 U	<0.03 U
Hydrogen Sulfide	mg S/L	0.17 J	0.19 J	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U

Table B-1 Sample Results - Field Parameters (Northeastern Pennsylvania)

	Sample	GW08	GW08	GW08	GW09	GW09	GW09	GW10	GW10	GW10
	Sample Date	10/27/11	4/27/12	5/11/13	10/27/11	4/27/12	5/9/13	10/27/11	4/24/12	5/11/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Temperature	^{o}C	10.08	10.16	10.99	10.30	10.72	12.01	10.36	10.59	11.35
SPC	mS/cm	1.471	1.586	1.733	0.398	0.399	0.393	0.121	0.106	0.137
TDS	mg/L	956	1031	1126	259	260	255	79	69	89
DO	mg/L	0.50	0.03	0.08	0.17	0.07	7.97	5.35	7.70	7.32
pH		8.50	8.69	8.53	7.50	7.52	7.43	6.14	6.40	6.12
ORP	mV	4	-191	-200	59	86	204	125	154	303
Turbidity	NTU	10.2	28.4	0.73	1.04	0.81	0.55	17.6	4.07	21.9
Alkalinity	mg $CaCO_3$/L	171	165	172	189	182	186	56	38	41
Ferrous Iron	mg Fe^{2+}/L	0.05 J	0.05 J	0.31 J	<0.03 U	<0.03 U	<0.03 U	0.04 J	0.04 J	0.05 J
Hydrogen Sulfide	mg S/L	0.08 J	0.14 J	0.07 J	<0.02 U	<0.02 U	<0.02 U	0.04 J	<0.02 U	0.04 J

Table B-1 Sample Results - Field Parameters (Northeastern Pennsylvania)

	Sample	GW11	GW11	GW11	GW12	GW12	GW13	GW13
	Sample Date	10/28/11	4/27/12	5/9/13	10/28/11	5/11/13	10/28/11	4/28/12
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 3	Round 1	Round 2
Temperature	^{o}C	10.51	10.84	12.23	11.56	13.12	9.54	9.46
SPC	mS/cm	0.453	0.505	0.487	0.332	0.347	0.335	0.342
TDS	mg/L	294	329	316	216	225	218	222
DO	mg/L	1.24	0.24	0.09	6.62	4.99	5.60	0.05
pH		8.36	8.72	8.57	7.20	7.34	7.64	7.37
ORP	mV	228	88	13	229	208	145	157
Turbidity	NTU	0.79	0.88	0.61	1.85	1.48	8.52	42.0
Alkalinity	mg $CaCO_3$/L	219	245	250	151	161	131	121
Ferrous Iron	mg Fe^{2+}/L	<0.03 U	<0.03 U	0.07 J	<0.03 U	<0.03 U	0.04 J	0.03 J
Hydrogen Sulfide	mg S/L	<0.02 U	<0.02 U	0.07 J	<0.02 U	<0.02 U	0.06 J	0.1 J

Table B-1 Sample Results - Field Parameters (Northeastern Pennsylvania)

	Sample	GW14	GW14	GW14	GW15	GW15	GW15	GW16	GW16	GW16
	Sample Date	10/28/11	4/24/12	5/9/13	10/29/11	4/30/12	5/14/13	10/29/11	4/30/12	5/14/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Temperature	^oC	10.62	10.80	15.66	10.95	10.43	11.19	9.41	10.19	10.56
SPC	mS/cm	0.155	0.134	0.158	0.308	0.310	0.303	0.510	0.488	0.508
TDS	mg/L	101	87	103	200	201	197	332	317	330
DO	mg/L	6.23	6.42	8.80	0.06	0.08	0.12	0.07	0.07	0.10
pH		6.52	6.52	6.68	7.83	7.70	7.81	7.95	7.92	7.95
ORP	mV	159	186	252	331	-69	-62	-62	-125	-137
Turbidity	NTU	11.2	4.65	21.8	8.51	1.53	3.52	3.90	2.85	2.09
Alkalinity	mg $CaCO_3$/L	55	51	66	150	135	164	157	160	161
Ferrous Iron	mg Fe^{2+}/L	<0.03 U	<0.03 U	<0.03 U	0.07 J	0.04 J	0.06 J	0.1 J	0.16 J	0.14 J
Hydrogen Sulfide	mg S/L	<0.02 U	<0.02 U	0.05 J	0.02 J	<0.02 U	0.02 J	0.2 J	0.25 J	0.26 J

Table B-1 Sample Results - Field Parameters (Northeastern Pennsylvania)

	Sample	GW17	GW17	GW18	GW18	GW19	GW20	GW20	GW21	GW22
	Sample Date	10/29/11	4/30/12	10/31/11	4/28/12	10/31/11	10/31/11	4/28/12	11/1/11	11/1/11
Parameter	Unit	Round 1	Round 2	Round 1	Round 2	Round 1	Round 1	Round 2	Round 1	Round 1
Temperature	^oC	9.74	10.19	10.08	9.23	10.13	9.56	9.22	11.36	10.42
SPC	mS/cm	1.934	1.941	0.323	0.314	0.268	0.324	0.316	0.163	0.346
TDS	mg/L	1257	1262	210	204	174	210	205	106	225
DO	mg/L	0.13	0.04	0.29	0.09	4.37	0.03	0.07	4.32	0.06
pH		8.03	7.82	7.75	7.77	6.55	7.71	7.77	7.68	8.37
ORP	mV	-108	-137	420	170	426	327	173	405	27
Turbidity	NTU	0.35	1.15	6.70	1.79	0.46	0.95	6.01	4.61	3.51
Alkalinity	mg $CaCO_3$/L	126	140	148	142	70	139	136	68	110
Ferrous Iron	mg Fe^{2+}/L	0.24 J	0.24 J	<0.03 U	<0.03 U	<0.03 U	<0.03 U	0.03 J	<0.03 U	0.12 J
Hydrogen Sulfide	mg S/L	0.03 J	0.02 J	0.03 J	<0.02 U	<0.02 U	<0.02 U	<0.02 U	0.02 J	0.07 J

Table B-1 Sample Results - Field Parameters (Northeastern Pennsylvania)

	Sample	GW23	GW24	GW25	GW26	GW26	GW26	GW27	GW27	GW27
	Sample Date	11/1/11	11/1/11	11/2/11	11/2/11	4/24/12	5/15/13	11/2/11	4/24/12	5/9/13
Parameter	Unit	Round 1	Round 1	Round 1	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Temperature	^{o}C	11.47	11.75	11.28	11.23	10.57	12.02	10.98	10.50	12.71
SPC	mS/cm	0.298	0.257	0.537	0.610	0.592	0.608	0.548	0.534	0.532
TDS	mg/L	194	168	349	396	385	395	356	347	346
DO	mg/L	0.10	2.47	0.17	0.28	0.15	0.34	0.14	0.12	0.18
pH		7.97	7.17	7.41	7.28	7.36	7.30	8.02	7.96	7.80
ORP	mV	22	158	450	277	-49	-38	143	-98	-23
Turbidity	NTU	4.32	>800	0.37	0.40	0.24	0.40	0.80	0.65	2.61
Alkalinity	mg $CaCO_3$/L	123	125	253	301	305	319	284	289	286
Ferrous Iron	mg Fe^{2+}/L	0.07 J	0.03 J	<0.03 U	0.38 J	0.41 J	0.43 J	0.08 J	0.09 J	<0.03 U
Hydrogen Sulfide	mg S/L	0.08 J	0.14 J	<0.02 U	0.03 J	<0.02 U	0.04 J	0.09 J	0.08 J	0.08 J

Table B-1 Sample Results - Field Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW28 11/3/11 Round 1	GW28 5/15/13 Round 3	GW29 11/3/11 Round 1	GW29 5/1/12 Round 2	GW29 5/14/13 Round 3	GW30 11/3/11 Round 1	GW31 11/4/11 Round 1
Temperature	^{o}C	10.44	10.86	11.02	11.36	11.39	11.19	10.61
SPC	mS/cm	0.411	0.407	0.488	0.483	0.474	0.520	0.254
TDS	mg/L	267	265	317	314	308	338	165
DO	mg/L	1.18	1.29	0.06	0.19	0.14	0.06	3.88
pH		7.52	7.42	7.39	7.26	7.40	7.28	6.98
ORP	mV	411	273	160	-54	11	195	268
Turbidity	NTU	0.48	0.38	2.44	1.26	0.83	0.25	>800
Alkalinity	mg $CaCO_3$/L	191	188	224	218	220	258	116
Ferrous Iron	mg Fe^{2+}/L	0.07 J	<0.03 U	0.41 J	0.22 J	<0.03 U	0.03 J	<0.03 U
Hydrogen Sulfide	mg S/L	<0.02 U	<0.02 U	0.1 J	0.05 J	0.02 J	<0.02 U	0.8 J

Table B-1 Sample Results - Field Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW32 11/4/11 Round 1	GW32 4/30/12 Round 2	GW32 5/10/13 Round 3	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3
Temperature	^{o}C	11.98	11.94	11.67	9.84	10.34	10.67	10.54	10.63	10.47
SPC	mS/cm	0.311	0.318	0.305	0.331	0.324	0.325	0.569	0.564	0.351
TDS	mg/L	202	207	198	215	211	211	370	366	228
DO	mg/L	0.50	0.90	0.92	0.03	0.05	0.06	0.46	0.14	0.20
pH		7.34	7.29	7.20	7.95	7.75	7.89	7.20	7.04	6.91
ORP	mV	220	55	164	137	-48	-39	15	20	64
Turbidity	NTU	6.14	27.2	13.1	0.37	0.12	0.25	1.67	1.13	1.71
Alkalinity	mg $CaCO_3$/L	129	126	135	123	113	121	241	252	111
Ferrous Iron	mg Fe^{2+}/L	0.07 J	0.03 J	0.05 J	0.08 J	<0.03 U	0.03 J	0.16 J	0.17 J	0.08 J
Hydrogen Sulfide	mg S/L	0.02 J	0.05 J	0.03 J	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U

Table B-1 Sample Results - Field Parameters (Northeastern Pennsylvania)

	Sample	GW38	SW01	SW01	SW01	SW02	SW03	SW04	SW05	SW06
	Sample Date	5/10/13	10/29/11	4/30/12	5/14/13	11/4/11	4/25/12	4/25/12	4/26/12	4/26/12
Parameter	Unit	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 2	Round 2	Round 2
Temperature	^{o}C	10.22	15.34	10.39	15.84	12.72	10.36	13.13	8.69	9.94
SPC	mS/cm	0.297	0.411	0.324	0.423	0.090	0.867	0.798	0.145	0.144
TDS	mg/L	193	267	211	275	59	563	529	95	94
DO	mg/L	0.13	0.60	2.71	0.13	4.09	9.18	9.03	12.67	12.16
pH		7.91	7.22	7.38	7.24	5.85	7.57	7.34	8.04	8.43
ORP	mV	-134	331	107	-66	396	117	142	157	181
Turbidity	NTU	78.0	0.92	1.30	0.65	1.00	3.62	2.98	4.68	5.11
Alkalinity	mg $CaCO_3$/L	154	202	156	208	22	21	25	41	39
Ferrous Iron	mg Fe^{2+}/L	0.07 J	0.08 J	<0.03 U	0.64 J	<0.03 U	<0.03 U	<0.03 U	<0.03 U	<0.03 U
Hydrogen Sulfide	mg S/L	0.11 J	<0.02 U	<0.02 U	0.04 J	<0.02 U	<0.02 U	<0.02 U	<0.02 U	<0.02 U

Table B-2 Sample Results - Anions and Ammonia (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW01 10/25/11 Round 1	GW01 4/25/12 Round 2	GW01 5/13/13 Round 3	GW02 10/25/11 Round 1	GW02 4/25/12 Round 2	GW02 5/13/13 Round 3	GW03 10/25/11 Round 1	GW03 4/25/12 Round 2	GW03 5/13/13 Round 3
Anion-Cation Balance	%	4.19	4.13	0.34	0.67	4.02	2.02	3.23	3.67	0.86
DOC	mg/L	0.25	0.33	0.42	<0.25 U	0.61	0.28	0.46	0.58	0.55
DIC	mg/L	56.4	57.3	57.2	56.5	57.8	58.4	97.2	103	94.5
Nitrate + Nitrite	mg N/L	<0.10 U	<0.05 U	0.01 J	<0.10 U	<0.05 U	0.03 J	<0.10 U	<0.05 U	<0.10 U
Ammonia	mg N/L	0.87	0.94	0.82	0.94	0.91	0.83	0.66	0.48	0.50
Bromide	mg/L	<1.00 U	<1.00 U, H	0.56 J	<1.00 U	0.18 H	0.54 J	<1.00 U	<1.00 U, H	<1.00 U
Chloride	mg/L	53.1	47.2	51.0	23.8	26.3	18.9	14.0	23.5	20.7
Sulfate	mg/L	<1.00 U	<1.00 U	<1.00 U	0.14 J	1.10	<1.00 U	1200	1260	1230
Fluoride	mg/L	0.32	0.38	0.41	0.18 J	0.23	0.21	<0.20 U	<0.20 U	<0.20 U

Table B-2 Sample Results - Anions and Ammonia (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW04 10/25/11 Round 1	GW04 4/27/12 Round 2	GW05 10/26/11 Round 1	GW06 10/26/11 Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 10/26/11 Round 1
Anion-Cation Balance	%	4.77	3.86	6.52	1.83	1.31	1.94	2.57
DOC	mg/L	0.48	0.42	0.25 B	0.31 B	0.34	<0.25 U	0.62 B
DIC	mg/L	48.0	47.0	33.4	31.8	32.7	32.4	34.3
Nitrate + Nitrite	mg N/L	<0.10 U	<0.05 U	0.62	2.74	2.81	2.49	3.24
Ammonia	mg N/L	1.32	1.42	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Bromide	mg/L	R	1.88 H	<1.00 U	<1.00 U	<1.00 U, H	<1.00 U	<1.00 U
Chloride	mg/L	381	344	3.88	19.1	18.6	16.7	6.97
Sulfate	mg/L	1.66	1.50	8.90	15.0	13.2	13.5	15.7
Fluoride	mg/L	0.26	0.30	0.07 J	<0.20 U	0.08 J	0.09 J	0.05 J

Table B-2 Sample Results - Anions and Ammonia (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW08 10/27/11 Round 1	GW08 4/27/12 Round 2	GW08 5/11/13 Round 3	GW09 10/27/11 Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 10/27/11 Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
Anion-Cation Balance	%	5.28	4.72	0.03	1.63	0.31	0.12	10.2	2.53	8.11
DOC	mg/L	0.45	0.62	<0.25 U	<0.25 U	<0.25 U	0.30	0.99	1.16	0.81
DIC	mg/L	37.6	38.4	36.6	45.7	47.0	47.9	19.8	15.5	19.1
Nitrate + Nitrite	mg N/L	<0.10 U	<0.05 U	<0.10 U	<0.10 U	<0.05 U	0.12	0.41	0.95	0.70
Ammonia	mg N/L	0.52	0.62	0.64	0.01 J	<0.10 U	0.012 J	<0.10 U	<0.10 U	<0.10 U
Bromide	mg/L	R	2.32 H	2.09	<1.00 U	<1.00 U, H	<1.00 U	1.34	<1.00 U, H	<1.00 U
Chloride	mg/L	335	374	440	3.95	3.67	3.80	1.02	0.87 J	1.39
Sulfate	mg/L	3.62	<1.00 U	<1.00 U	16.9	16.4	17.2	13.3	11.5	13.3
Fluoride	mg/L	0.44	0.40	0.45	0.09 J	0.10 J	0.16 J	<0.20 U	0.05 J	<0.20 U

Table B-2 Sample Results - Anions and Ammonia (Northeastern Pennsylvania)

	Sample	GW11	GW11	GW11	GW12	GW12	GW13	GW13
	Sample Date	10/28/11	4/27/12	5/9/13	10/28/11	5/11/13	10/28/11	4/28/12
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 3	Round 1	Round 2
Anion-Cation Balance	%	2.22	2.42	1.31	1.21	0.09	3.57	2.06
DOC	mg/L	<0.25 U	<0.25 U	<0.25 U	1.08	0.70	<0.25 U	0.53
DIC	mg/L	51.1	57.1	56.9	38.0	39.1	30.3	31.2
Nitrate + Nitrite	mg N/L	<0.10 U	<0.05 U	<0.10 U	1.26	1.46	0.13	0.08
Ammonia	mg N/L	0.04 J	0.16	0.20	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Bromide	mg/L	<1.00 U	<1.00 U, H	<1.00 U	0.14 J	<1.00 U	<1.00 U	<1.00 U, H
Chloride	mg/L	10.2	12.5	12.0	7.20	7.32	23.4	22.3
Sulfate	mg/L	10.9	8.29	8.13	10.5	12.5	11.2	11.1
Fluoride	mg/L	0.51	0.57	0.50	<0.20 U	0.05 J	0.11 J	0.07 J

Table B-2 Sample Results - Anions and Ammonia (Northeastern Pennsylvania)

	Sample	GW14	GW14	GW14	GW15	GW15	GW15	GW16	GW16	GW16
	Sample Date	10/28/11	4/24/12	5/9/13	10/29/11	4/30/12	5/14/13	10/29/11	4/30/12	5/14/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Anion-Cation Balance	%	3.91	0.93	0.68	3.25	0.43	4.25	2.17	4.00	0.40
DOC	mg/L	0.83	0.85	0.64	<0.25 U	<0.25 U	<0.25 U	<0.25 U	<0.25 U	0.25
DIC	mg/L	21.8	18.2	19.9	35.1	36.1	36.6	36.6	37.5	37.7
Nitrate + Nitrite	mg N/L	0.26	0.52	0.29	<0.10 U	<0.05 U	0.02 J	<0.10 U	<0.05 U	<0.10 U
Ammonia	mg N/L	<0.10 U	<0.10 U	<0.10 U	0.02 J	<0.10 U	0.06 J	<0.10 U	<0.10 U	0.05 J
Bromide	mg/L	<1.00 U	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U, H	<1.00 U	<1.00 U	0.40 H	0.47 J
Chloride	mg/L	1.04	1.19	1.01	2.35	1.16	1.12	65.8	53.2	64.7
Sulfate	mg/L	13.6	12.2	13.6	10.7	9.82	9.40	0.39 J	1.07	<1.00 U
Fluoride	mg/L	0.03 J	0.07 J	0.10 J	0.03 J	0.12 J	0.15 J	0.03 J	0.08 J	0.09 J

Table B-2 Sample Results - Anions and Ammonia (Northeastern Pennsylvania)

	Sample	GW17	GW17	GW18	GW18	GW19	GW20	GW20	GW21	GW22
	Sample Date	10/29/11	4/30/12	10/31/11	4/28/12	10/31/11	10/31/11	4/28/12	11/1/11	11/1/11
Parameter	Unit	Round 1	Round 2	Round 1	Round 2	Round 1	Round 1	Round 2	Round 1	Round 1
Anion-Cation Balance	%	5.05	3.21	5.91	5.35	1.22	3.86	2.96	4.93	15.6
DOC	mg/L	<0.25 U	<0.25 U	0.28	<0.25 U	0.33	<0.25 U	<0.25 U	<0.25 U	<0.25 U
DIC	mg/L	28.7	29.9	32.8	33.1	24.7	32.8	34.0	15.1	24.6
Nitrate + Nitrite	mg N/L	<0.10 U	<0.05 U	0.10	0.06	0.79	0.12	0.07	0.26	<0.10 U
Ammonia	mg N/L	0.19	0.19	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Bromide	mg/L	R	4.70 H	<1.00 U	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U, H	<1.00 U	R
Chloride	mg/L	525	495	12.4	11.7	24.7	12.5	9.78	1.01	132
Sulfate	mg/L	3.33	0.77 J	8.20	8.02	14.8	8.06	7.41	13.4	<1.00 U
Fluoride	mg/L	<0.20 U	<0.20 U	0.14 J	0.20	0.04 J	0.03 J	0.12 J	<0.20 U	<0.20 U

Table B-2 Sample Results - Anions and Ammonia (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW23 11/1/11 Round 1	GW24 11/1/11 Round 1	GW25 11/2/11 Round 1	GW26 11/2/11 Round 1	GW26 4/24/12 Round 2	GW26 5/15/13 Round 3	GW27 11/2/11 Round 1	GW27 4/24/12 Round 2	GW27 5/9/13 Round 3
Anion-Cation Balance	%	2.62	8.92	7.77	1.56	3.39	0.71	5.31	4.12	0.95
DOC	mg/L	<0.25 U	<0.25 U	0.29	0.28	0.33	<0.25 U	<0.25 U	<0.25 U	<0.25 U
DIC	mg/L	28.7	30.5	55.5	79.1	79.6	82.0	66.6	67.7	66.6
Nitrate + Nitrite	mg N/L	<0.10 U	0.10	1.09	<0.10 U	<0.05 U	<0.10 U	<0.10 U	<0.05 U	<0.10 U
Ammonia	mg N/L	<0.10 U	<0.10 U	<0.10 U	0.03 J	<0.10 U	0.06 J	0.11	0.14	0.13
Bromide	mg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U, H	<1.00 U
Chloride	mg/L	18.2	9.79	8.86	0.83 J	0.73 J	0.75 J	3.66	3.54	3.60
Sulfate	mg/L	2.55	12.3	17.6	26.0	26.0	26.7	10.7	11.2	10.0
Fluoride	mg/L	<0.20 U	0.06 J	0.04 J	<0.20 U	0.12 J	0.12 J	0.52	0.62	0.66

Table B-2 Sample Results - Anions and Ammonia (Northeastern Pennsylvania)

	Sample	GW28	GW28	GW29	GW29	GW29	GW30	GW31
	Sample Date	11/3/11	5/15/13	11/3/11	5/1/12	5/14/13	11/3/11	11/4/11
Parameter	Unit	Round 1	Round 3	Round 1	Round 2	Round 3	Round 1	Round 1
Anion-Cation Balance	%	5.06	1.51	4.92	3.29	0.08	1.92	2.70
DOC	mg/L	<0.25 U	<0.25 U	<0.25 U	0.25 B	<0.25 U	0.28	0.77
DIC	mg/L	44.6	45.3	54.6	54.9	54.6	65.6	30.6
Nitrate + Nitrite	mg N/L	0.90	0.92	<0.10 U	<0.05 U	0.01 J	0.12	<0.10 U
Ammonia	mg N/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	0.36
Bromide	mg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U
Chloride	mg/L	7.31	6.92	1.13	1.21	1.50	2.04	5.33
Sulfate	mg/L	20.8	20.1	39.6	40.1	40.3	21.4	11.7
Fluoride	mg/L	<0.20 U	0.14 J	0.10 J	0.16 J	0.20	<0.20 U	<0.20 U

Table B-2 Sample Results - Anions and Ammonia (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW32 11/4/11 Round 1	GW32 4/30/12 Round 2	GW32 5/10/13 Round 3	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3
Anion-Cation Balance	%	0.91	2.10	0.63	3.98	1.56	0.04	1.11	1.55	2.44
DOC	mg/L	<0.25 U	0.29	<0.25 U	<0.25 U	0.35	0.27	0.63 B	0.50	0.54
DIC	mg/L	32.6	32.3	32.1	28.9	28.8	28.9	62.8	64.2	30.9
Nitrate + Nitrite	mg N/L	2.11	1.75	1.67	<0.10 U	<0.05 U	<0.10 U	<0.05 U	<0.10 U	<0.10 U
Ammonia	mg N/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	0.09 J	<0.10 U
Bromide	mg/L	<1.00 U	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U, H	0.19 J	<1.00 U, H	<1.00 U	<1.00 U
Chloride	mg/L	7.45	8.50	9.06	29.4	26.1	28.7	7.32	7.46	28.1
Sulfate	mg/L	9.59	8.62	8.92	<1.00 U	<1.00 U	<1.00 U	49.0	47.2	14.2
Fluoride	mg/L	<0.20 U	0.13 J	0.11 J	<0.20 U	0.11 J	0.16 J	0.10 J	0.12 J	0.17 J

Table B-2 Sample Results - Anions and Ammonia (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW38 5/10/13 Round 3	SW01 10/29/11 Round 1	SW01 4/30/12 Round 2	SW01 5/14/13 Round 3	SW02 11/4/11 Round 1	SW03 4/25/12 Round 2	SW04 4/25/12 Round 2	SW05 4/26/12 Round 2	SW06 4/26/12 Round 2
Anion-Cation Balance	%	2.91	2.03	1.75	1.76	4.05	0.27	1.37	0.01	1.25
DOC	mg/L	0.42	1.29	1.01	1.09	0.98	7.36	7.19	3.79 B	3.82 B
DIC	mg/L	33.9	51.2	38.0	55.2	16.6	8.22	7.75	9.84	9.86
Nitrate + Nitrite	mg N/L	0.015 J	<0.10 U	0.077	<0.10 U	1.61	0.06	0.06	0.35	0.35
Ammonia	mg N/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Bromide	mg/L	<1.00 U	<1.00 U	<1.00 U, H	<1.00 U	1.46	0.61 H	0.87 H	<1.00 U, H	<1.00 U, H
Chloride	mg/L	7.15	0.82 J	0.72 J	0.84 J	1.66	224	230	9.23	9.25
Sulfate	mg/L	7.15	13.3	12.1	12.2	9.77	16.2	17.6	11.2	11.1
Fluoride	mg/L	0.13 J	0.11 J	0.15 J	0.12 J	<0.20 U	<0.20 U	<0.20 U	0.04 J	0.05 J

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW01 10/25/11 Round 1	GW01 4/25/12 Round 2	GW01 5/13/13 Round 3	GW02 10/25/11 Round 1	GW02 4/25/12 Round 2	GW02 5/13/13 Round 3	GW03 10/25/11 Round 1	GW03 4/25/12 Round 2	GW03 5/13/13 Round 3
Dissolved Ag	µg/L	<14 U	<14 U, J-	<10 U	<14 U	<14 U, J-	<10 U	<14 U	<14 U, J-	<10 U
Total Ag	µg/L	<16 U	<16 U	<10 U	<16 U	<16 U	<10 U	<16 U	<16 U	<10 U
Dissolved Al	µg/L	<494 U	<20.0 U	<20 U	<494 U	<20.0 U	<20 U	<494 U	<20.0 U	<20 U
Total Al	µg/L	<548 U	<20.0 U	<20 U	<548 U	<20.0 U	<20 U	<548 U	<20.0 U	<20 U
Dissolved As	µg/L	<20 U	<1.0 U	<0.2 U	<20 U	<1.0 U	<0.2 U	<20 U	<1.0 U	0.25
Total As	µg/L	<22 U	<1.0 U	0.29 B	<22 U	<1.0 U	<0.2 U	<22 U	<1.0 U	0.73 B
Dissolved B	µg/L	580 J	571 J	582	508 J	481 J	489	229 J	197 J	223
Total B	µg/L	580 J	588 J	619	499 J	493 J	520	231 J	206 J	242
Dissolved Ba	µg/L	886 J	855 J	845	1620 J	1650 J	1640	10 J	9 J	10.0
Total Ba	µg/L	917 J	880 J	870	1720 J	1720 J	1650	10 J	11 J	9.4
Dissolved Be	µg/L	<10 U	<10 U	<5 U	<10 U	<10 U	<5 U	<10 U	<10 U	<5 U
Total Be	µg/L	<11 U	<11 U	<2.5 U	<11 U	<11 U	<2.5 U	<11 U	<11 U	0.05 J
Dissolved Ca	mg/L	12.0	12.1	12.1	27.4	30.1	29.1	335	352	385
Total Ca	mg/L	12.1 J	12.3 J	12.5	28.5 J	32.2 J	28.9	346 J	377 J	370
Dissolved Cd	µg/L	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U
Total Cd	µg/L	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U
Dissolved Co	µg/L	<4 U	<4 U	<5 U	<4 U	1 J	<5 U	<4 U	1 J	1.7 J
Total Co	µg/L	<4 U	<4 U	0.88 J	<4 U	<4 U	1.2 J	<4 U	2 J	2.3 J
Dissolved Cr	µg/L	<7 U	<2.0 U	<2 U	<7 U	<2.0 U	0.74 J	<7 U	<2.0 U	<2 U
Total Cr	µg/L	<8 U	<2.0 U	<2 U	<8 U	<2.0 U	<2 U	<8 U	<2.0 U	<2 U
Dissolved Cu	µg/L	<20 U	<2.0 U	0.27 J	<20 U	<2.0 U	0.60	<20 U	<2.0 U	3.6
Total Cu	µg/L	11 J	18.9 J	8.8	<22 U	8.5 J	2.6	<22 U	3.2	5.3
Dissolved Fe	µg/L	48 J	40 J	<100 U	232	104	164	3260	3530	3810
Total Fe	µg/L	63 J	48 J	70.7	308 J	301 J	377	3460 J	3810 J	3690
Dissolved K	mg/L	1.79 J	2.08 J	1.80	2.14 J	2.31 J	2.15	3.92 J	4.08 J	4.00
Total K	mg/L	1.85 J	1.96 J	1.82	2.17 J	2.26 J	2.16	3.94 J	4.01 J	4.23
Dissolved Li	µg/L	NA	101	99.1	NA	59.6	61.2	NA	53.6	56.4
Total Li	µg/L	NA	102	99.8	NA	62.4	60.9	NA	59.2	59.4
Dissolved Mg	mg/L	2.06	1.96	2.01	6.70	6.97	7.11	127	129	134
Total Mg	mg/L	2.00 J	2.05 J	2.11	6.85 J	7.55 J	7.22	126 J	144 J	141
Dissolved Mn	µg/L	8 J	7 J	6.9	25	21	22.7	1120	1310	1170

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW04	GW04	GW05	GW06	GW06	GW06	GW07
	Sample Date	10/25/11	4/27/12	10/26/11	10/26/11	4/28/12	5/11/13	10/26/11
Parameter	Unit	Round 1	Round 2	Round 1	Round 1	Round 2	Round 3	Round 1
Dissolved Ag	µg/L	<14 U	<14 U	<14 U	<14 U	<14 U	<10 U	<14 U
Total Ag	µg/L	<16 U	<16 U, J-	<16 U	<16 U	<16 U, J-	<10 U	<16 U
Dissolved Al	µg/L	<494 U	121	<494 U	<494 U	<20.0 U	<20 U	<494 U
Total Al	µg/L	683 J	320	<548 U	<548 U	<20.0 U	<20 U	<548 U
Dissolved As	µg/L	<20 U	1.4	<20 U	<20 U	2.5	2.7	<20 U
Total As	µg/L	<22 U	1.4	<22 U	<22 U	2.5	2.7	<22 U
Dissolved B	µg/L	265 J	250 J	<333 U	<333 U	<333 U	<40 U	<333 U
Total B	µg/L	262 J	245 J	<370 U	<370 U	<370 U	35.4	<370 U
Dissolved Ba	µg/L	5180 J	4950 J	430 J	396 J	398 J	388	164 J
Total Ba	µg/L	5430 J	5130 J	447 J	410 J	397 J	389	174 J
Dissolved Be	µg/L	<10 U	<10 U	<10 U	<10 U	<10 U	<5 U	<10 U
Total Be	µg/L	<11 U	<11 U	<11 U	<11 U	<11 U	<2.5 U	<11 U
Dissolved Ca	mg/L	50.1	49.3	38.8	47.1	48.7	48.1	44.0
Total Ca	mg/L	51.7 J	50.9 J	40.0 J	49.0 J	48.2 J	49.3	45.6 J
Dissolved Cd	µg/L	<4 U	<1.0 U	<4 U	<4 U	<1.0 U	<0.2 U	<4 U
Total Cd	µg/L	<4 U	<1.0 U	<4 U	<4 U	<1.0 U	<0.2 U	<4 U
Dissolved Co	µg/L	1 J	2 J	<4 U	<4 U	<4 U	<5 U	<4 U
Total Co	µg/L	<4 U	3 J	<4 U	<4 U	<4 U	<2.5 U	<4 U
Dissolved Cr	µg/L	<7 U	<2.0 U	<7 U	<7 U	<2.0 U	<2 U	<7 U
Total Cr	µg/L	<8 U	<2.0 U	<8 U	<8 U	<2.0 U	<2 U	<8 U
Dissolved Cu	µg/L	<20 U	5.6	<20 U	<20 U	2.2	0.70 B	8 J
Total Cu	µg/L	7 J	9.9 J	14 J	<22 U	<2.0 U, J-	0.76 *	13 J
Dissolved Fe	µg/L	826	432	<67 U	<67 U	<67 U	<100 U	<67 U
Total Fe	µg/L	1430 J	1180 J	26 J	<74 U	<74 U	<50 U	84 J
Dissolved K	mg/L	3.36 J	3.69 J	1.56 J	1.54 J	1.26 J	1.56	0.93 J
Total K	mg/L	3.59 J	3.82 J	1.54 J	1.55 J	1.61 J	1.64	0.99 J
Dissolved Li	µg/L	NA	557	NA	NA	15.1	11.5	NA
Total Li	µg/L	NA	567	NA	NA	14.5	12.2	NA
Dissolved Mg	mg/L	8.51	8.13	4.57	5.64	5.80	5.82	4.16
Total Mg	mg/L	8.72 J	8.71 J	4.54 J	5.70 J	5.78 J	5.84	4.26 J
Dissolved Mn	µg/L	205	99	8 J	<14 U	<14 U	0.22 J	<14 U

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW08 10/27/11 Round 1	GW08 4/27/12 Round 2	GW08 5/11/13 Round 3	GW09 10/27/11 Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 10/27/11 Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
Dissolved Ag	µg/L	<14 U	<14 U, J-	<10 U	<14 U	<14 U, J-	<10 U	<14 U	<14 U, J-	<10 U
Total Ag	µg/L	<16 U	<16 U	<10 U	<16 U	<16 U	<10 U	<16 U	<16 U	<10 U
Dissolved Al	µg/L	<494 U	36.6	<20 U	<494 U	<20.0 U	<20 U	<494 U	24.8	<20 U
Total Al	µg/L	511 J	341	20.0	< 548 U	<20.0 U	<20 U	526 J	61.5	56.4
Dissolved As	µg/L	<20 U	6.0	5.5	<20 U	<1.0 U	0.75	<20 U	<1.0 U	0.13 J
Total As	µg/L	<22 U	6.9	5.9	<22 U	<1.0 U	1.0	<22 U	<1.0 U	0.34
Dissolved B	µg/L	339 J	318 J	301	<333 U	<333 U	85.5	<333 U	<333 U	<40 U
Total B	µg/L	326 J	324 J	334	<370 U	<370 U	95.5	<370 U	<370 U	<20 U
Dissolved Ba	µg/L	1260 J	1590 J	2020	116 J	114 J	115	135 J	114 J	142
Total Ba	µg/L	1580 J	1710 J	2050	122 J	118 J	119	145 J	120 J	149
Dissolved Be	µg/L	<10 U	<10 U	<5 U	<10 U	<10 U	<5 U	<10 U	<10 U	<5 U
Total Be	µg/L	<11 U	<11 U	<2.5 U	<11 U	<11 U	<2.5 U	<11 U	<11 U	<2.5 U
Dissolved Ca	mg/L	9.39	12.4	15.4	38.3	38.3	39.3	16.1	13.9	18.7
Total Ca	mg/L	11.4 J	14.0 J	15.9	39.1 J	40.6 J	40.4	16.2 J	14.6 J	19.1
Dissolved Cd	µg/L	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U
Total Cd	µg/L	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U
Dissolved Co	µg/L	<4 U	1 J	<5 U	<4 U	<4 U	<5 U	<4 U	<4 U	<5 U
Total Co	µg/L	<4 U	<4 U	<2.5 U	<4 U	<4 U	<2.5 U	<4 U	<4 U	<2.5 U
Dissolved Cr	µg/L	<7 U	<2.0 U	0.39 J	<7 U	<2.0 U	<2 U	<7 U	<2.0 U	<2 U
Total Cr	µg/L	<8 U	<2.0 U	<2 U	<8 U	<2.0 U	<2 U	<8 U	<2.0 U	<2 U
Dissolved Cu	µg/L	<20 U	2.7	<0.5 U	<20 U	<2.0 U	0.78	8 J	11.3	7.5 B
Total Cu	µg/L	<22 U	3.6 J	0.69 *	<22 U	2.1 J	1.1 *	<22 U	9.4	13.8 *
Dissolved Fe	µg/L	34 J	119	107	<67 U	<67 U	<100 U	<67 U	34 J	<100 U
Total Fe	µg/L	330 J	1480 J	104	63 J	<74 U	89.8	366 J	170 J	2270
Dissolved K	mg/L	2.66 J	3.55 J	3.48	1.46 J	1.47 J	1.47	0.90 J	0.87 J	0.91 J
Total K	mg/L	3.13 J	3.85 J	3.41	1.53 J	1.46 J	1.76	1.04 J	0.89 J	0.91
Dissolved Li	µg/L	NA	420	468	NA	29.1	31.3	NA	<10.0 U	<10 U
Total Li	µg/L	NA	439	460	NA	34.1	36.7	NA	<10.0 U	<5 U
Dissolved Mg	mg/L	1.89	2.43	3.10	14.2	13.9	14.9	2.71	2.31	3.21
Total Mg	mg/L	2.31 J	3.02 J	3.13	14.4 J	15.3 J	15.4	2.75 J	2.50 J	3.32
Dissolved Mn	µg/L	9 J	13 J	12.2	125	156	72.0	<14 U	<14 U	2.0 J

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW11 10/28/11 Round 1	GW11 4/27/12 Round 2	GW11 5/9/13 Round 3	GW12 10/28/11 Round 1	GW12 5/11/13 Round 3	GW13 10/28/11 Round 1	GW13 4/28/12 Round 2
Dissolved Ag	µg/L	<14 U	<14 U, J-	<10 U	<14 U	<10 U	<14 U	<14 U
Total Ag	µg/L	30	<16 U	<10 U	<16 U	<10 U	<16 U	<16 U, J-
Dissolved Al	µg/L	<494 U	<20.0 U	<20 U	<494 U	<20 U	<494 U	297
Total Al	µg/L	< 548 U	<20.0 U	<20 U	< 548 U	29.4	166 J	459
Dissolved As	µg/L	<20 U	<1.0 U	0.14 J	<20 U	0.36	<20 U	3.4
Total As	µg/L	<22 U	<1.0 U	0.31	<22 U	0.66	<22 U	3.6
Dissolved B	µg/L	240 J	329 J	318	<333 U	<40 U	<333 U	<333 U
Total B	µg/L	230 J	337 J	340	<370 U	<20 U	<370 U	<370 U
Dissolved Ba	µg/L	272 J	310 J	351	162 J	165	222 J	240 J
Total Ba	µg/L	287 J	322 J	361	169 J	168	244 J	291 J
Dissolved Be	µg/L	<10 U	<10 U	<5 U	<10 U	<5 U	<10 U	<10 U
Total Be	µg/L	<11 U	<11 U	<2.5 U	<11 U	<2.5 U	<11 U	<11 U
Dissolved Ca	mg/L	25.0	16.7	13.9	46.1	48.2	40.6	42.3
Total Ca	mg/L	26.2 J	17.7 J	13.0	47.3 J	48.9	41.7 J	42.6 J
Dissolved Cd	µg/L	<4 U	<1.0 U	<0.2 U	<4 U	<0.2 U	<4 U	<1.0 U
Total Cd	µg/L	<4 U	<1.0 U	<0.2 U	<4 U	<0.2 U	<4 U	<1.0 U
Dissolved Co	µg/L	<4 U	<4 U	<5 U	<4 U	<5 U	<4 U	<4 U
Total Co	µg/L	<4 U	<4 U	<2.5 U	<4 U	<2.5 U	<4 U	<4 U
Dissolved Cr	µg/L	<7 U	<2.0 U	<2 U	<7 U	0.65 J	<7 U	<2.0 U
Total Cr	µg/L	<8 U	<2.0 U	<2 U	<8 U	<2 U	<8 U	<2.0 U
Dissolved Cu	µg/L	<20 U	<2.0 U	<0.5 U	31	8.4 B	<20 U	<2.0 U
Total Cu	µg/L	<22 U	<2.0 U	0.66 *	33 J	9.7 *	<22 U	<2.0 U
Dissolved Fe	µg/L	<67 U	<67 U	<100 U	<67 U	<100 U	<67 U	718
Total Fe	µg/L	24 J	31 J	62.9	70 J	132	142 J	1650 J
Dissolved K	mg/L	1.79 J	2.06 J	2.06	1.12 J	1.14	1.68 J	1.60 J
Total K	mg/L	1.83 J	2.01 J	2.12	1.11 J	1.15	1.75 J	2.48 J
Dissolved Li	µg/L	NA	166	167	NA	12.2	NA	21.4
Total Li	µg/L	NA	179	164	NA	11.9	NA	26.6
Dissolved Mg	mg/L	8.00	5.71	5.18	11.2	13.2	6.68	7.03
Total Mg	mg/L	8.20 J	6.29 J	5.02	11.4 J	13.00	6.76 J	7.31 J
Dissolved Mn	µg/L	12 J	13 J	17.1	<14 U	<5 U	16	39

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW14 10/28/11 Round 1	GW14 4/24/12 Round 2	GW14 5/9/13 Round 3	GW15 10/29/11 Round 1	GW15 4/30/12 Round 2	GW15 5/14/13 Round 3	GW16 10/29/11 Round 1	GW16 4/30/12 Round 2	GW16 5/14/13 Round 3
Dissolved Ag	µg/L	<14 U	<14 U, J-	<10 U	<14 U	<14 U	<10 U	<14 U	<14 U	<10 U
Total Ag	µg/L	<16 U	<16 U	<10 U	<16 U	31 J-	<10 U	<16 U	<16 U, J-	<10 U
Dissolved Al	µg/L	<494 U	<20.0 U	<20 U	<494 U	<20.0 U	<20 U	<494 U	<20.0 U	<20 U
Total Al	µg/L	187 J	180	433	295 J	<20 U	35.5	< 548 U	34.3	<20 U
Dissolved As	µg/L	<20 U	<1.0 U	0.20	<20 U	3.6	3.2 B	<20 U	1.0	0.65 B
Total As	µg/L	<22 U	<1.0 U	0.87	<22 U	3.6	3.7	<22 U	1.0	1.0
Dissolved B	µg/L	<333 U	<333 U	49.3	122 J	136 J	138	131 J	129 J	127
Total B	µg/L	<370 U	<370 U	56.8	123 J	131 J	152	133 J	124 J	138
Dissolved Ba	µg/L	194 J	165 J	192	436 J	500 J	552	1780 J	1610 J	1710
Total Ba	µg/L	207 J	177 J	208	450 J	509 J	579	1800 J	1590 J	1670
Dissolved Be	µg/L	<10 U	<10 U	<5 U	<10 U	<10 U	<5 U	<10 U	<10 U	<5 U
Total Be	µg/L	<11 U	<11 U	<2.5 U	<11 U	<11 U	<2.5 U	<11 U	<11 U	<2.5 U
Dissolved Ca	mg/L	15.1	14.5	14.2	27.9	27.4	26.7	37.3	36.7	38.6
Total Ca	mg/L	15.5 J	15.2 J	14.5	28.2 J	27.4 J	26.9	38.1 J	36.5 J	37.6
Dissolved Cd	µg/L	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U
Total Cd	µg/L	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U
Dissolved Co	µg/L	<4 U	<4 U	<5 U	<4 U	<4 U	<5 U	<4 U	<4 U	<5 U
Total Co	µg/L	<4 U	<4 U	0.53 J	<4 U	<4 U	<2.5 U	<4 U	<4 U	<2.5 U
Dissolved Cr	µg/L	<7 U	<2.0 U	<2 U	<7 U	<2.0 U	<2 U	<7 U	<2.0 U	<2 U
Total Cr	µg/L	<8 U	<2.0 U	3.6	<8 U	<2.0 U	<2 U	<8 U	<2.0 U	<2 U
Dissolved Cu	µg/L	11 J	10.1	26.2	<20 U	<2.0 U	<0.5 U	<20 U	3.6	0.50 B
Total Cu	µg/L	<22 U	12.4	78.5 *	23 J	<2.0 U	0.70	<22 U	6.8	2.1
Dissolved Fe	µg/L	<67 U	<67 U	<100 U	52 J	52 J	<100 U	109	204	147
Total Fe	µg/L	148 J	344 J	876	303 J	83 J	177	324 J	276 J	243
Dissolved K	mg/L	1.03 J	0.98 J	0.99	1.40 J	1.22 J	1.57	1.95 J	1.69 J	2.03
Total K	mg/L	1.07 J	1.10 J	1.08	1.51 J	1.60 J	1.66	2.00 J	2.07 J	2.02
Dissolved Li	µg/L	NA	16.1	23.8	NA	32.4	38.1	NA	64.7	72.2
Total Li	µg/L	NA	20.3	26.1	NA	42.2	38.9	NA	73.3	72.8
Dissolved Mg	mg/L	2.19	2.13	2.13	7.42	7.14	6.86	8.27	8.23	8.70
Total Mg	mg/L	2.25 J	2.35 J	2.26	7.70 J	7.25 J	7.00	8.60 J	8.21 J	8.66
Dissolved Mn	µg/L	<14 U	<14 U	1.2 J	80	79	67.1	88	83	78.9

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW17	GW17	GW18	GW18	GW19	GW20	GW20	GW21	GW22
	Sample Date	10/29/11	4/30/12	10/31/11	4/28/12	10/31/11	10/31/11	4/28/12	11/1/11	11/1/11
Parameter	Unit	Round 1	Round 2	Round 1	Round 2	Round 1	Round 1	Round 2	Round 1	Round 1
Dissolved Ag	µg/L	<14 U	<14 U	<14 U	<14 U	<14 U	<14 U	<14 U	<14 U	<14 U
Total Ag	µg/L	<16 U	<16 U, J-	<16 U	<16 U, J-	<16 U	<16 U	<16 U, J-	<16 U	<16 U
Dissolved Al	µg/L	<494 U	<20.0 U	<494 U	<20.0 U	<494 U	<494 U	<20.0 U	<494 U	<494 U
Total Al	µg/L	<548 U	<20.0 U	236 J	32.0	<548 U	<548 U	89.4	<548 U	<548 U
Dissolved As	µg/L	<20 U	2.6	<20 U	1.1	<20 U	<20 U	<1.0 U	<20 U	<20 U
Total As	µg/L	<22 U	2.6	<22 U	1.1	<22 U	<22 U	1.1	<22 U	<22 U
Dissolved B	µg/L	243 J	241 J	<333 U	<333 U	<333 U	<333 U	<333 U	<333 U	<333 U
Total B	µg/L	240 J	234 J	<370 U	<370 U	<370 U	<370 U	<370 U	<370 U	<370 U
Dissolved Ba	µg/L	5170 J	4900 J	219 J	205 J	83 J	189 J	179 J	148 J	1850 J
Total Ba	µg/L	5130 J	4910 J	227 J	207 J	84 J	194 J	186 J	151 J	1850 J
Dissolved Be	µg/L	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U
Total Be	µg/L	<11 U	<11 U	<11 U	<11 U	<11 U	<11 U	<11 U	<11 U	<11 U
Dissolved Ca	mg/L	50.5	51.6	27.7	28.1	32.9	32.6	31.6	23.2	25.5
Total Ca	mg/L	51.3 J	51.4 J	28.2 J	28.2 J	33.2 J	33.1 J	32.3 J	23.6 J	25.9 J
Dissolved Cd	µg/L	<4 U	<1.0 U	<4 U	<1.0 U	<4 U	<4 U	<1.0 U	<4 U	<4 U
Total Cd	µg/L	<4 U	<1.0 U	<4 U	<1.0 U	<4 U	<4 U	<1.0 U	<4 U	<4 U
Dissolved Co	µg/L	1 J	1 J	<4 U	<4 U	<4 U	<4 U	<4 U	<4 U	<4 U
Total Co	µg/L	<4 U	<4 U	<4 U	<4 U	<4 U	<4 U	<4 U	<4 U	<4 U
Dissolved Cr	µg/L	<7 U	<2.0 U	<7 U	<2.0 U	<7 U	<7 U	<2.0 U	<7 U	<7 U
Total Cr	µg/L	<8 U	<2.0 U	<8 U	<2.0 U	<8 U	<8 U	<2.0 U	<8 U	<8 U
Dissolved Cu	µg/L	<20 U	2.9	<20 U	<2.0 U	<20 U	<20 U	<2.0 U	<20 U	<20 U
Total Cu	µg/L	<22 U	7.3	<22 U	<2.0 U	<22 U	<22 U	<2.0 U	<22 U	<22 U
Dissolved Fe	µg/L	229	227	<67 U	<67 U	<67 U	<67 U	<67 U	<67 U	85
Total Fe	µg/L	275 J	336 J	152 J	26 J	<74 U	<74 U	77 J	405 J	226 J
Dissolved K	mg/L	3.76 J	3.88 J	1.57 J	1.32 J	0.73 J	1.40 J	1.14 J	0.79 J	1.41 J
Total K	mg/L	3.84 J	4.57 J	1.69 J	1.75 J	0.75 J	1.45 J	1.55 J	0.88 J	1.44 J
Dissolved Li	µg/L	NA	444	NA	45.3	NA	NA	32.0	NA	NA
Total Li	µg/L	NA	469	NA	49.4	NA	NA	38.2	NA	NA
Dissolved Mg	mg/L	8.60	8.72	3.91	4.04	4.67	5.62	5.41	2.68	4.59
Total Mg	mg/L	8.80 J	8.74 J	4.10 J	4.09 J	4.80 J	5.80 J	5.64 J	2.82 J	4.71 J
Dissolved Mn	µg/L	81	79	7 J	<14 U	<14 U	<14 U	6 J	<14 U	92

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW23	GW24	GW25	GW26	GW26	GW26	GW27	GW27	GW27
	Sample Date	11/1/11	11/1/11	11/2/11	11/2/11	4/24/12	5/15/13	11/2/11	4/24/12	5/9/13
Parameter	Unit	Round 1	Round 1	Round 1	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Dissolved Ag	µg/L	<14 U	<14 U	<14 U	<14 U	<14 U, J-	<10 U	<14 U	<14 U, J-	<10 U
Total Ag	µg/L	<16 U	<16 U	<16 U	<16 U	<16 U	<10 U	<16 U	<16 U	<10 U
Dissolved Al	µg/L	<494 U	336 J	<494 U	<494 U	<20.0 U	<20 U	<494 U	<20.0 U	<20 U
Total Al	µg/L	<548 U	3000	<548 U	<548 U	<20.0 U	<20 U	<548 U	<20.0 U	23.1
Dissolved As	µg/L	<20 U	<20 U	<20 U	<20 U	5.6	5.6	<20 U	4.6	4.7
Total As	µg/L	<22 U	<22 U	<22 U	<22 U	5.8	5.4	<22 U	4.5	4.4
Dissolved B	µg/L	<333 U	<333 U	196 J	<333 U	<333 U	87.5	403 J	391 J	416
Total B	µg/L	<370 U	<370 U	178 J	<370 U	<370 U	96.5	406 J	392 J	426
Dissolved Ba	µg/L	516 J	244 J	347 J	150 J	142 J	153	798 J	795 J	909
Total Ba	µg/L	510 J	314 J	317 J	151 J	151 J	154	845 J	829 J	869
Dissolved Be	µg/L	<10 U	<10 U	<10 U	<10 U	<10 U	<5 U	<10 U	<10 U	<5 U
Total Be	µg/L	<11 U	<11 U	<11 U	<11 U	<11 U	<2.5 U	<11 U	<11 U	<2.5 U
Dissolved Ca	mg/L	29.2	29.9	36.9	68.5	66.8	72.9	18.8	22.4	19.7
Total Ca	mg/L	29.3 J	30.8 J	39.0 J	67.9 J	72.2 J	71.5	20.0 J	23.3 J	19.2
Dissolved Cd	µg/L	<4 U	<4 U	<4 U	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U
Total Cd	µg/L	<4 U	<4 U	<4 U	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U
Dissolved Co	µg/L	<4 U	<4 U	<4 U	<4 U	1 J	<5 U	<4 U	<4 U	<5 U
Total Co	µg/L	<4 U	<4 U	<4 U	<4 U	<4 U	<2.5 U	<4 U	<4 U	<2.5 U
Dissolved Cr	µg/L	<7 U	<7 U	<7 U	<7 U	<2.0 U	<2 U	<7 U	<2.0 U	<2 U
Total Cr	µg/L	<8 U	4 J	<8 U	<8 U	<2.0 U	<2 U	<8 U	<2.0 U	<2 U
Dissolved Cu	µg/L	<20 U	6 J	<20 U	<20 U	<2.0 U	<0.5 U	<20 U	<2.0 U	<0.5 U
Total Cu	µg/L	15 J	10 J	<22 U	<22 U	4.9	1.2	<22 U	2.5	1.7 *
Dissolved Fe	µg/L	65 J	343	<67 U	330	508	551	48 J	78	<100 U
Total Fe	µg/L	386 J	2380 J	26 J	320 J	712 J	556	55 J	97 J	92.6
Dissolved K	mg/L	1.22 J	1.00 J	3.16 J	2.12 J	2.28 J	2.29	2.36 J	2.73 J	2.57
Total K	mg/L	1.26 J	1.93 J	3.22 J	2.19 J	2.28 J	2.25	2.54 J	2.63 J	2.46
Dissolved Li	µg/L	NA	NA	NA	NA	15.0	17.0	NA	154	172
Total Li	µg/L	NA	NA	NA	NA	18.4	16.4	NA	180	164
Dissolved Mg	mg/L	8.89	7.00	10.7	20.8	20.3	23.1	3.40	4.15	3.56
Total Mg	mg/L	9.03 J	7.59 J	12.0 J	21.5 J	22.5 J	23.2	3.62 J	4.47 J	3.61
Dissolved Mn	µg/L	161	268	10 J	864	871	864	45	70	45.7

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample / Sample Date / Unit	GW28 11/3/11 Round 1	GW28 5/15/13 Round 3	GW29 11/3/11 Round 1	GW29 5/1/12 Round 2	GW29 5/14/13 Round 3	GW30 11/3/11 Round 1	GW31 11/4/11 Round 1
Dissolved Ag	µg/L	<14 U	<10 U	<14 U	<14 U	<10 U	<14 U	<14 U
Total Ag	µg/L	<16 U	<10 U	<16 U	<16 U, J-	<10 U	<16 U	<16 U
Dissolved Al	µg/L	<494 U	<20 U	<494 U	<20.0 U	<20 U	<494 U	<494 U
Total Al	µg/L	<548 U	<20 U	<548 U	<20.0 U	<20 U	<548 U	10700 J
Dissolved As	µg/L	<20 U	0.71	<20 U	<1.0 U	0.52 B	<20 U	<20 U
Total As	µg/L	<22 U	0.91 B	<22 U	<1.0 U	0.72	<22 U	9 J
Dissolved B	µg/L	<333 U	47.4	<333 U	<333 U	60.0	135 J	<333 U
Total B	µg/L	<370 U	50.2	<370 U	<370 U	66.4	132 J	<370 U
Dissolved Ba	µg/L	160 J	160	63 J	62 J	62.5	435 J	368 J
Total Ba	µg/L	167 J	155	66 J	62 J	62.4	436 J	672 J
Dissolved Be	µg/L	<10 U	<5 U	<10 U	<10 U	<5 U	<10 U	<10 U
Total Be	µg/L	<11 U	<2.5 U	<11 U	<11 U	<2.5 U	<11 U	<11 U
Dissolved Ca	mg/L	44.2	49.2	51.2	54.0	55.2	46.1	21.8
Total Ca	mg/L	47.7 J	46.5	54.9 J	54.3 J	53.8	46.9 J	24.8 J
Dissolved Cd	µg/L	<4 U	<0.2 U	<4 U	<1.0 U	<0.2 U	<4 U	<4 U
Total Cd	µg/L	<4 U	<0.2 U	<4 U	<1.0 U	<0.2 U	<4 U	<4 U
Dissolved Co	µg/L	<4 U	<5 U	<4 U	<4 U	<5 U	<4 U	3 J
Total Co	µg/L	<4 U	<2.5 U	<4 U	<4 U	<2.5 U	<4 U	12 J
Dissolved Cr	µg/L	<7 U	<2 U	<7 U	<2.0 U	<2 U	<7 U	<7 U
Total Cr	µg/L	<8 U	<2 U	<8 U	<2.0 U	<2 U	<8 U	11 J
Dissolved Cu	µg/L	<20 U	9.4 B	<20 U	<2.0 U	<0.5 U	<20 U	<20 U
Total Cu	µg/L	<22 U	6.3	12 J	<2.0 U	2.1	9 J	46 J
Dissolved Fe	µg/L	<67 U	<100 U	302	339	204	<67 U	73
Total Fe	µg/L	22 J	61.2	880 J	336 J	347	<74 U	10700 J
Dissolved K	mg/L	1.52 J	1.66	1.20 J	0.97 J	1.29	2.77 J	1.64 J
Total K	mg/L	1.62 J	1.58	1.28 J	1.35 J	1.28	2.91 J	5.25 J
Dissolved Li	µg/L	NA	23.9	NA	19.3	20.9	NA	NA
Total Li	µg/L	NA	22.2	NA	19.8	20.2	NA	NA
Dissolved Mg	mg/L	14.2	16.3	14.2	15.3	15.6	14.0	4.29
Total Mg	mg/L	15.2 J	15.7	15.3 J	15.3 J	15.5	14.6 J	6.70 J
Dissolved Mn	µg/L	<14 U	<5 U	239	244	214	28	1260

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW32 11/4/11 Round 1	GW32 4/30/12 Round 2	GW32 5/10/13 Round 3	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3
Dissolved Ag	µg/L	<14 U	<14 U	<10 U	<14 U	<14 U	<10 U	<14 U, J-	<10 U	<10 U
Total Ag	µg/L	<16 U	<16 U, J-	<10 U	<16 U	<16 U, J-	<10 U	<16 J	<10 U	<10 U
Dissolved Al	µg/L	<494 U	<20.0 U	<20 U	<494 U	<20.0 U	<20 U	<20.0 U	<20 U	<20 U
Total Al	µg/L	<548 U	256	144	<548 U	<20.0 U	<20 U	<20.0 U	<20 U	<20 U
Dissolved As	µg/L	<20 U	1.7	1.6	<20 U	<1.0 U	0.60	<1.0 U	0.37	1.5
Total As	µg/L	<22 U	2.1	2.1	<22 U	<1.0 U	0.73	<1.0 U	0.65 B	1.9
Dissolved B	µg/L	<333 U	<333 U	<40 U	<333 U	<333 U	61.5	<333 U	<40 U	<40 U
Total B	µg/L	<370 U	<370 U	28.8	<370 U	<370 U	70.4	<370 U	24.4	<20 U
Dissolved Ba	µg/L	267 J	260 J	261	923 J	894 J	901	36 J	37.2	139
Total Ba	µg/L	278 J	272 J	262	967 J	903 J	900	38 J	37.9	137
Dissolved Be	µg/L	<10 U	<10 U	<5 U	<10 U	<10 U	<5 U	<10 U	<5 U	<5 U
Total Be	µg/L	<11 U	<11 U	<2.5 U	<11 U	<11 U	<2.5 U	<11 U	<2.5 U	<2.5 U
Dissolved Ca	mg/L	38.4	39.2	39.5	26.5	27.8	27.9	78.6	79.4	49.5
Total Ca	mg/L	40.9 J	39.0 J	40.3	28.2 J	27.8 J	28.3	81.9 J	78.9	49.7
Dissolved Cd	µg/L	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U	<1.0 U	<0.2 U	<0.2 U
Total Cd	µg/L	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<0.2 U	<1.0 U	<0.2 U	<0.2 U
Dissolved Co	µg/L	<4 U	<4 U	<5 U	<4 U	<4 U	<5 U	<4 U	<5 U	<5 U
Total Co	µg/L	<4 U	<4 U	<2.5 U	<4 U	<4 U	<2.5 U	<4 U	<2.5 U	<2.5 U
Dissolved Cr	µg/L	<7 U	<2.0 U	<2 U	<7 U	<2.0 U	<2 U	<2.0 U	<2 U	<2 U
Total Cr	µg/L	<8 U	<2.0 U	<2 U	<8 U	<2.0 U	<2 U	<2.0 U	<2 U	<2 U
Dissolved Cu	µg/L	6 J	4.1	2.8	<20 U	<2.0 U	0.48 J	<2.0 U	0.50	0.27 J
Total Cu	µg/L	<22 U	22.9	12.5 B, *	<22 U	<2.0 U	0.84 B, *	4.4	2.6	1.5 B, *
Dissolved Fe	µg/L	32 J	<67 U	<100 U	32 J	28 J	<100 U	166	164	112
Total Fe	µg/L	60 J	574 J	242	36 J	32 J	66.8	264 J	308	263
Dissolved K	mg/L	0.91 J	0.67 J	0.95	1.15 J	0.91 J	1.16	1.25 J	1.20	0.88
Total K	mg/L	0.97 J	1.29 J	1.09	1.22 J	1.31 J	1.25	1.22 J	1.20	0.861
Dissolved Li	µg/L	NA	15.2	15.2	NA	49.4	48.8	<10.0 U	<10 U	<10 U
Total Li	µg/L	NA	17.2	15.5	NA	50.6	51.1	<10.0 U	0.65 J	9.60
Dissolved Mg	mg/L	5.06	5.19	5.29	2.77	2.91	2.95	14.0	14.7	6.63
Total Mg	mg/L	5.39 J	5.27 J	5.36	2.94 J	2.94 J	2.96	15.2 J	15.0	6.66
Dissolved Mn	µg/L	21	16	12.3	129	131	121	2670	2560	684

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW38 5/10/13 Round 3	SW01 10/29/11 Round 1	SW01 4/30/12 Round 2	SW01 5/14/13 Round 3	SW02 11/4/11 Round 1	SW03 4/25/12 Round 2	SW04 4/25/12 Round 2	SW05 4/26/12 Round 2	SW06 4/26/12 Round 2
Dissolved Ag	µg/L	<10 U	<14 U	<14 U	<10 U	<14 U	<14 U, J-	<14 U, J-	<14 U, J-	<14 U, J-
Total Ag	µg/L	<10 U	<16 U	<16 U, J-	<10 U	<16 U	<16 U	<16 U	<16 U	<16 U
Dissolved Al	µg/L	<20 U	<494 U	<20.0 U	<20 U	<494 U	35.2	<20.0 U	30.8	<20.0 U
Total Al	µg/L	1550	<548 U	26.4	<20 U	<548 U	43.4	25.1	82.8	82.3
Dissolved As	µg/L	2.3	<20 U	<1.0 U	1.1 B	<20 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Total As	µg/L	5.0	<22 U	<1.0 U	1.3	<22 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Dissolved B	µg/L	70.4	<333 U	<333 U	<40 U	<333 U	<333 U	<333 U	<333 U	<333 U
Total B	µg/L	81.0	<370 U	<370 U	<20 U	<370 U	<370 U	<370 U	<370 U	<370 U
Dissolved Ba	µg/L	176	30 J	22 J	28.0	137 J	677 J	663 J	28 J	27 J
Total Ba	µg/L	217	30 J	22 J	27.6	144 J	707 J	683 J	30 J	30 J
Dissolved Be	µg/L	<5 U	<10 U	<10 U	<5 U	<10 U	<10 U	<10 U	<10 U	<10 U
Total Be	µg/L	<2.5 U	<11 U	<11 U	<2.5 U	<11 U	<11 U	<11 U	<11 U	<11 U
Dissolved Ca	mg/L	29.6	70.5	56.6	76.6	9.21	36.2	36.0	14.8	14.8
Total Ca	mg/L	29.1	72.0 J	55.5 J	74.7	9.72 J	38.1 J	37.4 J	15.8 J	15.8 J
Dissolved Cd	µg/L	<0.2 U	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Total Cd	µg/L	<0.2 U	<4 U	<1.0 U	<0.2 U	<4 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Dissolved Co	µg/L	<5 U	<4 U	<4 U	<5 U	<4 U	3 J	3 J	<4 U	<4 U
Total Co	µg/L	0.88 J	<4 U	<4 U	<2.5 U	<4 U	2 J	2 J	<4 U	<4 U
Dissolved Cr	µg/L	<2 U	<7 U	<2.0 U	<2 U	<7 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U
Total Cr	µg/L	1.8 J	<8 U	<2.0 U	<2 U	<8 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U
Dissolved Cu	µg/L	0.26 J	<20 U	4.6	<0.5 U	<20 U	<2.0 U	<2.0 U	<2.0 U	14.2
Total Cu	µg/L	3.9 B, *	<22 U	4.9	4.6	<22 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U
Dissolved Fe	µg/L	149	190	<67 U	466	<67 U	310	59 J	95	49 J
Total Fe	µg/L	4720	300 J	32 J	732	<74 U	461 J	320 J	196 J	241 J
Dissolved K	mg/L	1.25	0.83 J	0.29 J	0.65	0.84 J	3.44 J	3.38 J	1.85 J	1.85 J
Total K	mg/L	1.53	0.85 J	0.67 J	0.645	0.88 J	3.36 J	3.32 J	1.92 J	1.97 J
Dissolved Li	µg/L	41.2	NA	<10.0 U	<10 U	NA	16.1	14.5	<10.0 U	<10.0 U
Total Li	µg/L	44.4	NA	<10.0 U	<5 U	NA	19.8	19.8	<10.0 U	<10.0 U
Dissolved Mg	mg/L	4.90	5.62	4.89	7.08	2.45	19.9	19.6	3.32	3.35
Total Mg	mg/L	5.11	5.87 J	4.91 J	7.02	2.59 J	21.7 J	21.2 J	3.70 J	3.67 J
Dissolved Mn	µg/L	289	224	28	323	<14 U	2700	2400	16	15

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW01	GW01	GW01	GW02	GW02	GW02	GW03	GW03	GW03
	Sample Date	10/25/11	4/25/12	5/13/13	10/25/11	4/25/12	5/13/13	10/25/11	4/25/12	5/13/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Total Mn	µg/L	7 J	7 J	7.20	26 J	23 J	23.3	1140 J	1430 J	1190
Dissolved Mo	µg/L	<17 U	<17 U	<0.5 U	<17 U	<17 U	<0.5 U	6 J	<17 U	<0.5 U
Total Mo	µg/L	<19 U	<19 U	<0.5 U	<19 U	<19 U	<0.5 U	<19 U	<19 U	<0.5 U
Dissolved Na	mg/L	115 J	115 J	123	74.7 J	68.5 J	71.7	73.7 J	76.6 J	81.6
Total Na	mg/L	124 J	120 J	123	73.0 J	70.7 J	72.0	74.7 J	80.1 J	83.6
Dissolved Ni	µg/L	<84 U	<1.0 U	0.41	<84 U	<1.0 U	0.90	<84 U	2.6	13.0
Total Ni	µg/L	<93 J	<1.0 U	0.76 *	<93 J	<1.0 U	1.5 *	<93 U	3.5 *	9.8 *
Dissolved P	mg/L	<0.06 U	0.02 J	53.6	<0.06 U	<0.06 U	28.2 J	<0.06 U	<0.06 U	18.5 J
Total P	mg/L	0.03 J	0.04 J	30.0	< 0.07 U	0.03 J	<25 U	< 0.07 U	<0.07 U	<25 U
Dissolved Pb	µg/L	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	0.09 J
Total Pb	µg/L	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	0.25
Dissolved S	mg/L	0.22 J	<0.46 U	NR	2.29 J	0.36 J	NR	384 J	391 J	NR
Total S	mg/L	<0.51 U	<0.51 U	NR	<0.51 U	<0.51 U	NR	376 J	385 J	NR
Dissolved Sb	µg/L	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U
Total Sb	µg/L	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U
Dissolved Se	µg/L	10 J	<5.0 U	0.40	11 J	1.3 J	<2 U	21 J	<5.0 U	<2 U
Total Se	µg/L	<33 U	<5.0 U	<2 U	<33 U	<5.0 U	<2 U	<33 U	<5.0 U	<2 U
Dissolved Si	mg/L	4.26 J	4.13 J+	4.09	5.57 J	5.45 J+	5.00	9.09 J	9.14 J+	8.18
Total Si	mg/L	3.95 J	3.92 J+	4.19	5.23 J	5.22 J+	5.09	8.95 J	9.24 J+	8.39
Dissolved Sr	µg/L	1790	1670	1730	3060	3060	3090	11300	9750	11100
Total Sr	µg/L	1770 J	1720 J	1690	3140 J	3190 J	3120	10100 J	10300 J	12200
Dissolved Th	µg/L	NA	R	<0.2 U	NA	R	<0.2 U	NA	R	<0.2 U
Total Th	µg/L	NA	R	<0.2 U	NA	R	<0.2 U	NA	R	<0.2 U
Dissolved Ti	µg/L	<7 U	<7 U	<5 U	<7 U	<7 U	<5 U	<7 U	<7 U	5.1
Total Ti	µg/L	<8 U	<8 U	0.13 J	<8 U	<8 U	0.12 J	<8 U	3 J	2.7
Dissolved Tl	µg/L	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U
Total Tl	µg/L	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<0.2 U
Dissolved U	µg/L	R	R	<0.2 U	R	R	<0.2 U	R	<1.0 U	0.33
Total U	µg/L	R	R	<0.2 U	R	R	<0.2 U	R	<1.0 U	0.33
Dissolved V	µg/L	<10 U	<10 U	<0.02 U	<10 U	<10 U	<0.02 U	<10 U	<10 U	<0.02 U
Total V	µg/L	<11 U	<11 U	0.36 B	<11 U	<11 U	0.10 J	<11 U	<11 U	0.43 B

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample / Sample Date / Unit	GW04 10/25/11 Round 1	GW04 4/27/12 Round 2	GW05 10/26/11 Round 1	GW06 10/26/11 Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 10/26/11 Round 1
Total Mn	µg/L	214 J	109 J	76 J	<16 U	<16 U	0.66 J	<16 U
Dissolved Mo	µg/L	<17 U	<17 U	<17 U	<17 U	<17 U	0.95	<17 U
Total Mo	µg/L	<19 U	<19 U	<19 U	<19 U	<19 U	1.5 B	<19 U
Dissolved Na	mg/L	228 J	213 J	14.3 J	10.5 J	5.72 J	10.7	14.1 J
Total Na	mg/L	233 J	222 J	14.3 J	10.7 J	10.7 J	11.3	13.7 J
Dissolved Ni	µg/L	<84 U	<1.0 U	<84 U	<84 U	<1.0 U	1.60	<84 U
Total Ni	µg/L	<93 U	1.4	<93 U	<93 U	<1.0 U	1.20 *	<93 U
Dissolved P	mg/L	<0.06 U	0.04 J	<0.06 U	<0.06 U	<0.06 U	<50 U	<0.06 U
Total P	mg/L	0.04 J	0.06 J	< 0.07 U	< 0.07 U	<0.07 U	<25 U	< 0.07 U
Dissolved Pb	µg/L	<17 U	<1.0 U	<17 U	<17 U	<1.0 U	0.30	<17 U
Total Pb	µg/L	<19 U	<1.0 U	<19 U	<19 U	<1.0 U	0.33	<19 U
Dissolved S	mg/L	3.26 J	6.68 J	3.15 J	5.15 J	1.87 J	NR	5.05 J
Total S	mg/L	<0.51 U	<0.51 U	2.55 J	4.43 J	3.78 J	NR	4.52 J
Dissolved Sb	µg/L	R	<2.0 U	R	R	<2.0 U	<0.2 U	R
Total Sb	µg/L	R	<2.0 U	R	R	<2.0 U	<0.2 U	R
Dissolved Se	µg/L	<30 U	5.2	<30 U	<30 U	<5.0 U	<2 U	<30 U
Total Se	µg/L	<33 U	5.2	<33 U	<33 U	<5.0 U	<2 U	<33 U
Dissolved Si	mg/L	5.93 J	6.39 J	5.81 J	6.12 J	6.10 J	5.33	5.34 J
Total Si	mg/L	6.57 J	6.69 J	5.27 J	5.64 J	5.47 J	5.50	5.31 J
Dissolved Sr	µg/L	8770	8160	1240	1370	1360	1360	410
Total Sr	µg/L	8910 J	8410 J	1220 J	1380 J	1340 J	1380	399 J
Dissolved Th	µg/L	NA	R	NA	NA	R	<0.2 U	NA
Total Th	µg/L	NA	R	NA	NA	R	<0.2 U	NA
Dissolved Ti	µg/L	<7 U	<7 U	<7 U	<7 U	<7 U	<5 U	<7 U
Total Ti	µg/L	17 J	13 J	<8 U	<8 U	<8 U	<2.5 U	3 J
Dissolved Tl	µg/L	<17 U	<1.0 U	<17 U	<17 U	<1.0 U	<0.2 U	<17 U
Total Tl	µg/L	<19 U	<1.0 U	<19 U	<19 U	<1.0 U	<0.2 U	<19 U
Dissolved U	µg/L	R	R	R	R	5.6 J-	7.0	R
Total U	µg/L	R	R	R	R	5.7 J-	6.4	R
Dissolved V	µg/L	<10 U	<10 U	<10 U	<10 U	<10 U	0.25	<10 U
Total V	µg/L	<11 U	<11 U	<11 U	<11 U	<11 U	0.57 B	<11 U

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW08 10/27/11 Round 1	GW08 4/27/12 Round 2	GW08 5/11/13 Round 3	GW09 10/27/11 Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 10/27/11 Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
Total Mn	µg/L	11 J	24 J	13.0	162 J	167 J	168	5 J	<16 U	37.5
Dissolved Mo	µg/L	<17 U	<17 U	0.58	13 J	<17 U	0.68	6 J	<17 U	<0.5 U
Total Mo	µg/L	<19 U	<19 U	0.88 B	<19 U	<19 U	1.1	<19 U	<19 U	0.54 B
Dissolved Na	mg/L	251 J	270 J	336	22.1 J	21.6 J	21.6	2.54 J	1.93 J	2.79
Total Na	mg/L	275 J	287 J	335	22.6 J	21.9 J	26.0	2.52 J	<1.90 U	2.85
Dissolved Ni	µg/L	<84 U	<1.0 U	0.57	<84 U	<1.0 U	1.40	<84 U	<1.0 U	0.88
Total Ni	µg/L	<93 U	1.2	1.10 *	<93 U	<1.0 U	1.10 *	<93 U	<1.0 U, J-	0.84 *
Dissolved P	mg/L	0.10 J	0.09 J	497	<0.06 U	<0.06 U	<50 U	<0.06 U	<0.06 U	<50 U
Total P	mg/L	0.09 J	0.10 J	100	< 0.07 U	<0.07 U	<25 U	0.02 J	0.03 J	<25 U
Dissolved Pb	µg/L	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U	<17 U	1.3	<0.2 U
Total Pb	µg/L	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	0.66	<19 U	<1.0 U	1.1
Dissolved S	mg/L	4.55 J	3.44 J	NR	5.99 J	5.37 J	NR	4.47 J	3.82 J	NR
Total S	mg/L	0.16 J	<0.51 U	NR	4.76 J	4.20 J	NR	3.95 J	2.70 J	NR
Dissolved Sb	µg/L	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U
Total Sb	µg/L	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U
Dissolved Se	µg/L	<30 U	5.5	<2 U	<30 U	<5.0 U	<2 U	<30 U	<5.0 U	<2 U
Total Se	µg/L	<33 U	5.6	<2 U	<33 U	<5.0 U	<2 U	<33 U	<5.0 U	<2 U
Dissolved Si	mg/L	3.55 J	3.53 J+	3.39	7.03 J	6.97 J+	6.13	5.10 J	4.52 J+	4.32
Total Si	mg/L	4.18 J	5.24 J+	3.53	6.68 J	6.65 J+	6.35	5.64 J	4.38 J+	4.56
Dissolved Sr	µg/L	1520	1810	2380	1210	1120	1180	97	74	103
Total Sr	µg/L	1770 J	1960 J	2470	1170 J	1160 J	1190	92 J	78 J	106
Dissolved Th	µg/L	NA	R	<0.2 U	NA	R	<0.2 U	NA	R	<0.2 U
Total Th	µg/L	NA	R	<0.2 U	NA	R	<0.2 U	NA	R	<0.2 U
Dissolved Ti	µg/L	<7 U	<7 U	<5 U	<7 U	<7 U	<5 U	<7 U	<7 U	<5 U
Total Ti	µg/L	13 J	33 J	<2.5 U	<8 U	<8 U	<2.5 U	13 J	3 J	<2.5 U
Dissolved Tl	µg/L	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U
Total Tl	µg/L	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<0.2 U
Dissolved U	µg/L	R	R	<0.2 U	R	<1.0 U	0.28	R	<1.0 U	0.34
Total U	µg/L	R	<1.0 U	<0.2 U	R	<1.0 U	0.27	R	<1.0 U	0.48
Dissolved V	µg/L	<10 U	<10 U	0.05 J	<10 U	<10 U	<0.02 U	<10 U	<10 U	0.04 J
Total V	µg/L	<11 U	<11 U	0.36 B	<11 U	<11 U	0.31 B	<11 U	<11 U	0.40 B

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW11 10/28/11 Round 1	GW11 4/27/12 Round 2	GW11 5/9/13 Round 3	GW12 10/28/11 Round 1	GW12 5/11/13 Round 3	GW13 10/28/11 Round 1	GW13 4/28/12 Round 2
Total Mn	µg/L	13 J	14 J	19.2	<16 U	2.60	20 J	51 J
Dissolved Mo	µg/L	<17 U	<17 U	0.9	<17 U	<0.5 U	<17 U	<17 U
Total Mo	µg/L	<19 U	<19 U	1.0	7 J	<0.5 U	<19 U	<19 U
Dissolved Na	mg/L	62.8 J	87.9 J	95.7	2.71 J	3.96	14.5 J	9.89 J
Total Na	mg/L	65.1 J	91.0 J	95.8	2.66 J	3.85	14.9 J	14.5 J
Dissolved Ni	µg/L	<84 U	<1.0 U	0.48	<84 U	1.70	<84 U	<1.0 U
Total Ni	µg/L	<93 U	<1.0 U, J-	0.60 *	<93 U	1.30 *	<93 U	1.4 *
Dissolved P	mg/L	<0.06 U	0.03 J	58.7	<0.06 U	<50 U	<0.06 U	<0.06 U
Total P	mg/L	< 0.07 U	0.05 J	44.6	< 0.07 U	<25 U	< 0.07 U	0.02 J
Dissolved Pb	µg/L	<17 U	<1.0 U	<0.2 U	<17 U	0.52	<17 U	<1.0 U
Total Pb	µg/L	<19 U	<1.0 U	<0.2 U	<19 U	1.8	<19 U	1.3
Dissolved S	mg/L	3.79 J	2.79 J	NR	3.73 J	NR	4.03 J	0.83 J
Total S	mg/L	3.06 J	1.96 J	NR	2.85 J	NR	3.39 J	3.26 J
Dissolved Sb	µg/L	R	<2.0 U	<0.2 U	R	<0.2 U	R	<2.0 U
Total Sb	µg/L	R	<2.0 U	<0.2 U	R	<0.2 U	R	<2.0 U
Dissolved Se	µg/L	<30 U	<5.0 U	<2 U	<30 U	<2 U	<30 U	<5.0 U
Total Se	µg/L	<33 U	<5.0 U	<2 U	<33 U	<2 U	<33 U	<5.0 U
Dissolved Si	mg/L	5.78 J	5.31 J+	4.86	4.92 J	4.23	5.35 J	7.44 J
Total Si	mg/L	5.42 J	4.97 J+	5.01	4.70 J	4.30	5.24 J	9.81 J
Dissolved Sr	µg/L	747	777	920	210	210	988	939
Total Sr	µg/L	749 J	806 J	978	206 J	218	959 J	930 J
Dissolved Th	µg/L	NA	R	<0.2 U	NA	<0.2 U	NA	R
Total Th	µg/L	NA	R	<0.2 U	NA	<0.2 U	NA	R
Dissolved Ti	µg/L	<7 U	<7 U	<5 U	<7 U	<5 U	3 J	43
Total Ti	µg/L	<8 U	<8 U	<2.5 U	<8 U	<2.5 U	3 J	80 J
Dissolved Tl	µg/L	<17 U	<1.0 U	<0.2 U	<17 U	<0.2 U	<17 U	<1.0 U
Total Tl	µg/L	<19 U	<1.0 U	<0.2 U	<19 U	<0.2 U	<19 U	<1.0 U
Dissolved U	µg/L	R	<1.0 U	0.19 J	R	0.56	R	1.7 J-
Total U	µg/L	R	<1.0 U	0.10 J	R	0.53	R	1.7 J-
Dissolved V	µg/L	<10 U	<10 U	<0.02 U	<10 U	0.04 J	<10 U	<10 U
Total V	µg/L	<11 U	<11 U	0.31 B	<11 U	0.37 B	<11 U	6 J

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW14 10/28/11 Round 1	GW14 4/24/12 Round 2	GW14 5/9/13 Round 3	GW15 10/29/11 Round 1	GW15 4/30/12 Round 2	GW15 5/14/13 Round 3	GW16 10/29/11 Round 1	GW16 4/30/12 Round 2	GW16 5/14/13 Round 3
Total Mn	µg/L	14 J	22 J	72.5	84 J	80 J	69.5	89 J	84 J	80.4
Dissolved Mo	µg/L	<17 U	<17 U	<0.5 U	<17 U	<17 U	1.40	<17 U	<17 U	<0.5 U
Total Mo	µg/L	<19 U	<19 U	0.50	6 J	<19 U	1.4	<19 U	<19 U	<0.5 U
Dissolved Na	mg/L	12.9 J	9.28 J	16.0	23.0 J	21.5 J	28.4	48.0 J	40.4 J	50.6
Total Na	mg/L	13.0 J	9.11 J	16.3	23.7 J	26.3 J	28.1	49.9 J	45.2 J	51.0
Dissolved Ni	µg/L	<84 U	1.1	1.10	<84 U	<1.0 U	0.98	<84 U	<1.0 U	1.30
Total Ni	µg/L	<93 U	1.1 *	3.10 *	<93 U	<1.0 U, J-	1.20	<93 U	<1.0 U, J-	1.40
Dissolved P	mg/L	<0.06 U	0.02 J	<50 U	<0.06 U	<0.06 U	<50 U	<0.06 U	<0.06 U	<50 U
Total P	mg/L	0.02 J	0.04 J	52.8	< 0.07 U	<0.07 U	<25 U	< 0.07 U	<0.07 U	<25 U
Dissolved Pb	µg/L	<17 U	<1.0 U	<0.2 U	<17 U	1.5	<0.2 U	<17 U	<1.0 U	<0.2 U
Total Pb	µg/L	<19 U	1.2	8.0	<19 U	<1.0 U	0.23 B	<19 U	<1.0 U	<0.2 U
Dissolved S	mg/L	4.54 J	4.08 J	NR	3.27 J	0.30 J	NR	7.63 J	<0.46 U	NR
Total S	mg/L	4.04 J	3.12 J	NR	2.86 J	2.66 J,B	NR	0.32 J	0.41 J	NR
Dissolved Sb	µg/L	R	<2.0 U	0.12 J	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U
Total Sb	µg/L	R	<2.0 U	0.16 J	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U
Dissolved Se	µg/L	<30 U	<5.0 U	<2 U	<30 U	<5.0 U	<2 U	<30 U	1.5 J	<2 U
Total Se	µg/L	<33 U	<5.0 U	<2 U	<33 U	<5.0 U	<2 U	<33 U	<5.0 U	<2 U
Dissolved Si	mg/L	5.49 J	4.73 J+	4.42	5.94 J	6.00 J	5.36	5.83 J	6.06 J	5.40
Total Si	mg/L	5.39 J	5.14 J+	5.15	6.00 J	5.47 J	5.39	5.54 J	5.55 J	5.37
Dissolved Sr	µg/L	225	178	214	1360	1410	1470	3070	2930	3050
Total Sr	µg/L	219 J	184 J	222	1370 J	1410 J	1420	3100 J	2870 J	3000
Dissolved Th	µg/L	NA	R	<0.2 U	NA	R	<0.2 U	NA	R	<0.2 U
Total Th	µg/L	NA	R	<0.2 U	NA	R	<0.2 U	NA	R	<0.2 U
Dissolved Ti	µg/L	<7 U	<7 U	<5 U	<7 U	<7 U	<5 U	<7 U	<7 U	<5 U
Total Ti	µg/L	3 J	12 J	3.9	7 J	<8 U	0.52 J	<8 U	<8 U	0.38 J
Dissolved Tl	µg/L	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U
Total Tl	µg/L	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<0.2 U
Dissolved U	µg/L	R	<1.0 U	0.38	R	<1.0 U	<0.2 U	R	R	<0.2 U
Total U	µg/L	R	<1.0 U	0.65	R	<1.0 U	0.05 J	R	R	<0.2 U
Dissolved V	µg/L	<10 U	<10 U	0.06 J	<10 U	<10 U	<0.02 U	<10 U	<10 U	<0.02 U
Total V	µg/L	<11 U	<11 U	1.1 B	<11 U	<11 U	0.52 B	<11 U	<11 U	0.77 B

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW17 10/29/11 Round 1	GW17 4/30/12 Round 2	GW18 10/31/11 Round 1	GW18 4/28/12 Round 2	GW19 10/31/11 Round 1	GW20 10/31/11 Round 1	GW20 4/28/12 Round 2	GW21 11/1/11 Round 1	GW22 11/1/11 Round 1
Total Mn	µg/L	81 J	80 J	23 J	<16 U	<16 U	<16 U	11 J	6 J	94 J
Dissolved Mo	µg/L	<17 U	<17 U	<17 U	<17 U	<17 U	<17 U	<17 U	<17 U	<17 U
Total Mo	µg/L	<19 U	<19 U	7 J	<19 U	<19 U	<19 U	<19 U	<19 U	<19 U
Dissolved Na	mg/L	280 J	290 J	30.3 J	28.1 J	7.17 J	21.0 J	20.8 J	2.55 J	59.5 J
Total Na	mg/L	291 J	287 J	31.4 J	32.5 J	7.52 J	22.2 J	25.0 J	2.71 J	61.4 J
Dissolved Ni	µg/L	<84 U	<1.0 U	<84 U	<1.0 U	<84 U	<84 U	<1.0 U	<84 U	<84 U
Total Ni	µg/L	<93 U	<1.0 U, J-	<93 U	<1.0 U, J-	<93 U	<93 U	<1.0 U, J-	<93 U	<93 U
Dissolved P	mg/L	<0.06 U	<0.06 U	<0.06 U	<0.06 U	<0.06 U	<0.06 U	<0.06 U	<0.06 U	<0.06 U
Total P	mg/L	< 0.07 U	<0.07 U	< 0.07 U	<0.07 U	< 0.07 U	< 0.07 U	<0.07 U	< 0.07 U	< 0.07 U
Dissolved Pb	µg/L	<17 U	<1.0 U	<17 U	<1.0 U	<17 U	<17 U	<1.0 U	<17 U	<17 U
Total Pb	µg/L	<19 U	<1.0 U	<19 U	<1.0 U	<19 U	<19 U	<1.0 U	<19 U	<19 U
Dissolved S	mg/L	<0.46 U	<0.46 U	2.75 J	<0.46 U	4.96 J	2.64 J	<0.46 U	4.54 J	<0.46 U
Total S	mg/L	<0.51 U	<0.51 U	2.37 J	2.40 J	4.31 J	2.23 J	2.13 J	3.91 J	<0.51 U
Dissolved Sb	µg/L	R	<2.0 U	R	<2.0 U	R	R	<2.0 U	R	R
Total Sb	µg/L	R	<2.0 U	R	<2.0 U	R	R	<2.0 U	R	R
Dissolved Se	µg/L	<30 U	7.3	<30 U	<5.0 U	<30 U	<30 U	<5.0 U	<30 U	<30 U
Total Se	µg/L	<33 U	8.0	<33 U	<5.0 U	<33 U	<33 U	<5.0 U	<33 U	<33 U
Dissolved Si	mg/L	4.26 J	4.27 J	5.05 J	5.03 J	5.46 J	5.21 J	5.11 J	4.59 J	5.30 J
Total Si	mg/L	3.84 J	3.85 J	4.87 J	4.52 J	4.96 J	4.70 J	4.78 J	4.34 J	4.88 J
Dissolved Sr	µg/L	5820	5670	1320	1300	60	737	779	67	753
Total Sr	µg/L	5770 J	5540 J	1320 J	1280 J	61 J	742 J	765 J	68 J	752 J
Dissolved Th	µg/L	NA	R	NA	R	NA	NA	R	NA	NA
Total Th	µg/L	NA	R	NA	R	NA	NA	R	NA	NA
Dissolved Ti	µg/L	<7 U	<7 U	<7 U	<7 U	<7 U	<7 U	<7 U	<7 U	<7 U
Total Ti	µg/L	<8 U	<8 U	6 J	<8 U	<8 U	<8 U	<8 U	<8 U	<8 U
Dissolved Tl	µg/L	<17 U	<1.0 U	<17 U	<1.0 U	<17 U	<17 U	<1.0 U	<17 U	<17 U
Total Tl	µg/L	<19 U	<1.0 U	<19 U	<1.0 U	<19 U	<19 U	<1.0 U	<19 U	<19 U
Dissolved U	µg/L	R	R	R	1.4 J-	R	R	2.3 J-	R	R
Total U	µg/L	R	R	R	1.4 J-	R	R	2.3 J-	R	R
Dissolved V	µg/L	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U	<10 U
Total V	µg/L	<11 U	<11 U	<11 U	<11 U	<11 U	<11 U	<11 U	<11 U	<11 U

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW23 11/1/11 Round 1	GW24 11/1/11 Round 1	GW25 11/2/11 Round 1	GW26 11/2/11 Round 1	GW26 4/24/12 Round 2	GW26 5/15/13 Round 3	GW27 11/2/11 Round 1	GW27 4/24/12 Round 2	GW27 5/9/13 Round 3
Total Mn	µg/L	163 J	2470 J	22 J	854 J	905 J	871	46 J	71 J	46.7
Dissolved Mo	µg/L	<17 U	<17 U	<17 U	<17 U	<17 U	1.10	<17 U	<17 U	<0.5 U
Total Mo	µg/L	<19 U	<19 U	<19 U	<19 U	<19 U	1.1	<19 U	<19 U	0.78
Dissolved Na	mg/L	14.2 J	9.41 J	46.1 J	25.0 J	24.5 J	27.4	93.7 J	92.7 J	103
Total Na	mg/L	14.8 J	10.1 J	46.0 J	26.1 J	25.9 J	26.9	99.6 J	96.1 J	99.0
Dissolved Ni	µg/L	<84 U	<84 U	<84 U	<84 U	<1.0 U	2.60	<84 U	<1.0 U	0.64
Total Ni	µg/L	<93 U	<93 U	<93 U	<93 U	<1.0 U, J-	2.00 B,*	<93 U	<1.0 U	1.10 *
Dissolved P	mg/L	<0.06 U	<0.06 U	<0.06 U	<0.06 U	<0.06 U	<50 U	<0.06 U	<0.06 U	<50 U
Total P	mg/L	< 0.07 U	< 0.07 U	< 0.07 U	< 0.07 U	<0.07 U	<25 U	< 0.07 U	<0.07 U	<25 U
Dissolved Pb	µg/L	<17 U	<17 U	<17 U	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U
Total Pb	µg/L	<19 U	<19 U	<19 U	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<0.2 U
Dissolved S	mg/L	2.39 J	3.98 J	5.98 J	8.19 J	8.89 J	NR	3.69 J	6.48 J	NR
Total S	mg/L	0.57 J	3.37 J	5.39 J	7.01 J	6.79 J	NR	3.39 J	2.87 J	NR
Dissolved Sb	µg/L	R	R	R	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U
Total Sb	µg/L	R	R	R	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U
Dissolved Se	µg/L	<30 U	<30 U	<30 U	11 J	<5.0 U	<2 U	<30 U	<5.0 U	<2 U
Total Se	µg/L	<33 U	<33 U	<33 U	<33 U	<5.0 U	<2 U	<33 J	<5.0 U	<2 U
Dissolved Si	mg/L	6.27 J	6.76 J	5.42 J	6.29 J	6.40 J+	5.83	5.60 J	5.68 J+	5.45
Total Si	mg/L	6.00 J	11.3 J	5.02 J	6.01 J	6.08 J+	5.75	5.24 J	5.11 J+	5.26
Dissolved Sr	µg/L	747	306	2500	1820	1680	1840	2350	2400	2430
Total Sr	µg/L	733 J	319 J	2230 J	1790 J	1810 J	1740	2410 J	2510 J	2400
Dissolved Th	µg/L	NA	NA	NA	NA	R	<0.2 U	NA	R	<0.2 U
Total Th	µg/L	NA	NA	NA	NA	R	<0.2 U	NA	R	<0.2 U
Dissolved Ti	µg/L	<7 U	9	<7 U	<7 U	<7 U	<5 U	<7 U	<7 U	<5 U
Total Ti	µg/L	<8 U	79 J	<8 U	<8 U	<8 U	0.64 J	<8 U	<8 U	<2.5 U
Dissolved Tl	µg/L	<17 U	<17 U	<17 U	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U
Total Tl	µg/L	<19 U	<19 U	<19 U	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<0.2 U
Dissolved U	µg/L	R	R	R	R	4.5 J-	4.9	R	<1.0 U	<0.2 U
Total U	µg/L	R	R	R	R	4.6 J-	5.0	R	<1.0 U	0.07 J
Dissolved V	µg/L	<10 U	<10 U	<10 U	<10 U	<10 U	<0.02 U	<10 U	<10 U	<0.02 U
Total V	µg/L	<11 U	4 J	<11 U	<11 U	<11 U	<0.2 U	<11 U	<11 U	0.30 B

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW28 11/3/11 Round 1	GW28 5/15/13 Round 3	GW29 11/3/11 Round 1	GW29 5/1/12 Round 2	GW29 5/14/13 Round 3	GW30 11/3/11 Round 1	GW31 11/4/11 Round 1
Total Mn	µg/L	<16 U	<2.5 U	247 J	243 J	214	28 J	1420 J
Dissolved Mo	µg/L	<17 U	<0.5 U	<17 U	<17 U	1.1 0	<17 U	6 J
Total Mo	µg/L	<19 U	<0.5 U	6 J	<19 U	1.0	<19 U	7 J
Dissolved Na	mg/L	13.8 J	15.2	24.1 J	20.4 J	27.3	42.8 J	23.4 J
Total Na	mg/L	14.5 J	14.2	25.3 J	25.2 J	26.3	43.2 J	21.9 J
Dissolved Ni	µg/L	<84 U	2.10	<84 U	<1.0 U	1.90	<84 U	<84 U
Total Ni	µg/L	<93 U	2.3 *	<93 U	<1.0 U, J-	2.30	<93 U	<93 U
Dissolved P	mg/L	<0.06 U	<50 U	<0.06 U	<0.06 U	<50 U	<0.06 U	<0.06 U
Total P	mg/L	< 0.07 U	<25 U	< 0.07 U	<0.07 U	<25 U	< 0.07 U	0.33 J
Dissolved Pb	µg/L	<17 U	0.20	<17 U	<1.0 U	0.09 J	<17 U	<17 U
Total Pb	µg/L	<19 U	0.26	<19 U	<1.0 U	0.54 B	<19 U	26 J
Dissolved S	mg/L	6.62 J	NR	12.9 J	10.6 J	NR	6.88 J	3.79 J
Total S	mg/L	5.96 J	NR	12.1 J	11.7 J	NR	6.20 J	3.50 J
Dissolved Sb	µg/L	R	<0.2 U	R	<2.0 U	<0.2 U	R	R
Total Sb	µg/L	R	<0.2 U	R	<2.0 U	<0.2 U	R	R
Dissolved Se	µg/L	<30 U	<2 U	<30 U	<5.0 U	<2 U	<30 U	<30 U
Total Se	µg/L	<33 U	<2 U	<33 U	<5.0 U	<2 U	<33 U	<33 U
Dissolved Si	mg/L	5.21 J	4.94	6.13 J	6.31 J	5.77	5.36 J	5.70 J
Total Si	mg/L	4.99 J	4.72	6.01 J	5.88 J	5.71	5.08 J	24.9 J
Dissolved Sr	µg/L	1030	1010	606	614	600	2370	647
Total Sr	µg/L	1060 J	995	615 J	601 J	605	2300 J	691 J
Dissolved Th	µg/L	NA	<0.2 U	NA	R	<0.2 U	NA	NA
Total Th	µg/L	NA	<0.2 U	NA	R	<0.2 U	NA	NA
Dissolved Ti	µg/L	<7 U	<5 U	<7 U	<7 U	<5 U	<7 U	<7 U
Total Ti	µg/L	<8 U	0.54 J	<8 U	<8 U	0.34 J	<8 U	374 J
Dissolved Tl	µg/L	<17 U	<0.2 U	<17 U	<1.0 U	<0.2 U	<17 U	<17 U
Total Tl	µg/L	<19 U	<0.2 U	<19 U	<1.0 U	<0.2 U	<19 U	<19 U
Dissolved U	µg/L	R	1.4	R	2.9 J-	3.0	R	R
Total U	µg/L	R	1.4	R	2.9 J-	3.1	R	R
Dissolved V	µg/L	<10 U	0.06 J	<10 U	<10 U	<0.02 U	<10 U	<10 U
Total V	µg/L	<11 U	0.46 B	<11 U	<11 U	0.39 B	<11 U	19 J

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW32 11/4/11 Round 1	GW32 4/30/12 Round 2	GW32 5/10/13 Round 3	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3
Total Mn	µg/L	23 J	35 J	18.6	129 J	133 J	123	2840 J	2640	701
Dissolved Mo	µg/L	<17 U	<17 U	0.76	<17 U	<17 U	0.78	<17 U	0.84	0.99
Total Mo	µg/L	<19 U	<19 U	1.0 B	<19 U	<19 U	0.90 B	<19 U	0.96	1.1 B
Dissolved Na	mg/L	13.6 J	10.3 J	15.7	32.6 J	28.9 J	35.1	16.2 J	17.0	9.35
Total Na	mg/L	14.2 J	15.2 J	15.5	34.4 J	33.3 J	36.4	16.5 J	17.0	9.12
Dissolved Ni	µg/L	<84 U	<1.0 U	1.40	<84 U	<1.0 U	0.93	<1.0 U	3.00	2.20
Total Ni	µg/L	<93 U	<1.0 U, J-	1.20 *	<93 U	<1.0 U, J-	0.80 *	<1.0 U, J-	2.50	1.90 *
Dissolved P	mg/L	<0.06 U	<0.06 U	<50 U	<0.06 U	<0.06 U	<50 U	<0.06 U	47.0 J	<50 U
Total P	mg/L	< 0.07 U	0.03 J	<25 U	< 0.07 U	<0.07 U	<25 U	0.02 J	<25 U	<25 U
Dissolved Pb	µg/L	<17 U	<1.0 U	0.26	<17 U	<1.0 U	<0.2 U	<1.0 U	<0.2 U	0.14 J
Total Pb	µg/L	<19 U	3.1	1.1 B	<19 U	<1.0 U	<0.2 U	<1.0 U	<0.2 U	0.28 B
Dissolved S	mg/L	3.06 J	<0.46 U	NR	<0.46 U	<0.46 U	NR	16.0 J	NR	NR
Total S	mg/L	2.76 J	2.51 J,B	NR	<0.51 U	<0.51 U	NR	13.9 J	NR	NR
Dissolved Sb	µg/L	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U	<2.0 U	<0.2 U	<0.2 U
Total Sb	µg/L	R	<2.0 U	<0.2 U	R	<2.0 U	<0.2 U	<2.0 U	<0.2 U	<0.2 U
Dissolved Se	µg/L	<30 U	<5.0 U	<2 U	<30 U	<5.0 U	<2 U	<5.0 U	<2 U	<2 U
Total Se	µg/L	<33 U	<5.0 U	<2 U	<33 U	<5.0 U	<2 U	<5.0 U	<2 U	<2 U
Dissolved Si	mg/L	5.86 J	5.96 J	5.30	5.26 J	5.23 J	4.73	5.36 J+	4.78	4.69
Total Si	mg/L	5.50 J	6.47 J	5.90	4.72 J	4.70 J	4.82	5.07 J+	4.90	4.80
Dissolved Sr	µg/L	559	547	550	828	818	821	232	245	133
Total Sr	µg/L	568 J	537 J	553	840 J	804 J	846	241 J	240	136
Dissolved Th	µg/L	NA	R	<0.2 U	NA	R	<0.2 U	R	<0.2 U	<0.2 U
Total Th	µg/L	NA	R	0.10 J	NA	R	<0.2 U	R	<0.2 U	<0.2 U
Dissolved Ti	µg/L	<7 U	<7 U	<5 U	<7 U	<7 U	<5 U	<7 U	<5 U	<5 U
Total Ti	µg/L	<8 U	16 J	4.5	<8 U	<8 U	<2.5 U	<8 U	0.81 J	<2.5 U
Dissolved Tl	µg/L	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<0.2 U	<1.0 U	<0.2 U	<0.2 U
Total Tl	µg/L	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<0.2 U	<1.0 U	<0.2 U	<0.2 U
Dissolved U	µg/L	R	3.9 J-	4.4	R	<1.0 U	0.62	3.1 J-	3.2	1.4
Total U	µg/L	R	4.0 J-	4.1	R	<1.0 U	0.58	3.2 J-	3.3	1.3
Dissolved V	µg/L	<10 U	<10 U	0.14 J	<10 U	<10 U	<0.02 U	<10 U	0.08 J	<0.02 U
Total V	µg/L	<11 U	4 J	0.71 B	<11 U	<11 U	0.31 B	<11 U	0.51 B	0.34 B

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample / Sample Date / Unit	GW38 5/10/13 Round 3	SW01 10/29/11 Round 1	SW01 4/30/12 Round 2	SW01 5/14/13 Round 3	SW02 11/4/11 Round 1	SW03 4/25/12 Round 2	SW04 4/25/12 Round 2	SW05 4/26/12 Round 2	SW06 4/26/12 Round 2
Total Mn	µg/L	327	223 J	36 J	323	<16 U	2880 J	2520 J	21 J	21 J
Dissolved Mo	µg/L	2.90	<17 U	<17 U	<0.5 U	<17 U	<17 U	<17 U	<17 U	<17 U
Total Mo	µg/L	2.8 B	<19 U	<19 U	<0.5 U	<19 U	<19 U	<19 U	<19 U	<19 U
Dissolved Na	mg/L	29.7	2.95 J	<1.71 U	3.42	2.04 J	76.5 J	76.1 J	5.81 J	5.85 J
Total Na	mg/L	30.1	3.04 J	2.51 J	3.33	2.07 J	78.9 J	77.3 J	5.53 J	5.96 J
Dissolved Ni	µg/L	1.10	<84 U	<1.0 U	2.80	<84 U	4.7	2.9	<1.0 U	<1.0 U
Total Ni	µg/L	2.90 *	<93 U	<1.0 U, J-	2.90 *	<93 U	3.0 *	2.7	<1.0 U	<1.0 U
Dissolved P	mg/L	<50 U	<0.06 U	0.02 J	70.2	<0.06 U	<0.06 U	<0.06 U	<0.06 U	<0.06 U
Total P	mg/L	48.0	0.03 J	0.03 J	44.0	0.03 J	<0.07 U	<0.07 U	0.03 J	0.03 J
Dissolved Pb	µg/L	0.06 J	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Total Pb	µg/L	1.7 B	<19 U	<1.0 U	2.3 B	<19 U	<1.0 U	1.3	<1.0 U	<1.0 U
Dissolved S	mg/L	NR	4.24 J	0.87 J	NR	3.20 J	6.28 J	6.30 J	3.86 J	3.81 J
Total S	mg/L	NR	3.69 J	3.49 J,B	NR	2.88 J	4.98 J	4.97 J	2.78 J	2.91 J
Dissolved Sb	µg/L	0.13 J	R	<2.0 U	<0.2 U	R	<2.0 U	<2.0 U	<2.0 U	<2.0 U
Total Sb	µg/L	0.16 J	R	<2.0 U	<0.2 U	R	<2.0 U	<2.0 U	<2.0 U	<2.0 U
Dissolved Se	µg/L	0.45 J	9 J	<5.0 U	<2 U	<30 U	1.9 J	2.1 J	<5.0 U	<5.0 U
Total Se	µg/L	<2 U	<33 U	<5.0 U	<2 U	<33 U	2.4 J	2.0 J	<5.0 U	<5.0 U
Dissolved Si	mg/L	4.06	5.57 J	5.12 J	4.60	4.55 J	0.81 J+	0.79 J+	1.99 J+	1.91 J+
Total Si	mg/L	7.00	5.19 J	4.63 J	4.60	4.29 J	0.80 J+	0.79 J+	1.98 J+	2.08 J+
Dissolved Sr	µg/L	511	79	62	90.3	30	1300	1280	64	64
Total Sr	µg/L	541	79 J	61 J	90.4	30 J	1350 J	1320 J	67 J	67 J
Dissolved Th	µg/L	<0.2 U	NA	R	<0.2 U	NA	R	R	R	R
Total Th	µg/L	0.38	NA	R	<0.2 U	NA	R	R	R	R
Dissolved Ti	µg/L	<5 U	<7 U	<7 U	<5 U	<7 U	<7 U	<7 U	<7 U	<7 U
Total Ti	µg/L	21.4	<8 U	<8 U	0.42 J	<8 U	<8 U	<8 U	2 J	3 J
Dissolved Tl	µg/L	<0.2 U	<17 U	<1.0 U	<0.2 U	<17 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Total Tl	µg/L	<0.2 U	<19 U	<1.0 U	<0.2 U	<19 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Dissolved U	µg/L	2.4	R	<1.0 U	0.40	R	R	R	R	R
Total U	µg/L	2.3	R	<1.0 U	0.39	R	<1.0 U, J-	<1.0 U, J-	R	R
Dissolved V	µg/L	0.03 J	<10 U	<10 U	<0.02 U	<10 U	<10 U	<10 U	<10 U	<10 U
Total V	µg/L	2.7 B	<11 U	<11 U	0.36 B	<11 U	<11 U	<11 U	<11 U	<11 U

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW01	GW01	GW01	GW02	GW02	GW02	GW03	GW03	GW03
	Sample Date	10/25/11	4/25/12	5/13/13	10/25/11	4/25/12	5/13/13	10/25/11	4/25/12	5/13/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Dissolved Zn	µg/L	<50 U	<50 U	1.7 J	<50 U	<50 U	0.58 J	<50 U	<50 U	4.4 J
Total Zn	µg/L	<56 U	<56 U	<2.5 U	<56 U	<56 U	<2.5 U	<56 U	<56 U	3.8

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW04 10/25/11 Round 1	GW04 4/27/12 Round 2	GW05 10/26/11 Round 1	GW06 10/26/11 Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 10/26/11 Round 1
Dissolved Zn	µg/L	<50 U	<50 U	<50 U	<50 U	<50 U	<5 U	<50 U
Total Zn	µg/L	<56 U	<56 U	<56 U	<56 U	<56 U	3.0 B	<56 U

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW08	GW08	GW08	GW09	GW09	GW09	GW10	GW10	GW10
	Sample Date	10/27/11	4/27/12	5/11/13	10/27/11	4/27/12	5/9/13	10/27/11	4/24/12	5/11/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Dissolved Zn	µg/L	<50 U	<50 U	<5 U	<50 U	<50 U	<5 U	<50 U	<50 U	<5 U
Total Zn	µg/L	<56 U	<56 U	<2.5 U	<56 U	<56 U	1.8 J	<56 U	<56 U	4.9 B

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW11	GW11	GW11	GW12	GW12	GW13	GW13
	Sample Date	10/28/11	4/27/12	5/9/13	10/28/11	5/11/13	10/28/11	4/28/12
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 3	Round 1	Round 2
Dissolved Zn	µg/L	<50 U	<50 U	<5 U	25 J	11.9	<50 U	<50 U
Total Zn	µg/L	<56 U	<56 U	0.59 J	30 J	15.7 B	<56 U	<56 U

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW14	GW14	GW14	GW15	GW15	GW15	GW16	GW16	GW16
	Sample Date	10/28/11	4/24/12	5/9/13	10/29/11	4/30/12	5/14/13	10/29/11	4/30/12	5/14/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Dissolved Zn	µg/L	<50 U	<50 U	<5 U	<50 U	<50 U	1.4 J	<50 U	<50 U	0.67 J
Total Zn	µg/L	<56 U	<56 U	8.4	<56 U	<56 U	<2.5 U	<56 U	<56 U	3.5

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW17	GW17	GW18	GW18	GW19	GW20	GW20	GW21	GW22
	Sample Date	10/29/11	4/30/12	10/31/11	4/28/12	10/31/11	10/31/11	4/28/12	11/1/11	11/1/11
Parameter	Unit	Round 1	Round 2	Round 1	Round 2	Round 1	Round 1	Round 2	Round 1	Round 1
Dissolved Zn	µg/L	<50 U	<50 U	<50 U	<50 U	<50 U	<50 U	<50 U	<50 U	<50 U
Total Zn	µg/L	<56 U	<56 U	<56 U	<56 U	<56 U	<56 U	<56 U	<56 U	<56 U

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW23	GW24	GW25	GW26	GW26	GW26	GW27	GW27	GW27
	Sample Date	11/1/11	11/1/11	11/2/11	11/2/11	4/24/12	5/15/13	11/2/11	4/24/12	5/9/13
Parameter	Unit	Round 1	Round 1	Round 1	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Dissolved Zn	µg/L	<50 U	<50 U	<50 U	<50 U	<50 U	1.8 J	<50 U	<50 U	<5 U
Total Zn	µg/L	<56 U	<56 U	<56 U	<56 U	<56 U	<2.5 U	<56 U	<56 U	5.4

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW28	GW28	GW29	GW29	GW29	GW30	GW31
	Sample Date	11/3/11	5/15/13	11/3/11	5/1/12	5/14/13	11/3/11	11/4/11
Parameter	Unit	Round 1	Round 3	Round 1	Round 2	Round 3	Round 1	Round 1
Dissolved Zn	µg/L	<50 U	12.1	43 J	55 U	49.2	<50 U	<50 U
Total Zn	µg/L	<56 U	7.4	226 J	90 J	72.4	<56 U	<56 U

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW32	GW32	GW32	GW33	GW33	GW33	GW36	GW36	GW37
	Sample Date	11/4/11	4/30/12	5/10/13	11/4/11	4/30/12	5/10/13	4/26/12	5/13/13	5/10/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 2	Round 3	Round 3
Dissolved Zn	µg/L	<50 U	<50 U	2.2 J	<50 U	<50 U	3.6 J	<50 U	2.1 J	2.6 J
Total Zn	µg/L	<56 U	<56 U	3.7	<56 U	<56 U	4.9	<56 U	3.4	2.6

Table B-3 Sample Results - Dissolved and Total Metals (Northeastern Pennsylvania)

	Sample	GW38	SW01	SW01	SW01	SW02	SW03	SW04	SW05	SW06
	Sample Date	5/10/13	10/29/11	4/30/12	5/14/13	11/4/11	4/25/12	4/25/12	4/26/12	4/26/12
Parameter	Unit	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 2	Round 2	Round 2
Dissolved Zn	µg/L	<5 U	<50 U	<50 U	3.9 J	<50 U	<50 U	<50 U	<50 U	<50 U
Total Zn	µg/L	7.8	<56 U	<56 U	44.9	<56 U	<56 U	<56 U	<56 U	<56 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW01 10/25/11 Round 1	GW01 4/25/12 Round 2	GW01 5/13/13 Round 3	GW02 10/25/11 Round 1	GW02 4/25/12 Round 2	GW02 5/13/13 Round 3
ethanol (64-17-5)	µg /L	<100 U	<100 U	<100 U	<100 U	<100 U	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U	<25.0 U	<10 U	<25.0 U	<25.0 U	<10 U
acrylonitrile (107-13-1)	µg /L	<25.0 U	<25.0 U, J-	<1 U	<25.0 U	<25.0 U, J-	<1 U
styrene (100-42-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
acetone (67-64-1)	µg /L	<1.0 U	<1.0 U	<1 U	<1.0 U	<1.0 U	<1 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U	<5.0 U	<10 U	<5.0 U	<5.0 U	<10 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
vinyl chloride (75-01-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	R	<0.5 U
carbon disulfide (75-15-0)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	0.3 J	<0.5 U
methylene chloride (75-09-2)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	5.53	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	R	<0.5 U
tetrachloroethene (127-18-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U	<2.0 U	<0.5 U	<2.0 U	<2.0 U	<0.5 U
o-xylene (95-47-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW03 10/25/11 Round 1	GW03 4/25/12 Round 2	GW03 5/13/13 Round 3	GW04 10/25/11 Round 1	GW04 4/27/12 Round 2	GW05 10/26/11 Round 1
ethanol (64-17-5)	µg /L	<100 U	<100 U	<100 U	<100 U	<100 U	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U	<25.0 U	<10 U	<25.0 U	<25.0 U	<25.0 U
acrylonitrile (107-13-1)	µg /L	<25.0 U	<25.0 U, J-	<1 U	<25.0 U	<25.0 U, J-	<25.0 U
styrene (100-42-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
acetone (67-64-1)	µg /L	<1.0 U	<1.0 U	<1 U	<1.0 U	<1.0 U	<1.0 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U	<5.0 U	<10 U	<5.0 U	<5.0 U	<5.0 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U
vinyl chloride (75-01-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	R	R
carbon disulfide (75-15-0)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U, J-	<0.5 U
methylene chloride (75-09-2)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	R	R
tetrachloroethene (127-18-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U	<2.0 U	<0.5 U	<2.0 U	<2.0 U	<2.0 U
o-xylene (95-47-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW06 10/26/11 Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 10/26/11 Round 1	GW08 10/27/11 Round 1	GW08 4/27/12 Round 2	GW08 5/11/13 Round 3
ethanol (64-17-5)	µg /L	<100 U	<100 U	<100 U	<100 U	<100 U	<100 U	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U	<25.0 U	<10 U	<25.0 U	<25.0 U	<25.0 U	<10 U
acrylonitrile (107-13-1)	µg /L	<25.0 U	<25.0 U, J-	<1 U	<25.0 U	<25.0 U	<25.0 U, J-	<1 U
styrene (100-42-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
acetone (67-64-1)	µg /L	<1.0 U	<1.0 U	<1 U	<1.0 U	<1.0 U	<1.0 U	<1 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U	<5.0 U	<10 U	<5.0 U	<5.0 U	<5.0 U	<10 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<0.5 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<0.5 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<0.5 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<0.5 U
vinyl chloride (75-01-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	R	R	<0.5 U
carbon disulfide (75-15-0)	µg /L	<0.5 U	<0.5 U, J-	<0.5 U	<0.5 U	<0.5 U, J-	<0.5 U, J-	0.11 J
methylene chloride (75-09-2)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<0.5 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	R	R	<0.5 U
tetrachloroethene (127-18-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<0.5 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U	<2.0 U	<0.5 U	<2.0 U	<2.0 U	<2.0 U	<0.5 U
o-xylene (95-47-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW09 10/27/11 Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 10/27/11 Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
ethanol (64-17-5)	µg /L	<100 U	<100 U	<100 U	<100 U	<100 U	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U	<25.0 U	<10 U	<25.0 U	<25.0 U	<10 U
acrylonitrile (107-13-1)	µg /L	<25.0 U	<25.0 U, J-	<1 U	<25.0 U	<25.0 U, J-	<1 U
styrene (100-42-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
acetone (67-64-1)	µg /L	<1.0 U	<1.0 U	<1 U	<1.0 U	<1.0 U	<1 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U	<5.0 U	<10 U	<5.0 U	<5.0 U	<10 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
vinyl chloride (75-01-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	R	<0.5 U
carbon disulfide (75-15-0)	µg /L	<0.5 U, J-	<0.5 U, J-	<0.5 U	<0.5 U, J-	<0.5 U	<0.5 U
methylene chloride (75-09-2)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	R	<0.5 U
tetrachloroethene (127-18-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U	<2.0 U	<0.5 U	<2.0 U	<2.0 U	<0.5 U
o-xylene (95-47-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample / Sample Date / Unit	GW11 10/28/11 Round 1	GW11 4/27/12 Round 2	GW11 5/9/13 Round 3	GW12 10/28/11 Round 1	GW12 5/11/13 Round 3	GW13 10/28/11 Round 1	GW13 4/28/12 Round 2
ethanol (64-17-5)	µg /L	<100 U	<100 U	<100 U	<100 U	<100 U	<100 U	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U	<25.0 U	<10 U	<25.0 U	<10 U	<25.0 U	<25.0 U
acrylonitrile (107-13-1)	µg /L	<25.0 U, H	<25.0 U, J-	<1 U	<25.0 U, H	<1 U	<25.0 U, H	<25.0 U, J-
styrene (100-42-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U, H	<0.5 U
acetone (67-64-1)	µg /L	<1.0 U	<1.0 U	<1 U	<1.0 U	<1 U	<1.0 U	<1.0 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U	<5.0 U	<10 U	<5.0 U	<10 U	<5.0 U	<5.0 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U
vinyl chloride (75-01-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	<0.5 U	R	R
carbon disulfide (75-15-0)	µg /L	<0.5 U, J-	<0.5 U, J-	<0.5 U	<0.5 U, J-	<0.5 U	<0.5 U, J-	<0.5 U, J-
methylene chloride (75-09-2)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	0.24 J	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	<0.5 U	R	R
tetrachloroethene (127-18-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U	<2.0 U	<0.5 U	<2.0 U	<0.5 U	<2.0 U	<2.0 U
o-xylene (95-47-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW14 10/28/11 Round 1	GW14 4/24/12 Round 2	GW14 5/9/13 Round 3	GW15 10/29/11 Round 1	GW15 4/30/12 Round 2	GW15 5/14/13 Round 3
ethanol (64-17-5)	µg /L	<100 U	<100 U, J-	<100 U	<100 U	<100 U	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U	<25.0 U	<10 U	<25.0 U	<25.0 U	<10 U
acrylonitrile (107-13-1)	µg /L	<25.0 U, H	<25.0 U, J-	<1 U	<25.0 U, H	<25.0 U, J-	<1 U
styrene (100-42-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U
acetone (67-64-1)	µg /L	<1.0 U	<1.0 U	<1 U	<1.0 U	<1.0 U	<1 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U	<5.0 U	<10 U	<5.0 U	<5.0 U	<10 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
vinyl chloride (75-01-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	R	<0.5 U
carbon disulfide (75-15-0)	µg /L	<0.5 U, J-	<0.5 U, J-	<0.5 U	<0.5 U, J-	<0.5 U	<0.5 U
methylene chloride (75-09-2)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	R	<0.5 U
tetrachloroethene (127-18-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<0.5 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U	<2.0 U	<0.5 U	<2.0 U	<2.0 U	<0.5 U
o-xylene (95-47-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW16 10/29/11 Round 1	GW16 4/30/12 Round 2	GW16 5/14/13 Round 3	GW17 10/29/11 Round 1	GW17 4/30/12 Round 2	GW18 10/31/11 Round 1	GW18 4/28/12 Round 2	GW19 10/31/11 Round 1
ethanol (64-17-5)	µg /L	<100 U	<100 U, J-	<100 U	<100 U	<100 U, J-	<100 U	<100 U	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U	<25.0 U	<10 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U
acrylonitrile (107-13-1)	µg /L	<25.0 U, H	<25.0 U, J-	<1 U	<25.0 U, H	<25.0 U, J-	<25.0 U, H	<25.0 U, J-	<25.0 U, H
styrene (100-42-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U, H
acetone (67-64-1)	µg /L	<1.0 U	<1.0 U	0.33 J	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U	<5.0 U	<10 U	<5.0 U	<5.0 U	<5.0 U	<5.0 U	<5.0 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
vinyl chloride (75-01-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	R	R	R	R
carbon disulfide (75-15-0)	µg /L	<0.5 U, J-	<0.5 U, J-	0.12 J	<0.5 U, J-	<0.5 U, J-	<0.5 U, J-	<0.5 U, J-	<0.5 U, J-
methylene chloride (75-09-2)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	R	R	R	R
tetrachloroethene (127-18-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U	<2.0 U	<0.5 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U
o-xylene (95-47-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW20 10/31/11 Round 1	GW20 4/28/12 Round 2	GW21 11/1/11 Round 1	GW22 11/1/11 Round 1	GW23 11/1/11 Round 1	GW24 11/1/11 Round 1	GW25 11/2/11 Round 1
ethanol (64-17-5)	µg /L	<100 U	<100 U	<100 U, H	<100 U, H	<100 U, H	<100 U, H	<100 U, H
isopropanol (67-63-0)	µg /L	<25.0 U	<25.0 U	<25.0 U, H	<25.0 U, H	<25.0 U, H	<25.0 U, H	<25.0 U, H
acrylonitrile (107-13-1)	µg /L	<25.0 U, H	<25.0 U, J-	<25.0 U, H	<25.0 U, H	<25.0 U, H	<25.0 U, H	<25.0 U, H
styrene (100-42-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
acetone (67-64-1)	µg /L	<1.0 U	<1.0 U	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U	<5.0 U	<5.0 U, H	<5.0 U, H	<5.0 U, H	<5.0 U, H	<5.0 U, H
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U	<1.0 U	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H
diisopropyl ether (108-20-3)	µg /L	<1.0 U	<1.0 U	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U	<1.0 U	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U	<1.0 U	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H
vinyl chloride (75-01-4)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
1,1-dichloroethene (75-35-4)	µg /L	R	R	R	R	R	R	R
carbon disulfide (75-15-0)	µg /L	<0.5 U, J-	<0.5 U, J-	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
methylene chloride (75-09-2)	µg /L	<1.0 U	<1.0 U	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
chloroform (67-66-3)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
carbon tetrachloride (56-23-5)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
benzene (71-43-2)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
trichloroethene (79-01-6)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
toluene (108-88-3)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	R	R	R	R	R
tetrachloroethene (127-18-4)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
chlorobenzene (108-90-7)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
ethylbenzene (100-41-4)	µg /L	<1.0 U	<1.0 U	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H	<1.0 U, H
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U	<2.0 U	<2.0 U, H	<2.0 U, H	<2.0 U, H	<2.0 U, H	<2.0 U, H
o-xylene (95-47-6)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
isopropylbenzene (98-82-8)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW26 11/2/11 Round 1	GW26 4/24/12 Round 2	GW26 5/15/13 Round 3	GW27 11/2/11 Round 1	GW27 4/24/12 Round 2	GW27 5/9/13 Round 3	GW28 11/3/11 Round 1	GW28 5/15/13 Round 3
ethanol (64-17-5)	µg /L	<100 U, H	<100 U	<100 U	<100 U, H	<100 U	<100 U	<100 U, H	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U, H	<25.0 U	<10 U	<25.0 U, H	<25.0 U	<10 U	<25.0 U, H	<10 U
acrylonitrile (107-13-1)	µg /L	<25.0 U, H	<25.0 U, J-	<1 U	<25.0 U, H	<25.0 U, J-	<1 U	<25.0 U, H	<1 U
styrene (100-42-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
acetone (67-64-1)	µg /L	<1.0 U, H	<1.0 U	<1 U	<1.0 U, H	<1.0 U	<1 U	<1.0 U, H	<1 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U, H	<5.0 U	<10 U	<5.0 U, H	<5.0 U	<10 U	<5.0 U, H	<10 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<0.5 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<0.5 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<0.5 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<0.5 U
vinyl chloride (75-01-4)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	R	<0.5 U	R	<0.5 U
carbon disulfide (75-15-0)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
methylene chloride (75-09-2)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<0.5 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	R	<0.5 U	R	<0.5 U
tetrachloroethene (127-18-4)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<0.5 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U, H	<2.0 U	<0.5 U	<2.0 U, H	<2.0 U	<0.5 U	<2.0 U, H	<0.5 U
o-xylene (95-47-6)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW29 11/3/11 Round 1	GW29 5/1/12 Round 2	GW29 5/14/13 Round 3	GW30 11/3/11 Round 1	GW31 11/4/11 Round 1	GW32 11/4/11 Round 1	GW32 4/30/12 Round 2	GW32 5/10/13 Round 3
ethanol (64-17-5)	µg /L	<100 U, H	<100 U, J-	<100 U	<100 U, H	<100 U	<100 U	<100 U, J-	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U, H	<25.0 U	<10 U	<25.0 U, H	<25.0 U	<25.0 U	<25.0 U	<10 U
acrylonitrile (107-13-1)	µg /L	<25.0 U, H	<25.0 U, J-	<1 U	<25.0 U, H	<25.0 U	<25.0 U	<25.0 U, J-	<1 U
styrene (100-42-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
acetone (67-64-1)	µg /L	<1.0 U, H	<1.0 U	<1 U	<1.0 U, H	<1.0 U	<1.0 U	<1.0 U	<1 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U, H	<5.0 U	<10 U	<5.0 U, H	<5.0 U	<5.0 U	<5.0 U	<10 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<1.0 U	<1.0 U	<0.5 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<1.0 U	<1.0 U	<0.5 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<1.0 U	<1.0 U	<0.5 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<1.0 U	<1.0 U	<0.5 U
vinyl chloride (75-01-4)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	R	R	R	<0.5 U
carbon disulfide (75-15-0)	µg /L	<0.5 U, H	<0.5 U, J-	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, J-	<0.5 U
methylene chloride (75-09-2)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<1.0 U	<1.0 U	<0.5 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U, H	<0.5 U	0.4 J	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	R	R	R	<0.5 U
tetrachloroethene (127-18-4)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U, H	<1.0 U	<0.5 U	<1.0 U, H	<1.0 U	<1.0 U	<1.0 U	<0.5 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U, H	<2.0 U	<0.5 U	<2.0 U, H	<2.0 U	<2.0 U	<2.0 U	<0.5 U
o-xylene (95-47-6)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3	GW38 5/10/13 Round 3
ethanol (64-17-5)	µg /L	<100 U	<100 U, J-	<100 U	<100 U	<100 U	<100 U	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U	<25.0 U	<10 U	<25.0 U	<10 U	<10 U	<10 U
acrylonitrile (107-13-1)	µg /L	<25.0 U	<25.0 U, J-	<1 U	<25.0 U, J-	<1 U	<1 U	<1 U
styrene (100-42-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
acetone (67-64-1)	µg /L	<1.0 U	<1.0 U	<1 U	<1.0 U	<1 U	8.3	<1 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U	<5.0 U	<10 U	<5.0 U	<10 U	<10 U	<10 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<0.5 U	<0.5 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<0.5 U	<0.5 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<0.5 U	<0.5 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<0.5 U	<0.5 U
vinyl chloride (75-01-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	<0.5 U	<0.5 U	<0.5 U
carbon disulfide (75-15-0)	µg /L	<0.5 U	<0.5 U, J-	<0.5 U	<0.5 U, J-	<0.5 U	<0.5 U	<0.5 U
methylene chloride (75-09-2)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<0.5 U	<0.5 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	<0.5 U	<0.5 U	<0.5 U
tetrachloroethene (127-18-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<0.5 U	<0.5 U	<0.5 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U	<2.0 U	<0.5 U	<2.0 U	<0.5 U	<0.5 U	<0.5 U
o-xylene (95-47-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

	Sample	SW01	SW01	SW01	SW02	SW03	SW04	SW05	SW06
	Sample Date	10/29/11	4/30/12	5/14/13	11/4/11	4/25/12	4/25/12	4/26/12	4/26/12
Parameter (CAS Number)	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 2	Round 2	Round 2
ethanol (64-17-5)	µg /L	<100 U	<100 U, J-	<100 U	<100 U	<100 U	<100 U	<100 U	<100 U
isopropanol (67-63-0)	µg /L	<25.0 U	<25.0 U	<10 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U
acrylonitrile (107-13-1)	µg /L	<25.0 U, H	<25.0 U, J-	<1 U	<25.0 U	<25.0 U, J-	<25.0 U, J-	<25.0 U, J-	<25.0 U, J-
styrene (100-42-5)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
acetone (67-64-1)	µg /L	<1.0 U	<1.0 U	<1 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
tert-butyl alcohol (75-65-0)	µg /L	<5.0 U	<5.0 U	<10 U	<5.0 U	<5.0 U	<5.0 U	<5.0 U	<5.0 U
methyl tert-butyl ether (1634-04-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
diisopropyl ether (108-20-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
ethyl tert-butyl ether (637-92-3)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
tert-amyl methyl ether (994-05-8)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
vinyl chloride (75-01-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethene (75-35-4)	µg /L	R	R	<0.5 U	R	R	R	R	R
carbon disulfide (75-15-0)	µg /L	<0.5 U, J-	<0.5 U, J-	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U, J-	<0.5 U, J-
methylene chloride (75-09-2)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
trans-1,2-dichloroethene (156-60-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1-dichloroethane (75-34-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
cis-1,2-dichloroethene (156-59-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chloroform (67-66-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,1-trichloroethane (71-55-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
carbon tetrachloride (56-23-5)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
benzene (71-43-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichloroethane (107-06-2)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
trichloroethene (79-01-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
toluene (108-88-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,1,2-trichloroethane (79-00-5)	µg /L	R	R	<0.5 U	R	R	R	R	R
tetrachloroethene (127-18-4)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
chlorobenzene (108-90-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
ethylbenzene (100-41-4)	µg /L	<1.0 U	<1.0 U	<0.5 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
m+p xylene (108-38-3, 106-42-3)	µg /L	<2.0 U	<2.0 U	<0.5 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U
o-xylene (95-47-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
isopropylbenzene (98-82-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3,5-trimethylbenzene (108-67-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

	Sample	GW01	GW01	GW01	GW02	GW02	GW02
	Sample Date	10/25/11	4/25/12	5/13/13	10/25/11	4/25/12	5/13/13
Parameter (CAS Number)	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

	Sample	GW03	GW03	GW03	GW04	GW04	GW05
	Sample Date	10/25/11	4/25/12	5/13/13	10/25/11	4/27/12	10/26/11
Parameter (CAS Number)	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 1
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW06 10/26/11 Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 10/26/11 Round 1	GW08 10/27/11 Round 1	GW08 4/27/12 Round 2	GW08 5/11/13 Round 3
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW09 10/27/11 Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 10/27/11 Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW11 10/28/11 Round 1	GW11 4/27/12 Round 2	GW11 5/9/13 Round 3	GW12 10/28/11 Round 1	GW12 5/11/13 Round 3	GW13 10/28/11 Round 1	GW13 4/28/12 Round 2
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW14 10/28/11 Round 1	GW14 4/24/12 Round 2	GW14 5/9/13 Round 3	GW15 10/29/11 Round 1	GW15 4/30/12 Round 2	GW15 5/14/13 Round 3
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

	Sample	GW16	GW16	GW16	GW17	GW17	GW18	GW18	GW19
	Sample Date	10/29/11	4/30/12	5/14/13	10/29/11	4/30/12	10/31/11	4/28/12	10/31/11
Parameter (CAS Number)	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 1	Round 2	Round 1
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

	Sample	GW20	GW20	GW21	GW22	GW23	GW24	GW25
	Sample Date	10/31/11	4/28/12	11/1/11	11/1/11	11/1/11	11/1/11	11/2/11
Parameter (CAS Number)	Unit	Round 1	Round 2	Round 1	Round 1	Round 1	Round 1	Round 1
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H
naphthalene (91-20-3)	µg /L	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H	<0.5 U, H

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW26 11/2/11 Round 1	GW26 4/24/12 Round 2	GW26 5/15/13 Round 3	GW27 11/2/11 Round 1	GW27 4/24/12 Round 2	GW27 5/9/13 Round 3	GW28 11/3/11 Round 1	GW28 5/15/13 Round 3
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

	Sample	GW29	GW29	GW29	GW30	GW31	GW32	GW32	GW32
	Sample Date	11/3/11	5/1/12	5/14/13	11/3/11	11/4/11	11/4/11	4/30/12	5/10/13
Parameter (CAS Number)	Unit	Round 1	Round 2	Round 3	Round 1	Round 1	Round 1	Round 2	Round 3
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U, H	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3	GW38 5/10/13 Round 3
1,2,4-trimethylbenzene (95-63-6)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-4 Sample Results - Volatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	SW01 10/29/11 Round 1	SW01 4/30/12 Round 2	SW01 5/14/13 Round 3	SW02 11/4/11 Round 1	SW03 4/25/12 Round 2	SW04 4/25/12 Round 2	SW05 4/26/12 Round 2	SW06 4/26/12 Round 2
1,2,4-trimethylbenzene (95-63-6)	µg /L	0.38 J	<0.5 U	1.6	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,3-dichlorobenzene (541-73-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,4-dichlorobenzene (106-46-7)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2,3-trimethylbenzene (526-73-8)	µg /L	<0.5 U	<0.5 U	1.1	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
1,2-dichlorobenzene (95-50-1)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U
naphthalene (91-20-3)	µg /L	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample / Sample Date / Unit	GW01 10/25/11 Round 1	GW01 4/25/12 Round 2	GW01 5/13/13 Round 3	GW02 10/25/11 Round 1	GW02 4/25/12 Round 2	GW02 5/13/13 Round 3
Dissolved Gases							
Methane (74-82-8)	mg/L	37.2	40.4	56.1	40.7 *	39.4	44.7
Ethane (74-84-0)	mg/L	0.0178	0.0184	0.0267	0.0257 *	0.0265	0.0267
Propane (74-98-6)	mg/L	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	<0.0039 U	<0.0038 U
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics							
GRO/TPH	µg/L	<20 U	<20.0 U	<20.0 U	<20 U	<20.0 U	<20.0 U
DRO	µg/L	<20 U	<20.0 U, J-	<20.0 U	<20 U	21.1 J-	<20.0 U
Glycols							
2-butoxyethanol (111-76-2)	µg/L	<5.0	<5.0 U	<10.0 U	<5.0 U	<5.0 U	<10.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<5.0 U	<10.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<10.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<10.0 U
Low Molecular Weight Acids							
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	<0.10 U	1.13	NR	<0.10 U	0.905 B	NR
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	R	<0.10 U	<0.10 U
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW03 10/25/11 Round 1	GW03 4/25/12 Round 2	GW03 5/13/13 Round 3	GW04 10/25/11 Round 1	GW04 4/27/12 Round 2	GW05 10/26/11 Round 1
Dissolved Gases							
Methane (74-82-8)	mg/L	0.0924	0.0043	0.0061 B	18.9	27.6	0.0032 B
Ethane (74-84-0)	mg/L	<0.0028 U	<0.0028 U	<0.0028 U	0.0116	0.0165	<0.0028 U
Propane (74-98-6)	mg/L	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	<0.0039 U	<0.0038 U
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics							
GRO/TPH	µg/L	<20 U	<20.0 U	<20.0 U	<20 U	<20.0 U	<20 U
DRO	µg/L	<20 U	<20.0 U, J-	<20.0 U	23.4	<20.0 U, J-	<20 U
Glycols							
2-butoxyethanol (111-76-2)	µg/L	<5.0 U	<5.0 U	<10.0 U	<5.0 U	<5.0 U	<5.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<5.0 U	<25.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U
Low Molecular Weight Acids							
Lactate (50-21-5)	mg/L	0.049 J	<0.10 U	<0.10 U	0.068 J	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	<0.10 U	0.37 B	NR	<0.10 U	0.52	<0.10 U
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	R	<0.10 U	R
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW06 10/26/11 Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 10/26/11 Round 1	GW08 10/27/11 Round 1	GW08 4/27/12 Round 2	GW08 5/11/13 Round 3
Dissolved Gases								
Methane (74-82-8)	mg/L	1.19	1.10	0.74	0.0071 B	14.8	17.3	20.0
Ethane (74-84-0)	mg/L	0.0212 B	0.0176	0.0097	<0.0028 U	0.0079	0.0065	0.0088
Propane (74-98-6)	mg/L	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	<0.0038 U	<0.0039 U	<0.0038 U
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics								
GRO/TPH	µg/L	<20 U	<20.0 U	<20.0 U	<20 U	<20 U	<20.0 U	<20.0 U
DRO	µg/L	<20 U	<20.0 U, J-	<20.0 U	<20 U	<20 U	<20.0 U, J-	<20.0 U
Glycols								
2-butoxyethanol (111-76-2)	µg/L	<5.0 U	<5.0 U	<10.0 U	<5.0 U	<5.0 U	<5.0 U	<10.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<25.0 U	<5.0 U	<10.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U	<10.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U	<10.0 U
Low Molecular Weight Acids								
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	<0.10 U	0.16	NR	<0.10 U	<0.10 U	0.62	NR
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	R	R	<0.10 U	<0.10 U
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW09 10/27/11 Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 10/27/11 Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
Dissolved Gases							
Methane (74-82-8)	mg/L	0.0061	0.0099	<0.0014 U	0.0523	<0.0014 U	<0.0014 U
Ethane (74-84-0)	mg/L	<0.0028 U	<0.0028 U	<0.0028 U	<0.0028 U	<0.0028 U	<0.0028 U
Propane (74-98-6)	mg/L	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	<0.0039 U	<0.0038 U
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics							
GRO/TPH	µg/L	<20 U	<20.0 U	<20.0 U	<20 U	<20.0 U	<20.0 U
DRO	µg/L	<20 U	<20.0 U, J-	<20.0 U	<20 U	28.1 J-	<20.0 U
Glycols							
2-butoxyethanol (111-76-2)	µg/L	<5.0 U	<5.0 U	<10.0 U	<5.0 U	<5.0 U	<10.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<5.0 U	<10.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<10.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<10.0 U
Low Molecular Weight Acids							
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	<0.10 U	0.22	NR	<0.10 U	<0.10 U	NR
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	R	<0.10 U	<0.10 U
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW11 10/28/11 Round 1	GW11 4/27/12 Round 2	GW11 5/9/13 Round 3	GW12 10/28/11 Round 1	GW12 5/11/13 Round 3	GW13 10/28/11 Round 1	GW13 4/28/12 Round 2
Dissolved Gases								
Methane (74-82-8)	mg/L	1.62	3.06	2.44	<0.0014 U	0.0182	5.62	21.7
Ethane (74-84-0)	mg/L	<0.0028 U	0.0012 J	<0.0028 U	<0.0028 U	<0.0028 U	0.1560	0.4970
Propane (74-98-6)	mg/L	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	<0.0038 U	<0.0038 U	0.0038 J
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics								
GRO/TPH	µg/L	<20 U	<20.0 U	<20.0 U	<20 U	<20.0 U	<20 U	<20.0 U
DRO	µg/L	<20 U	<20.0 U, J-	<20.0 U	<20 U	<20.0 U	<20 U	<20.0 U, J-
Glycols								
2-butoxyethanol (111-76-2)	µg/L	<5.0 U	<5.0 U	<10.0 U	<5.0 U	<10.0 U	<5.0 U	<5.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<10.0 U	<25.0 U	<5.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U
Low Molecular Weight Acids								
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	<0.10 U	0.66	NR	<0.10 U	NR	<0.10 U	0.12
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	R	<0.10 U	R	<0.10 U
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW14 10/28/11 Round 1	GW14 4/24/12 Round 2	GW14 5/9/13 Round 3	GW15 10/29/11 Round 1	GW15 4/30/12 Round 2	GW15 5/14/13 Round 3
Dissolved Gases							
Methane (74-82-8)	mg/L	0.0298	0.0106	<0.0014 U	0.5250	0.6590	0.6860
Ethane (74-84-0)	mg/L	<0.0028 U	<0.0028 U	<0.0028 U	0.0048	0.0035	<0.0028 U
Propane (74-98-6)	mg/L	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	<0.0039 U	<0.0038 U
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics							
GRO/TPH	µg/L	<20 U	<20.0 U	<20.0 U	<20 U	<20.0 U	<20.0 U
DRO	µg/L	<20 U	23.1 J-	<20.0 U	<20 U	<20.0 U, J-	<20.0 U
Glycols							
2-butoxyethanol (111-76-2)	µg/L	<5.0 U	<5.0 U	<10.0 U	<5.0 U	<5.0 U	<10.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<5.0 U	<10.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<10.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<10.0 U
Low Molecular Weight Acids							
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	<0.10 U	0.17	NR	0.14	0.28	NR
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	R	<0.10 U	<0.10 U
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW16 10/29/11 Round 1	GW16 4/30/12 Round 2	GW16 5/14/13 Round 3	GW17 10/29/11 Round 1	GW17 4/30/12 Round 2	GW18 10/31/11 Round 1	GW18 4/28/12 Round 2	GW19 10/31/11 Round 1
Dissolved Gases									
Methane (74-82-8)	mg/L	10.1	8.19	7.53	21.0	24.6	6.77	7.90	0.0020 B
Ethane (74-84-0)	mg/L	0.1290	0.1090	0.0701	0.0264	0.0291	0.2800	0.2590	<0.0028 U
Propane (74-98-6)	mg/L	<0.0038 U	0.0022 J	<0.0038 U	<0.0038 U	<0.0039 U	<0.0038 U	<0.0039 U	<0.0038 U
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics									
GRO/TPH	µg/L	<20 U	<20.0 U	<20.0 U	<20 U	<20.0 U	<20 U	<20.0 U	<20 U
DRO	µg/L	<20 U	<20.0 U, J-	<20.0 U	<20 U	<20.0 U, J-	<20 U	<20.0 U, J-	<20 U
Glycols									
2-butoxyethanol (111-76-2)	µg/L	<5.0 U	<5.0 U	<10.0 U	<5.0 U	<5.0 U	<5.0 U	<5.0 U	<5.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<5.0 U	<25.0 U	<5.0 U	<25.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U
Low Molecular Weight Acids									
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	0.15	0.28	NR	0.22	0.46	0.15 B	0.28	0.13 B
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	R	<0.10 U	R	<0.10 U	R
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW20 10/31/11 Round 1	GW20 4/28/12 Round 2	GW21 11/1/11 Round 1	GW22 11/1/11 Round 1	GW23 11/1/11 Round 1	GW24 11/1/11 Round 1	GW25 11/2/11 Round 1
Dissolved Gases								
Methane (74-82-8)	mg/L	7.55	18.4	<0.0014 U	<0.0014 U	7.79	0.0085	<0.0014 U
Ethane (74-84-0)	mg/L	0.2160	0.4140	<0.0028 U	0.0009 J	0.0545	<0.0028 U	<0.0028 U
Propane (74-98-6)	mg/L	<0.0038 U	0.0023 J	<0.0038 U	<0.0038 U	<0.0038 U	<0.0038 U	<0.0038 U
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics								
GRO/TPH	µg/L	<20 U	<20.0 U	<20 U	<20 U	<20 U	<20 U	<20 U
DRO	µg/L	<20 U	<20.0 U, J-	<20 U	<20 U	<20 U	<20 U	<20 U
Glycols								
2-butoxyethanol (111-76-2)	µg/L	<5.0 U	<5.0 U	<5.0 U, J-	<5.0 U, J-	<5.0 U, J-	<5.0 U, J-	<5.0 U, J-
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U
Low Molecular Weight Acids								
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	<0.10 U	0.17	0.13	0.12	0.13	0.12	0.26 B
Acetate (64-19-7)	mg/L	R	<0.10 U	R	R	R	R	R
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample / Sample Date / Unit	GW26 11/2/11 Round 1	GW26 4/24/12 Round 2	GW26 5/15/13 Round 3	GW27 11/2/11 Round 1	GW27 4/24/12 Round 2	GW27 5/9/13 Round 3	GW28 11/3/11 Round 1	GW28 5/15/13 Round 3
Dissolved Gases									
Methane (74-82-8)	mg/L	<0.0014 U	<0.0014 U	<0.0014 U	0.4470	0.4430	0.6300	<0.0014 U	<0.0014 U
Ethane (74-84-0)	mg/L	<0.0028 U	<0.0028 U	<0.0028 U	<0.0028 U	<0.0028 U	<0.0028 U	<0.0028 U	<0.0028 U
Propane (74-98-6)	mg/L	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	<0.0038 U
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics									
GRO/TPH	µg/L	<20 U	<20.0 U	<20.0 U	<20 U	<20.0 U	<20.0 U	<20 U	<20.0 U
DRO	µg/L	<20 U	<20.0 U, J-	<20.0 U	<20 U	21.1 J-	<20.0 U	<20 U	<20.0 U
Glycols									
2-butoxyethanol (111-76-2)	µg/L	<5.0 U, J-	<5.0 U	<10.0 U	<5.0 U, J-	<5.0 U	<10.0 U	<5.0 U, J-	<10.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<10.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<10.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<10.0 U
Low Molecular Weight Acids									
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	0.10 B	0.21	NR	0.30 B	0.81	NR	0.17 B	NR
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	R	<0.10 U	<0.10 U	R	<0.10 U
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW29 11/3/11 Round 1	GW29 5/1/12 Round 2	GW29 5/14/13 Round 3	GW30 11/3/11 Round 1	GW31 11/4/11 Round 1	GW32 11/4/11 Round 1	GW32 4/30/12 Round 2	GW32 5/10/13 Round 3
Dissolved Gases									
Methane (74-82-8)	mg/L	<0.0014 U	0.0020	<0.0014 U	<0.0014 U	1.95	0.7290	2.42	1.23
Ethane (74-84-0)	mg/L	<0.0028 U	<0.0028 U	<0.0028 U	<0.0028 U	0.0095	<0.0028 U	<0.0028 U	<0.0028 U
Propane (74-98-6)	mg/L	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	<0.0038 U	<0.0038 U	<0.0039 U	<0.0038 U
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics									
GRO/TPH	µg/L	<20 U	<20.0 U	<20.0 U	<20 U	<20 U	<20 U	<20.0 U	<20.0 U
DRO	µg/L	<20 U	<20.0 U, J-	<20.0 U	<20 U	<20 U	<20 U	<20.0 U, J-	<20.0 U
Glycols									
2-butoxyethanol (111-76-2)	µg/L	<5.0 U, J-	<5.0 U	<10.0 U	<5.0 U, J-	<5.0 U, J-	<5.0 U, J-	<5.0 U	<10.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U	<5.0 U	<10.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<10.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<10.0 U
Low Molecular Weight Acids									
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	0.14 B	0.15	NR	0.17 B	0.19	0.13	<0.10 U	NR
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	R	R	R	<0.10 U	<0.10 U
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3	GW38 5/10/13 Round 3
Dissolved Gases								
Methane (74-82-8)	mg/L	27.1	37.2	41.5	0.0012 J	<0.0014 U	15.5	17.5
Ethane (74-84-0)	mg/L	0.0450	0.0616	0.0882	<0.0028 U	<0.0028 U	0.3840	0.4280
Propane (74-98-6)	mg/L	<0.0038 U	<0.0039 U	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	<0.0038 U
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U
Diesel and Gas Range Organics								
GRO/TPH	µg/L	<20 U	<20.0 U	<20.0 U	<20.0 U	<20.0 U	<20.0 U	<20.0 U
DRO	µg/L	<20 U	<20.0 U, J-	<20.0 U	21.1 J-	<20.0 U	<20.0 U	<20.0 U
Glycols								
2-butoxyethanol (111-76-2)	µg/L	<5.0 U, J-	<5.0 U	<10.0 U	<5.0 U	<10.0 U	<10.0 U	<10.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<5.0 U	<10.0 U	<10.0 U	<10.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<10.0 U	<10.0 U	<10.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<10.0 U	<10.0 U	<10.0 U
Low Molecular Weight Acids								
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	0.13	0.15	NR	<0.10 U	NR	NR	NR
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-5 Sample Results - Dissolved Gases, Diesel and Gasoline Range Organics, Glycols, and Low Molecular Weight Acids (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	SW01 10/29/11 Round 1	SW01 4/30/12 Round 2	SW01 5/14/13 Round 3	SW02 11/4/11 Round 1	SW03 4/25/12 Round 2	SW04 4/25/12 Round 2	SW05 4/26/12 Round 2	SW06 4/26/12 Round 2
Dissolved Gases									
Methane (74-82-8)	mg/L	0.0244	0.0011 J	0.21	<0.0014 U	NA	NA	NA	NA
Ethane (74-84-0)	mg/L	<0.0028 U	<0.0028 U	<0.0028 U	<0.0028 U	NA	NA	NA	NA
Propane (74-98-6)	mg/L	<0.0038 U	<0.0039 U	<0.0038 U	<0.0038 U	NA	NA	NA	NA
Butane (106-97-8)	mg/L	<0.0048 U	<0.0048 U	<0.0048 U	<0.0048 U	NA	NA	NA	NA
Diesel and Gas Range Organics									
GRO/TPH	µg/L	<20 U	<20.0 U	24.2	<20 U	<20.0 U	<20.0 U	<20.0 U	<20.0 U
DRO	µg/L	23.1	<20.0 U, J-	27.7 B	<20 U	243 J-	273 J-	48.2 J-	46.0 J-
Glycols									
2-butoxyethanol (111-76-2)	µg/L	<5.0 U	<5.0 U	<10.0 U	<5.0 U, J-	<5.0 U	<5.0 U	<5.0 U	<5.0 U
Diethylene glycol (111-46-6)	µg/L	<25.0 U	<5.0 U	<10.0 U	<25.0 U	<5.0 U	<5.0 U	<5.0 U	<5.0 U
Triethylene glycol (112-27-6)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U
Tetraethylene glycol (112-60-7)	µg/L	<25.0 U	<25.0 U	<10.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U	<25.0 U
Low Molecular Weight Acids									
Lactate (50-21-5)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	0.069	<0.10 U	<0.10 U
Formate (64-18-6)	mg/L	<0.10 U	<0.10 U	NR	0.13	<0.10 U	0.17 B	<0.10 U	<0.10 U
Acetate (64-19-7)	mg/L	R	<0.10 U	<0.10 U	R	0.095	0.143	<0.10 U	<0.10 U
Propionate (79-09-4)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U
Isobutyrate (79-31-2)	mg/L	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-	<0.10 U, J-
Butyrate (107-92-6)	mg/L	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U	<0.10 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample / Sample Date / Unit	GW01 10/25/11 Round 1	GW01 4/25/12 Round 2	GW01 5/13/13 Round 3	GW02 10/25/11 Round 1	GW02 4/25/12 Round 2	GW02 5/13/13 Round 3
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 J	<1.00 U	<1.00 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<5.00 U	<5.00 U	<0.50 U	<5.00 U	<5.00 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	<1.00 U	<1.00 U	NR	<1.00 U	<1.00 U
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW03 10/25/11 Round 1	GW03 4/25/12 Round 2	GW03 5/13/13 Round 3	GW04 10/25/11 Round 1	GW04 4/27/12 Round 2	GW05 10/26/11 Round 1
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<0.50 U
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<0.50 U
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<5.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<5.00 U	<5.00 U	<0.50 U	<5.00 U	<0.50 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	<1.00 U	<1.00 U	NR	<1.00 U	NR
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<0.50 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW06 10/26/11 Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 10/26/11 Round 1	GW08 10/27/11 Round 1	GW08 4/27/12 Round 2	GW08 5/11/13 Round 3
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U, J-
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<5.00 U	<3.00 U	<3.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<5.00 U	<5.00 U	<0.50 U	<0.50 U	<5.00 U	<5.00 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	<1.00 U	<1.00 U	NR	NR	<1.00 U	<1.00 U
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<0.50 U	<3.00 U	<3.00 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW09 10/27/11 Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 10/27/11 Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U	<1.00 U	<1.00 U, J-	<0.50 U	<1.00 U, J-	<1.00 U
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<5.00 U	<5.00 U	<0.50 U	<5.00 U	<5.00 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	<1.00 U	<1.00 U	NR	<1.00 U	<1.00 U
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW11 10/28/11 Round 1	GW11 4/27/12 Round 2	GW11 5/9/13 Round 3	GW12 10/28/11 Round 1	GW12 5/11/13 Round 3	GW13 10/28/11 Round 1	GW13 4/28/12 Round 2
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U, J-
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U, J-	<0.50 U	<1.00 U	<0.50 U	<1.00 U, J-
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<5.00 U	<3.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<5.00 U	<5.00 U	<0.50 U	<5.00 U	<0.50 U	<5.00 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	<1.00 U	<1.00 U	NR	<1.00 U	NR	<1.00 U
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<0.50 U	<3.00 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW14 10/28/11 Round 1	GW14 4/24/12 Round 2	GW14 5/9/13 Round 3	GW15 10/29/11 Round 1	GW15 4/30/12 Round 2	GW15 5/14/13 Round 3
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U, J-
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U, J-	<0.50 U	<1.00 U, J-	<1.00 U, J-
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<5.00 U	<5.00 U	<0.50 U	<5.00 U	<5.00 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	<1.00 U	<1.00 U	NR	<1.00 U	<1.00 U
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW16 10/29/11 Round 1	GW16 4/30/12 Round 2	GW16 5/14/13 Round 3	GW17 10/29/11 Round 1	GW17 4/30/12 Round 2	GW18 10/31/11 Round 1	GW18 4/28/12 Round 2
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U, J-	<0.50 U	<1.00 U, J-	<0.50 U, J-	<1.00 U, J-
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U, J-	<0.50 U	<1.00 U, J-	<0.50 U, J-	<1.00 U, J-
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<5.00 U	<3.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<0.50 U	<1.00 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<0.50 U	<1.00 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<5.00 U	<5.00 U	<0.50 U	<5.00 U	<0.50 U	<5.00 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	<1.00 U	<1.00 U	NR	<1.00 U	NR	<1.00 U
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<0.50 U	<3.00 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW19 10/31/11 Round 1	GW20 10/31/11 Round 1	GW20 4/28/12 Round 2	GW21 11/1/11 Round 1	GW22 11/1/11 Round 1	GW23 11/1/11 Round 1	GW24 11/1/11 Round 1
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U, J-	<0.50 U, J-	<1.00 U, J-	<0.50 U, J-	<0.50 U, J-	<0.50 U, J-	<0.50 U, J-
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U, J-	<0.50 U, J-	<1.00 U, J-	<0.50 U, J-	<0.50 U, J-	<0.50 U, J-	<0.50 U, J-
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<5.00 U	<3.00 U	<5.00 U	<5.00 U, J-	<5.00 U	<5.00 U, J-
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2-methylphenol (95-48-7)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<0.50 U	<5.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	NR	<1.00 U	NR	NR	NR	NR
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<0.50 U	<3.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW25 11/2/11 Round 1	GW26 11/2/11 Round 1	GW26 4/24/12 Round 2	GW26 5/15/13 Round 3	GW27 11/2/11 Round 1	GW27 4/24/12 Round 2	GW27 5/9/13 Round 3
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U	<0.50 U, J-	<1.00 U	<1.00 U, J-	<0.50 U, J-	<1.00 U	<1.00 U
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<0.50 U	<5.00 U	<5.00 U	<0.50 U	<5.00 U	<5.00 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	NR	<1.00 U	<1.00 U	NR	<1.00 U	<1.00 U
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample / Sample Date / Unit	GW28 11/3/11 Round 1	GW28 5/15/13 Round 3	GW29 11/3/11 Round 1	GW29 5/1/12 Round 2	GW29 5/14/13 Round 3	GW30 11/3/11 Round 1	GW31 11/4/11 Round 1
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U, J-	<1.00 U, J-	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-	<0.50 U, J-	<0.50 U, J-
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U, J-	<1.00 U, J-	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-	<0.50 U, J-	<0.50 U, J-
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<5.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<0.50 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<0.50 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<5.00 U	<0.50 U	<5.00 U	<5.00 U	<0.50 U	<0.50 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	<1.00 U	NR	<1.00 U	<1.00 U	NR	NR
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<0.50 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW32 11/4/11 Round 1	GW32 4/30/12 Round 2	GW32 5/10/13 Round 3	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U, J-	<1.00 U, J-	<1.00 U	<0.50 U, J-	<1.00 U, J-	<1.00 U
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<5.00 U	<5.00 U	<0.50 U	<5.00 U	<5.00 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	<1.00 U	<1.00 U	NR	<1.00 U	<1.00 U
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3	GW38 5/10/13 Round 3	SW01 10/29/11 Round 1	SW01 4/30/12 Round 2	SW01 5/14/13 Round 3
R-(+)-limonene (5989-27-5)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U, J-
1,2,4-trichlorobenzene (120-82-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dichlorobenzene (95-50-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,2-dinitrobenzene (528-29-0)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dichlorobenzene (541-73-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,3-dimethyladamantane (702-79-4)	µg/L	<1.00 U, H	<1.00 U	<1.00 U, J-	<1.00 U, J-	<0.50 U	<1.00 U, J-	<1.00 U, J-
1,3 -dinitrobenzene (99-65-0)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dichlorobenzene (106-46-7)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1,4-dinitrobenzene (100-25-4)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
1-methylnaphthalene (90-12-0)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dichlorophenol (120-83-2)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dimethylphenol (105-67-9)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2,4-dinitrophenol (51-28-5)	µg/L	<3.00 U, H	<3.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2,6-dinitrotoluene (606-20-2)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-butoxyethanol (111-76-2)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
2-chloronaphthalene (91-58-7)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
2-chlorophenol (95-57-8)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-methylnaphthalene (91-57-6)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-methylphenol (95-48-7)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
2-nitroaniline (88-74-4)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
2-nitrophenol (88-75-5)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<5.00 U, H	<5.00 U	<5.00 U	<5.00 U	<0.50 U	<5.00 U	<5.00 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	NR	<1.00 U	<1.00 U
3-nitroaniline (99-09-2)	µg/L	<3.00 U, H	<3.00 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

	Sample	SW02	SW03	SW04	SW05	SW06
	Sample Date	11/4/11	4/25/12	4/25/12	4/26/12	4/26/12
Parameter (CAS Number)	Unit	Round 1	Round 2	Round 2	Round 2	Round 2
R-(+)-limonene (5989-27-5)	µg/L	<0.50 U, J-	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U, J-
1,2,4-trichlorobenzene (120-82-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
1,2-dichlorobenzene (95-50-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
1,2-dinitrobenzene (528-29-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
1,3-dichlorobenzene (541-73-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
1,3-dimethyladamantane (702-79-4)	µg/L	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-	<1.00 U, J-	<1.00 U, J-
1,3 -dinitrobenzene (99-65-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
1,4-dichlorobenzene (106-46-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
1,4-dinitrobenzene (100-25-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
1-methylnaphthalene (90-12-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
2,3,4,6-tetrachlorophenol (58-90-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
2,3,5,6-tetrachlorophenol (935-95-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
2,4,5-trichlorophenol (95-95-4)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
2,4,6-trichlorophenol (88-06-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
2,4-dichlorophenol (120-83-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
2,4-dimethylphenol (105-67-9)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
2,4-dinitrophenol (51-28-5)	µg/L	<5.00 U	<3.00 U	<3.00 U	<3.00 U	<3.00 U
2,4-dinitrotoluene (121-14-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
2,6-dinitrotoluene (606-20-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
2-butoxyethanol (111-76-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
2-chloronaphthalene (91-58-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
2-chlorophenol (95-57-8)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
2-methylnaphthalene (91-57-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
2-methylphenol (95-48-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
2-nitroaniline (88-74-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
2-nitrophenol (88-75-5)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
3&4-methylphenol (108-39-4 & 106-44-5)	µg/L	<0.50 U	<5.00 U	<5.00 U	<5.00 U	<5.00 U
3,3'-dichlorobenzidine (91-94-1)	µg/L	NR	<1.00 U	<1.00 U	<1.00 U	<1.00 U
3-nitroaniline (99-09-2)	µg/L	<0.50 U	<3.00 U	<3.00 U	<3.00 U	<3.00 U
4,6-dinitro-2-methylphenol (534-52-1)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
4-bromophenyl phenyl ether (101-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
4-chloro-3-methylphenol (59-50-7)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW01 10/25/11 Round 1	GW01 4/25/12 Round 2	GW01 5/13/13 Round 3	GW02 10/25/11 Round 1	GW02 4/25/12 Round 2	GW02 5/13/13 Round 3
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<3.00 U	<3.00 U	<1.00 U	<3.00 U	<3.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<3.00 U, J-	<3.00 U	<0.50 U	<3.00 U, J-	<3.00 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<3.00 U	<3.00 U	<2.50 U	<3.00 U	<3.00 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Adamantane (281-23-2)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	3.06 B	<1.00 U	<1.00 U	3.57 B	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	<2.00 U	5.38	<1.00 U	<2.00 U	<2.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Carbazole (86-74-8)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
Chrysene (218-01-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW03 10/25/11 Round 1	GW03 4/25/12 Round 2	GW03 5/13/13 Round 3	GW04 10/25/11 Round 1	GW04 4/27/12 Round 2	GW05 10/26/11 Round 1
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<3.00 U	<3.00 U	<1.00 U	<3.00 U	<1.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<3.00 U, J-	<3.00 U	<0.50 U	<3.00 U	<0.50 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<3.00 U	<3.00 U	<2.50 U	<3.00 U	<2.50 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Adamantane (281-23-2)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<0.50 U
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<5.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	2.99 B	<1.00 U	<1.00 U	3.10 B	<1.00 U	3.47 B
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	<2.00 U	18.3	<1.00 U	<2.00 U	<1.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Carbazole (86-74-8)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<0.50 U
Chrysene (218-01-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW06 10/26/11 Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 10/26/11 Round 1	GW08 10/27/11 Round 1	GW08 4/27/12 Round 2	GW08 5/11/13 Round 3
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<3.00 U	<3.00 U	<1.00 U	<1.00 U	<3.00 U	<3.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<0.50 U	<3.00 U	<3.00 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<3.00 U	<3.00 U	<2.50 U	<2.50 U	<3.00 U	<3.00 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Adamantane (281-23-2)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U, J-
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<5.00 U	<3.00 U	<3.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	2.89 B	<1.00 U	<1.00 U	3.59 B	3.35 B	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	<2.00 U	<2.00 U	1.21 B	4.10 B	<2.00 U	<2.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Carbazole (86-74-8)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<0.50 U	<3.00 U	<3.00 U
Chrysene (218-01-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW09 10/27/11 Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 10/27/11 Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<3.00 U	<3.00 U	<1.00 U	<3.00 U	<3.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U, J-	<3.00 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<3.00 U	<3.00 U	<2.50 U	<3.00 U	<3.00 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Adamantane (281-23-2)	µg/L	<0.50 U	<1.00 U	<1.00 U, J-	<0.50 U	<1.00 U, J-	<1.00 U
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	3.54 B	<1.00 U	<1.00 U	3.88 B	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	36.7†	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Carbazole (86-74-8)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
Chrysene (218-01-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW11 10/28/11 Round 1	GW11 4/27/12 Round 2	GW11 5/9/13 Round 3	GW12 10/28/11 Round 1	GW12 5/11/13 Round 3	GW13 10/28/11 Round 1	GW13 4/28/12 Round 2
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<3.00 U	<3.00 U	<1.00 U	<3.00 U	<1.00 U	<3.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<0.50 U	<3.00 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<3.00 U	<3.00 U	<2.50 U	<3.00 U	<2.50 U	<3.00 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Adamantane (281-23-2)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U, J-	<0.50 U	<1.00 U	<0.50 U	<1.00 U, J-
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<5.00 U	<3.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	3.15 B	<1.00 U	<1.00 U	3.39 B	<1.00 U	4.04 B	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<1.00 U	<2.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Carbazole (86-74-8)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<0.50 U	<3.00 U
Chrysene (218-01-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW14 10/28/11 Round 1	GW14 4/24/12 Round 2	GW14 5/9/13 Round 3	GW15 10/29/11 Round 1	GW15 4/30/12 Round 2	GW15 5/14/13 Round 3
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<3.00 U	<3.00 U	<1.00 U	<3.00 U	<3.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<3.00 U, J-	<3.00 U	<0.50 U	<3.00 U	<3.00 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<3.00 U	<3.00 U	<2.50 U	<3.00 U	<3.00 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Adamantane (281-23-2)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U, J-	<0.50 U	<1.00 U, J-	<1.00 U, J-
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	2.34 B	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	<2.00 U	5.75 B	<1.00 U	<2.00 U	<2.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Carbazole (86-74-8)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
Chrysene (218-01-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

	Sample	GW16	GW16	GW16	GW17	GW17	GW18	GW18
	Sample Date	10/29/11	4/30/12	5/14/13	10/29/11	4/30/12	10/31/11	4/28/12
Parameter (CAS Number)	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 1	Round 2
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<3.00 U	<3.00 U	<1.00 U	<3.00 U	<1.00 U	<3.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<0.50 U	<3.00 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<3.00 U	<3.00 U	<2.50 U	<3.00 U	<2.50 U	<3.00 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Adamantane (281-23-2)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U, J-	<0.50 U	<1.00 U, J-	<0.50 U, J-	<1.00 U, J-
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<5.00 U	<3.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<0.50 U	<1.00 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	2.74 B	<2.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Carbazole (86-74-8)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<0.50 U	<3.00 U
Chrysene (218-01-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<0.50 U	<1.00 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<0.50 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW19 10/31/11 Round 1	GW20 10/31/11 Round 1	GW20 4/28/12 Round 2	GW21 11/1/11 Round 1	GW22 11/1/11 Round 1	GW23 11/1/11 Round 1	GW24 11/1/11 Round 1
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<1.00 U	<3.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U, J-
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<0.50 U	<3.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<2.50 U	<3.00 U	<2.50 U	<2.50 U, J-	<2.50 U	<2.50 U, J-
Acenaphthene (83-32-9)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Adamantane (281-23-2)	µg/L	<0.50 U, J-	<0.50 U, J-	<1.00 U, J-	<0.50 U, J-	<0.50 U, J-	<0.50 U	<0.50 U, J-
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U, J-
Anthracene (120-12-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Azobenzene (103-33-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<5.00 U	<3.00 U	<5.00 U	<5.00 U, J-	<5.00 U	<5.00 U, J-
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U, J-
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	1.57 B	<1.00 U	<2.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U, J-
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Carbazole (86-74-8)	µg/L	<0.50 U	<0.50 U	<3.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Chrysene (218-01-9)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Diphenylamine (122-39-4)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW25 11/2/11 Round 1	GW26 11/2/11 Round 1	GW26 4/24/12 Round 2	GW26 5/15/13 Round 3	GW27 11/2/11 Round 1	GW27 4/24/12 Round 2	GW27 5/9/13 Round 3
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<1.00 U	<3.00 U	<3.00 U	<1.00 U	<3.00 U	<3.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<0.50 U	<3.00 U, J-	<3.00 U	<0.50 U	<3.00 U, J-	<3.00 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<2.50 U	<3.00 U	<3.00 U	<2.50 U	<3.00 U	<3.00 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Adamantane (281-23-2)	µg/L	<0.50 U	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	<1.00 U	<2.00 U	<2.00 U	2.45 B	<2.00 U	<2.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Carbazole (86-74-8)	µg/L	<0.50 U	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
Chrysene (218-01-9)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW28 11/3/11 Round 1	GW28 5/15/13 Round 3	GW29 11/3/11 Round 1	GW29 5/1/12 Round 2	GW29 5/14/13 Round 3	GW30 11/3/11 Round 1	GW31 11/4/11 Round 1
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<3.00 U	<1.00 U	<3.00 U	<3.00 U	<1.00 U	<1.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<0.50 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<3.00 U	<2.50 U	<3.00 U	<3.00 U	<2.50 U	<2.50 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Adamantane (281-23-2)	µg/L	<0.50 U, J-	<1.00 U, J-	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-	<0.50 U, J-	<0.50 U, J-
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<5.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<0.50 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<1.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Carbazole (86-74-8)	µg/L	<0.50 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<0.50 U
Chrysene (218-01-9)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<0.50 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<0.50 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW32 11/4/11 Round 1	GW32 4/30/12 Round 2	GW32 5/10/13 Round 3	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<3.00 U	<3.00 U	<1.00 U	<3.00 U	<3.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<3.00 U	<3.00 U	<2.50 U	<3.00 U	<3.00 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Adamantane (281-23-2)	µg/L	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-	<0.50 U, J-	<1.00 U, J-	<1.00 U, J-
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Carbazole (86-74-8)	µg/L	<0.50 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
Chrysene (218-01-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3	GW38 5/10/13 Round 3	SW01 10/29/11 Round 1	SW01 4/30/12 Round 2	SW01 5/14/13 Round 3
4-chloroaniline (106-47-8)	µg/L	<3.00 U, H	<3.00 U	<3.00 U	<3.00 U	<1.00 U	<3.00 U	<3.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
4-nitroaniline (100-01-6)	µg/L	<3.00 U, H	<3.00 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
4-nitrophenol (100-02-7)	µg/L	<3.00 U, H	<3.00 U	<3.00 U	<3.00 U	<2.50 U	<3.00 U	<3.00 U
Acenaphthene (83-32-9)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Acenaphthylene (208-96-8)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Adamantane (281-23-2)	µg/L	<1.00 U, H	<1.00 U	<1.00 U, J-	<1.00 U, J-	<0.50 U	<1.00 U,H,J-	<1.00 U, J-
Aniline (62-53-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Azobenzene (103-33-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)anthracene (56-55-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(a)pyrene (50-32-8)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Benzoic Acid (65-85-0)	µg/L	<3.00 U, H	<3.00 U	<3.00 U	<3.00 U	<5.00 U	<3.00 U	<3.00 U
Benzyl alcohol (100-51-6)	µg/L	<1.00 U,H,J-	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<2.00 U, H	3.82	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Butyl benzyl phthalate (85-68-7)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Carbazole (86-74-8)	µg/L	<3.00 U, H	<3.00 U	<3.00 U	<3.00 U	<0.50 U	<3.00 U	<3.00 U
Chrysene (218-01-9)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dibenzofuran (132-64-9)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
Diethyl phthalate (84-66-2)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Dimethyl phthalate (131-11-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-butyl phthalate (84-74-2)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Di-n-octyl phthalate (117-84-0)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Diphenylamine (122-39-4)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	SW02 11/4/11 Round 1	SW03 4/25/12 Round 2	SW04 4/25/12 Round 2	SW05 4/26/12 Round 2	SW06 4/26/12 Round 2
4-chloroaniline (106-47-8)	µg/L	<1.00 U	<3.00 U	<3.00 U	<3.00 U	<3.00 U
4-chlorophenyl phenyl ether (7005-72-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
4-nitroaniline (100-01-6)	µg/L	<0.50 U	<3.00 U, J-	<3.00 U, J-	<3.00 U	<3.00 U
4-nitrophenol (100-02-7)	µg/L	<2.50 U	<3.00 U	<3.00 U	<3.00 U	<3.00 U
Acenaphthene (83-32-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Acenaphthylene (208-96-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Adamantane (281-23-2)	µg/L	<0.50 U, J-	<1.00 U,H,J-	<1.00 U,H,J-	<1.00 U,H,J-	<1.00 U,H,J-
Aniline (62-53-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Anthracene (120-12-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Azobenzene (103-33-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Benzo(a)anthracene (56-55-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Benzo(a)pyrene (50-32-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Benzo(b)fluoranthene (205-99-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Benzo(g,h,i)perylene (191-24-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Benzo(k)fluoranthene (207-08-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Benzoic Acid (65-85-0)	µg/L	<5.00 U	<3.00 U	<3.00 U	<3.00 U	<3.00 U
Benzyl alcohol (100-51-6)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-chloroethoxy)methane (111-91-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-chloroethyl)ether (111-44-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-chloroisopropyl)ether (108-60-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) adipate (103-23-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Bis-(2-ethylhexyl) phthalate (117-81-7)	µg/L	<1.00 U	<2.00 U	<2.00 U	<2.00 U	3.02
Butyl benzyl phthalate (85-68-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Carbazole (86-74-8)	µg/L	<0.50 U	<3.00 U	<3.00 U	<3.00 U	<3.00 U
Chrysene (218-01-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Dibenz(a,h)anthracene (53-70-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Dibenzofuran (132-64-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Diethyl phthalate (84-66-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Dimethyl phthalate (131-11-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Di-n-butyl phthalate (84-74-2)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Di-n-octyl phthalate (117-84-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Diphenylamine (122-39-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW01 10/25/11 Round 1	GW01 4/25/12 Round 2	GW01 5/13/13 Round 3	GW02 10/25/11 Round 1	GW02 4/25/12 Round 2	GW02 5/13/13 Round 3
Fluoranthene (206-44-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Fluorene (86-73-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 J	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 J	<1.00 U	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Isophorone (78-59-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Phenol (108-95-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
Pyrene (129-00-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pyridine (110-86-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Squalene (111-02-4)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW03 10/25/11 Round 1	GW03 4/25/12 Round 2	GW03 5/13/13 Round 3	GW04 10/25/11 Round 1	GW04 4/27/12 Round 2	GW05 10/26/11 Round 1
Fluoranthene (206-44-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Fluorene (86-73-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Isophorone (78-59-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<1.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Phenol (108-95-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U
Pyrene (129-00-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Pyridine (110-86-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
Squalene (111-02-4)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<1.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

	Sample	GW06	GW06	GW06	GW07	GW08	GW08	GW08
	Sample Date	10/26/11	4/28/12	5/11/13	10/26/11	10/27/11	4/27/12	5/11/13
Parameter (CAS Number)	Unit	Round 1	Round 2	Round 3	Round 1	Round 1	Round 2	Round 3
Fluoranthene (206-44-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Fluorene (86-73-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Isophorone (78-59-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<1.00 U	<2.00 U	<2.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Phenol (108-95-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U	<2.00 U	<2.00 U
Pyrene (129-00-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Pyridine (110-86-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
Squalene (111-02-4)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<1.00 U	<2.00 U	<2.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U	<1.00 U	<1.00 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample / Sample Date / Unit	GW09 10/27/11 Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 10/27/11 Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
Fluoranthene (206-44-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Fluorene (86-73-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Isophorone (78-59-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Phenol (108-95-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
Pyrene (129-00-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pyridine (110-86-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Squalene (111-02-4)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW11 10/28/11 Round 1	GW11 4/27/12 Round 2	GW11 5/9/13 Round 3	GW12 10/28/11 Round 1	GW12 5/11/13 Round 3	GW13 10/28/11 Round 1	GW13 4/28/12 Round 2
Fluoranthene (206-44-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Fluorene (86-73-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Isophorone (78-59-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<1.00 U	<2.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Phenol (108-95-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
Pyrene (129-00-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Pyridine (110-86-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Squalene (111-02-4)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<1.00 U	<2.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW14 10/28/11 Round 1	GW14 4/24/12 Round 2	GW14 5/9/13 Round 3	GW15 10/29/11 Round 1	GW15 4/30/12 Round 2	GW15 5/14/13 Round 3
Fluoranthene (206-44-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Fluorene (86-73-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Isophorone (78-59-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Phenol (108-95-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
Pyrene (129-00-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pyridine (110-86-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Squalene (111-02-4)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U, J-	<2.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW16 10/29/11 Round 1	GW16 4/30/12 Round 2	GW16 5/14/13 Round 3	GW17 10/29/11 Round 1	GW17 4/30/12 Round 2	GW18 10/31/11 Round 1	GW18 4/28/12 Round 2
Fluoranthene (206-44-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Fluorene (86-73-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Isophorone (78-59-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<1.00 U	<2.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Phenol (108-95-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<0.50 U	<2.00 U
Pyrene (129-00-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Pyridine (110-86-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<0.50 U	<1.00 U
Squalene (111-02-4)	µg/L	<1.00 U	<2.00 U, J-	<2.00 U	<1.00 U	<2.00 U, J-	<1.00 U	<2.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<0.50 U	<1.00 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW19 10/31/11 Round 1	GW20 10/31/11 Round 1	GW20 4/28/12 Round 2	GW21 11/1/11 Round 1	GW22 11/1/11 Round 1	GW23 11/1/11 Round 1	GW24 11/1/11 Round 1
Fluoranthene (206-44-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Fluorene (86-73-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U, J-
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U, J-
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Isophorone (78-59-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Naphthalene (91-20-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<1.00 U	<2.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U, J-
Phenanthrene (85-01-8)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Phenol (108-95-2)	µg/L	<0.50 U	<0.50 U	<2.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Pyrene (129-00-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Pyridine (110-86-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
Squalene (111-02-4)	µg/L	<1.00 U	<1.00 U	<2.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U, J-
Terpiniol (98-55-5)	µg/L	<0.50 U	<0.50 U	<1.00 U	<0.50 U	<0.50 U, J-	<0.50 U	<0.50 U, J-
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U, J-

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW25 11/2/11 Round 1	GW26 11/2/11 Round 1	GW26 4/24/12 Round 2	GW26 5/15/13 Round 3	GW27 11/2/11 Round 1	GW27 4/24/12 Round 2	GW27 5/9/13 Round 3
Fluoranthene (206-44-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Fluorene (86-73-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Isophorone (78-59-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Phenol (108-95-2)	µg/L	<0.50 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
Pyrene (129-00-0)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pyridine (110-86-1)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Squalene (111-02-4)	µg/L	<1.00 U	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample / Sample Date / Unit	GW28 11/3/11 Round 1	GW28 5/15/13 Round 3	GW29 11/3/11 Round 1	GW29 5/1/12 Round 2	GW29 5/14/13 Round 3	GW30 11/3/11 Round 1	GW31 11/4/11 Round 1
Fluoranthene (206-44-0)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Fluorene (86-73-7)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Isophorone (78-59-1)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<1.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Phenol (108-95-2)	µg/L	<0.50 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<0.50 U
Pyrene (129-00-0)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Pyridine (110-86-1)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<0.50 U
Squalene (111-02-4)	µg/L	<1.00 U	<2.00 U	<1.00 U	<2.00 U, J-	<2.00 U	<1.00 U	<1.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<0.50 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW32 11/4/11 Round 1	GW32 4/30/12 Round 2	GW32 5/10/13 Round 3	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3
Fluoranthene (206-44-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Fluorene (86-73-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Isophorone (78-59-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Phenol (108-95-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
Pyrene (129-00-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pyridine (110-86-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Squalene (111-02-4)	µg/L	<1.00 U	<2.00 U, J-	<2.00 U	<1.00 U	<2.00 U, J-	<2.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<1.00 U, J-	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U, J-	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3	GW38 5/10/13 Round 3	SW01 10/29/11 Round 1	SW01 4/30/12 Round 2	SW01 5/14/13 Round 3
Fluoranthene (206-44-0)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Fluorene (86-73-7)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobenzene (118-74-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Isophorone (78-59-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Naphthalene (91-20-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Nitrobenzene (98-95-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodimethylamine (62-75-9)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pentachlorophenol (87-86-5)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U	<2.00 U
Phenanthrene (85-01-8)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Phenol (108-95-2)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<0.50 U	<2.00 U	<2.00 U
Pyrene (129-00-0)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Pyridine (110-86-1)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U	<1.00 U
Squalene (111-02-4)	µg/L	<2.00 U, H	<2.00 U	<2.00 U	<2.00 U	<1.00 U	<2.00 U, J-	<2.00 U
Terpiniol (98-55-5)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<0.50 U	<1.00 U, J-	<1.00 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U, H	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U, J-	<1.00 U

Table B-6 Sample Results - Semivolatile Organic Compounds (Northeastern Pennsylvania)

Parameter (CAS Number)	Sample Sample Date Unit	SW02 11/4/11 Round 1	SW03 4/25/12 Round 2	SW04 4/25/12 Round 2	SW05 4/26/12 Round 2	SW06 4/26/12 Round 2
Fluoranthene (206-44-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Fluorene (86-73-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorobenzene (118-74-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorobutadiene (87-68-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachlorocyclopentadiene (77-47-4)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Hexachloroethane (67-72-1)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Indeno(1,2,3-cd)pyrene (193-39-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Isophorone (78-59-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Naphthalene (91-20-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Nitrobenzene (98-95-3)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
N-nitrosodimethylamine (62-75-9)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
N-nitrosodi-n-propylamine (621-64-7)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Pentachlorophenol (87-86-5)	µg/L	<1.00 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
Phenanthrene (85-01-8)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Phenol (108-95-2)	µg/L	<0.50 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
Pyrene (129-00-0)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Pyridine (110-86-1)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Squalene (111-02-4)	µg/L	<1.00 U	<2.00 U	<2.00 U	<2.00 U	<2.00 U
Terpiniol (98-55-5)	µg/L	<0.50 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U
tri-(2-butoxyethyl) phosphate (78-51-3)	µg/L	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U

Table B-7 Sample Results - Water Isotopes, Strontium Isotopes, and Radiological Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW01 10/25/11 Round 1	GW01 4/25/12 Round 2	GW01 5/13/13 Round 3	GW02 10/25/11 Round 1	GW02 4/25/12 Round 2	GW02 5/13/13 Round 3	GW03 10/25/11 Round 1	GW03 4/25/12 Round 2	GW03 5/13/13 Round 3
Water Isotopes										
δ^2H	‰	-67.31	-64.65	-65.7	-67.41	-64.85	-65.5	-64.99	-64.57	-65.4
$\delta^{18}O$	‰	-10.46	-9.81	-9.87	-10.37	-9.71	-9.88	-9.82	-9.66	-9.70
Strontium Isotopes										
Sr	µg/L	1870	1870	1680	3010	3310	3290	11000	10800	11500
Rb	µg/L	5.3	5.4	5.4	5.9	6.2	6.0	9.4	8.4	8.6
$^{87}Sr/^{86}Sr$	Atom Ratio	0.710362	0.710334	0.710348	0.710364	0.710394	0.710384	0.710455	0.710498	0.710451
1/Sr	L/µg	0.00053	0.00053	0.00060	0.00033	0.00030	0.00030	0.00009	0.00009	0.00009
Rb/Sr	Weight Ratio	0.0028	0.0029	0.0032	0.0020	0.0019	0.0018	0.0009	0.0008	0.0007
Radiological Parameters										
Gross Alpha	pCi/L	NA	<3.0 U	<3.0 U	NA	<3.0 U	<3.0 U	NA	<3.0 U	4.2 ± 2.5 J
Gross Beta	pCi/L	NA	<4.0 U	<4.0 U	NA	<4.0 U	<4.0 U	NA	<4.0 U	<4.0 U
Radium-226	pCi/L	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U
Radium-228	pCi/L	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U

Table B-7 Sample Results - Water Isotopes, Strontium Isotopes, and Radiological Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW04 10/25/11 Round 1	GW04 4/27/12 Round 2	GW05 10/26/11 Round 1	GW06 10/26/11 Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 10/26/11 Round 1
Water Isotopes								
δ^2H	‰	-63.79	-61.77	-64.42	-63.24	-61.82	-62.9	-61.85
$\delta^{18}O$	‰	-9.38	-9.35	-9.17	-9.56	-9.42	-9.48	-9.02
Strontium Isotopes								
Sr	µg/L	9300	9090	1220	NA	1480	1320	424
Rb	µg/L	8.1	8.1	1.2	NA	1.2	1.2	0.8
$^{87}Sr/^{86}Sr$	Atom Ratio	0.709618	0.709604	0.713006	NA	0.712963	0.712953	0.713494
1/Sr	L/µg	0.00011	0.00011	0.00082	NA	0.00068	0.00076	0.00236
Rb/Sr	Weight Ratio	0.0009	0.0009	0.0010	NA	0.0008	0.0009	0.0019
Radiological Parameters								
Gross Alpha	pCi/L	NA	6.1 +/- 2.2	NA	NA	5.7 +/- 1.9	5.1 ± 1.9 J	NA
Gross Beta	pCi/L	NA	6.6 +/- 2.5	NA	NA	<4.0 U	<4.0 U	NA
Radium-226	pCi/L	NA	4.40 +/- 1.3	NA	NA	<1.00 U	<1.00 U	NA
Radium-228	pCi/L	NA	2.88 +/- 0.73	NA	NA	<1.00 U	<1.00 U	NA

Table B-7 Sample Results - Water Isotopes, Strontium Isotopes, and Radiological Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW08 10/27/11 Round 1	GW08 4/27/12 Round 2	GW08 5/11/13 Round 3	GW09 10/27/11 Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 10/27/11 Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
Water Isotopes										
$\delta^{2}H$	‰	-63.76	-63.50	-64.4	-62.98	-63.44	-64.1	-57.54	-59.33	-58.6
$\delta^{18}O$	‰	-9.41	-9.56	-9.66	-8.97	-9.54	-9.74	-8.36	-9.11	-8.88
Strontium Isotopes										
Sr	µg/L	1570	2150	2350	1130	1270	1100	93	89	101
Rb	µg/L	5.4	6.8	7.2	1.4	1.6	1.5	0.5	0.5	0.5
$^{87}Sr/^{86}Sr$	Atom Ratio	0.711799	0.711811	0.711770	0.712267	0.712180	0.712257	0.712668	0.712701	0.712667
1/Sr	L/µg	0.00064	0.00047	0.00043	0.00088	0.00079	0.00091	0.01075	0.01124	0.00990
Rb/Sr	Weight Ratio	0.0034	0.0032	0.0031	0.0012	0.0013	0.0014	0.0054	0.0056	0.0050
Radiological Parameters										
Gross Alpha	pCi/L	NA	<3.0 U	<3.0 U	NA	<3.0 U	<3.0 U	NA	<3.0 U	<3.0 U
Gross Beta	pCi/L	NA	<4.0 U	<4.0 U	NA	<4.0 U	<4.0 U	NA	<4.0 U	<4.0 U
Radium-226	pCi/L	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U
Radium-228	pCi/L	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U

Table B-7 Sample Results - Water Isotopes, Strontium Isotopes, and Radiological Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW11 10/28/11 Round 1	GW11 4/27/12 Round 2	GW11 5/9/13 Round 3	GW12 10/28/11 Round 1	GW12 5/11/13 Round 3	GW13 10/28/11 Round 1	GW13 4/28/12 Round 2
Water Isotopes								
δ^2H	‰	-63.92	-63.96	-64.3	-59.49	-60.2	-64.74	-61.73
$\delta^{18}O$	‰	-8.95	-9.57	-9.67	-8.53	-9.07	-9.81	-9.40
Strontium Isotopes								
Sr	µg/L	655	907	898	209	209	975	1050
Rb	µg/L	2.0	3.1	3.5	0.5	<1.0	2.0	2.3
$^{87}Sr/^{86}Sr$	Atom Ratio	0.713092	0.712980	0.712965	0.712554	0.712579	0.713118	0.713121
1/Sr	L/µg	0.00153	0.00110	0.00111	0.00478	0.00478	0.00103	0.00095
Rb/Sr	Weight Ratio	0.0031	0.0034	0.0039	0.0024	NR	0.0021	0.0022
Radiological Parameters								
Gross Alpha	pCi/L	NA	<3.0 U	<3.0 U	NA	<3.0 U	NA	<3.0 U
Gross Beta	pCi/L	NA	<4.0 U	<4.0 U	NA	<4.0 U	NA	<4.0 U
Radium-226	pCi/L	NA	<1.00 U	<1.00 U	NA	<1.00 U	NA	<1.00 U
Radium-228	pCi/L	NA	<1.00 U	<1.00 U	NA	<1.00 U	NA	<1.00 U

Table B-7 Sample Results - Water Isotopes, Strontium Isotopes, and Radiological Parameters (Northeastern Pennsylvania)

Parameter	Sample / Sample Date / Unit	GW14 10/28/11 Round 1	GW14 4/24/12 Round 2	GW14 5/9/13 Round 3	GW15 10/29/11 Round 1	GW15 4/30/12 Round 2	GW15 5/14/13 Round 3	GW16 10/29/11 Round 1	GW16 4/30/12 Round 2	GW16 5/14/13 Round 3
Water Isotopes										
$\delta^{2}H$	‰	-61.91	-58.83	-59.2	-67.74	-64.26	-64.9	-65.82	-64.72	-64.9
$\delta^{18}O$	‰	-9.54	-9.04	-9.23	-9.93	-9.63	-9.80	-9.47	-9.58	-9.88
Strontium Isotopes										
Sr	µg/L	224	217	209	1390	1490	1410	3080	2990	3190
Rb	µg/L	0.7	0.6	0.7	1.8	2.0	1.9	2.0	2.0	2.0
$^{87}Sr/^{86}Sr$	Atom Ratio	0.712720	0.712723	0.712736	0.713433	0.713441	0.713456	0.713463	0.713470	0.713489
1/Sr	L/µg	0.00446	0.00461	0.00478	0.00072	0.00067	0.00071	0.00032	0.00033	0.00031
Rb/Sr	Weight Ratio	0.0031	0.0028	0.0033	0.0013	0.0013	0.0013	0.0006	0.0007	0.0006
Radiological Parameters										
Gross Alpha	pCi/L	NA	<3.0 U	4.1 ± 1.7 J	NA	<3.0 U	<3.0 U	NA	<3.0 U	<3.0 U
Gross Beta	pCi/L	NA	<4.0 U	<4.0 U	NA	<4.0 U	<4.0 U	NA	<4.0 U	<4.0 U
Radium-226	pCi/L	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U	NA	<1.00 U	1.31 ± 0.5 J
Radium-228	pCi/L	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U

Table B-7 Sample Results - Water Isotopes, Strontium Isotopes, and Radiological Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW17 10/29/11 Round 1	GW17 4/30/12 Round 2	GW18 10/31/11 Round 1	GW18 4/28/12 Round 2	GW19 10/31/11 Round 1	GW20 10/31/11 Round 1	GW20 4/28/12 Round 2	GW21 11/1/11 Round 1	GW22 11/1/11 Round 1
Water Isotopes										
$\delta^{2}H$	‰	-62.52	-64.92	-61.71	-62.53	-57.93	-62.75	-62.90	-62.37	-60.76
$\delta^{18}O$	‰	-9.10	-9.83	-8.99	-9.49	-8.46	-9.13	-9.45	-9.15	-9.13
Strontium Isotopes										
Sr	µg/L	5840	5860	1360	1450	63	741	877	70	773
Rb	µg/L	4.3	4.5	0.6	0.7	<0.5	0.9	0.8	0.4	0.6
$^{87}Sr/^{86}Sr$	Atom Ratio	0.713492	0.713486	0.713119	0.713110	0.712886	0.713108	0.713097	0.713519	0.713049
1/Sr	L/µg	0.00017	0.00017	0.00074	0.00069	0.01587	0.00135	0.00114	0.01429	0.00129
Rb/Sr	Weight Ratio	0.0007	0.0008	0.0004	0.0005	NR	0.0012	0.0009	0.0057	0.0008
Radiological Parameters										
Gross Alpha	pCi/L	NA	4.3 +/- 1.9	NA	<3.0 U	NA	NA	<3.0 U	NA	NA
Gross Beta	pCi/L	NA	7.4 +/- 2.8	NA	<4.0 U	NA	NA	<4.0 U	NA	NA
Radium-226	pCi/L	NA	3.70 +/- 1.1	NA	<1.00 U	NA	NA	<1.00 U	NA	NA
Radium-228	pCi/L	NA	2.68 +/- 0.70	NA	<1.00 U	NA	NA	<1.00 U	NA	NA

Table B-7 Sample Results - Water Isotopes, Strontium Isotopes, and Radiological Parameters (Northeastern Pennsylvania)

Parameter	Sample / Sample Date / Unit	GW23 11/1/11 Round 1	GW24 11/1/11 Round 1	GW25 11/2/11 Round 1	GW26 11/2/11 Round 1	GW26 4/24/12 Round 2	GW26 5/15/13 Round 3	GW27 11/2/11 Round 1	GW27 4/24/12 Round 2	GW27 5/9/13 Round 3
Water Isotopes										
δ^2H	‰	-61.31	-61.19	-59.99	-60.34	-61.59	-62.4	-60.68	-63.64	-63.6
$\delta^{18}O$	‰	-8.99	-9.03	-8.98	-8.62	-9.40	-9.59	-8.58	-9.59	-9.64
Strontium Isotopes										
Sr	µg/L	759	307	2500	1810	1930	1750	2380	2590	2570
Rb	µg/L	0.5	0.9	3.2	1.7	1.8	1.7	3.0	3.2	3.2
$^{87}Sr/^{86}Sr$	Atom Ratio	0.713094	0.714472	0.712869	0.713092	0.713089	0.713093	0.712764	0.712812	0.712770
1/Sr	L/µg	0.00132	0.00326	0.00040	0.00055	0.00052	0.00057	0.00042	0.00039	0.00039
Rb/Sr	Weight Ratio	0.0007	0.0029	0.0013	0.0009	0.0009	0.0010	0.0013	0.0012	0.0012
Radiological Parameters										
Gross Alpha	pCi/L	NA	NA	NA	NA	4.1 +/- 1.7	5.9 ± 1.6 J	NA	<3.0 U	<3.0 U
Gross Beta	pCi/L	NA	NA	NA	NA	4.7 +/- 2.1	<4.0 U	NA	<4.0 U	<4.0 U
Radium-226	pCi/L	NA	NA	NA	NA	1.79 +/- 0.69	2.70 ± 0.89 J	NA	<1.00 U	<1.00 U
Radium-228	pCi/L	NA	NA	NA	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U

Table B-7 Sample Results - Water Isotopes, Strontium Isotopes, and Radiological Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW28 11/3/11 Round 1	GW28 5/15/13 Round 3	GW29 11/3/11 Round 1	GW29 5/1/12 Round 2	GW29 5/14/13 Round 3	GW30 11/3/11 Round 1	GW31 11/4/11 Round 1
Water Isotopes								
δ^2H	‰	-61.09	-64.1	-59.35	-61.01	-61.7	-61.43	-59.49
$\delta^{18}O$	‰	-9.20	-9.85	-8.93	-9.30	-9.52	-9.27	-8.87
Strontium Isotopes								
Sr	µg/L	1040	934	585	624	561	2080	666
Rb	µg/L	0.9	<1.0	0.6	0.6	<1.0	3.6	2.2
$^{87}Sr/^{86}Sr$	Atom Ratio	0.712233	0.712246	0.713328	0.713360	0.713340	0.711836	0.714281
1/Sr	L/µg	0.00096	0.00107	0.00171	0.00160	0.00178	0.00048	0.00150
Rb/Sr	Weight Ratio	0.0009	NR	0.0010	0.0010	NR	0.0017	0.0033
Radiological Parameters								
Gross Alpha	pCi/L	NA	<3.0 U	NA	<3.0 U	3.3 ± 1.0 J	NA	NA
Gross Beta	pCi/L	NA	<4.0 U	NA	<4.0 U	<4.0 U	NA	NA
Radium-226	pCi/L	NA	<1.00 U	NA	<1.00 U	<1.00 U	NA	NA
Radium-228	pCi/L	NA	<1.00 U	NA	<1.00 U	<1.00 U	NA	NA

Table B-7 Sample Results - Water Isotopes, Strontium Isotopes, and Radiological Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW32 11/4/11 Round 1	GW32 4/30/12 Round 2	GW32 5/10/13 Round 3	GW33 11/4/11 Round 1	GW33 4/30/12 Round 2	GW33 5/10/13 Round 3	GW36 4/26/12 Round 2	GW36 5/13/13 Round 3	GW37 5/10/13 Round 3
Water Isotopes										
δ^2H	‰	-61.94	-61.94	-62.8	-61.59	-62.72	-63.6	-57.35	-58.5	-61.1
$\delta^{18}O$	‰	-9.22	-9.44	-9.54	-9.18	-9.60	-9.74	-8.78	-8.79	-9.35
Strontium Isotopes										
Sr	µg/L	556	563	525	822	861	774	274	228	136
Rb	µg/L	0.7	0.7	<1.0	0.7	0.8	<1.0	<0.5	<1.0	<1.0
$^{87}Sr/^{86}Sr$	Atom Ratio	0.712988	0.713051	0.713055	0.713013	0.713012	0.712998	0.714515	0.714517	0.713364
1/Sr	L/µg	0.00180	0.00178	0.00190	0.00122	0.00116	0.00129	0.00365	0.00439	0.00735
Rb/Sr	Weight Ratio	0.0013	0.0012	NR	0.0009	0.0009	NR	NR	NR	NR
Radiological Parameters										
Gross Alpha	pCi/L	NA	3.3 +/- 1.7	<3.0 U	NA	<3.0 U	4.2 ± 1.6 J	<3.0 U	<3.0 U	<3.0 U
Gross Beta	pCi/L	NA	<4.0 U	<4.0 U	NA	4.5 +/- 2.0	5.6 ± 1.9 J	<4.0 U	<4.0 U	<4.0 U
Radium-226	pCi/L	NA	<1.00 U	<1.00 U	NA	2.07 +/- 0.66	1.81 ± 0.63 J	<1.00 U	<1.00 U	<1.00 U
Radium-228	pCi/L	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U	<1.00 U	<1.00 U	<1.00 U

Table B-7 Sample Results - Water Isotopes, Strontium Isotopes, and Radiological Parameters (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW38 5/10/13 Round 3	SW01 10/29/11 Round 1	SW01 4/30/12 Round 2	SW01 5/14/13 Round 3	SW02 11/4/11 Round 1	SW03 4/25/12 Round 2	SW04 4/25/12 Round 2	SW05 4/26/12 Round 2	SW06 4/26/12 Round 2
Water Isotopes										
δ^2H	‰	-63.5	-60.67	-59.79	-59.3	-52.68	-62.99	-63.54	-70.99	-70.91
$\delta^{18}O$	‰	-9.47	-8.98	-9.10	-8.93	-8.09	-8.86	-8.86	-10.17	-10.20
Strontium Isotopes										
Sr	µg/L	482	84	71	87	32	1490	1490	78	79
Rb	µg/L	<1.0	<0.5	<0.5	<1.0	0.4	2.8	2.8	0.5	0.5
$^{87}Sr/^{86}Sr$	Atom Ratio	0.713145	0.711886	0.711131	0.711228	0.713092	0.710026	0.710105	0.713350	0.713340
1/Sr	L/µg	0.00207	0.01190	0.01408	0.01149	0.03125	0.00067	0.00067	0.01282	0.01266
Rb/Sr	Weight Ratio	NR	NR	NR	NR	0.0125	0.0019	0.0019	0.0064	0.0063
Radiological Parameters										
Gross Alpha	pCi/L	3.7 ± 1.6 J	NA	<3.0 U	<3.0 U	NA	<3.0 U	<3.0 U	<3.0 U	<3.0 U
Gross Beta	pCi/L	4.9 ± 1.7 J	NA	<4.0 U	<4.0 U	NA	<4.0 U	<4.0 U	<4.0 U	<4.0 U
Radium-226	pCi/L	<1.00 U	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U	<1.00 U	<1.00 U
Radium-228	pCi/L	<1.00 U	NA	<1.00 U	<1.00 U	NA	<1.00 U	<1.00 U	<1.00 U	<1.00 U

Table B-8 Sample Results - Isotech Gas Isotopes (Northeastern Pennsylvania)

	Sample	GW01	GW01	GW01	GW02	GW02	GW02	GW03	GW03	GW03
	Sample Date	NA	4/25/12	5/13/13	10/25/11	4/25/12	5/13/13	NA	4/25/12	5/13/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Helium	%	NA	0.0095	NR	0.0037	0.0091	0.0064	NA	NR	NA
Hydrogen	%	NA	ND	ND	ND	ND	ND	NA	NA	NA
Argon	%	NA	0.124	0.169	0.111	0.0889	0.0979	NA	NA	NA
Oxygen	%	NA	1.15	1.85	1.94	1.09	1.18	NA	NA	NA
Carbon dioxide	%	NA	0.075	0.11	0.17	0.41	0.19	NA	NA	NA
Nitrogen	%	NA	6.14	7.75	5.03	3.78	4.34	NA	NA	NA
Carbon monoxide	%	NA	ND	ND	ND	ND	ND	NA	NA	NA
Methane	%	NA	92.48	90.1	92.72	94.60	94.16	NA	NA	NA
Ethane	%	NA	0.0180	0.0207	0.0233	0.0260	0.0284	NA	NA	NA
Ethene	%	NA	ND	ND	ND	ND	ND	NA	NA	NA
Propane	%	NA	ND	ND	ND	ND	ND	NA	NA	NA
Propylene	%	NA	ND	ND	0.0001	ND	ND	NA	NA	NA
Isobutane	%	NA	ND	ND	ND	ND	ND	NA	NA	NA
Normal Butane	%	NA	ND	ND	ND	ND	ND	NA	NA	NA
Isopentane	%	NA	ND	ND	ND	ND	ND	NA	NA	NA
Normal Pentane	%	NA	ND	ND	ND	ND	ND	NA	NA	NA
Hexane Plus	%	NA	ND	ND	ND	ND	ND	NA	NA	NA
$\delta^{13}C_{CH4}$	‰	NA	-39.42	-39.27	-38.43	-38.26	-38.20	NA	NA	NA
$\delta^{2}H_{CH4}$	‰	NA	-203.9	-201.0	-206.7	-204.7	-204.0	NA	NA	NA
$\delta^{13}C_{C2H6}$	‰	NA	NR	NA	-32.0	-31.4	-31.3	NA	NA	NA
$\delta^{13}C_{DIC}$	‰	NA	-7.25	-6.3	-15.34	-13.86	-14.0	NA	NA	-15.7
Specific Gravity		NA	0.587	0.599	0.588	0.580	0.581	NA	NA	NA
BTU		NA	938	914	940	960	955	NA	NA	NA
Helium dilution factor		NA	NR	0.31	NR	NR	NA	NA	NA	NA

Table B-8 Sample Results - Isotech Gas Isotopes (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW04 NA Round 1	GW04 4/27/12 Round 2	GW05 NA Round 1	GW06 NA Round 1	GW06 4/28/12 Round 2	GW06 5/11/13 Round 3	GW07 NA Round 1
Helium	%	NA	NR	NA	NA	NR	NR	NA
Hydrogen	%	NA	ND	NA	NA	ND	ND	NA
Argon	%	NA	0.224	NA	NA	1.62	1.60	NA
Oxygen	%	NA	1.30	NA	NA	3.39	4.36	NA
Carbon dioxide	%	NA	0.41	NA	NA	2.48	1.71	NA
Nitrogen	%	NA	9.62	NA	NA	86.02	88.31	NA
Carbon monoxide	%	NA	ND	NA	NA	ND	ND	NA
Methane	%	NA	88.42	NA	NA	6.44	4.00	NA
Ethane	%	NA	0.0249	NA	NA	0.0505	0.023	NA
Ethene	%	NA	ND	NA	NA	ND	ND	NA
Propane	%	NA	ND	NA	NA	ND	ND	NA
Propylene	%	NA	ND	NA	NA	ND	ND	NA
Isobutane	%	NA	ND	NA	NA	ND	ND	NA
Normal Butane	%	NA	ND	NA	NA	ND	ND	NA
Isopentane	%	NA	ND	NA	NA	ND	ND	NA
Normal Pentane	%	NA	ND	NA	NA	ND	ND	NA
Hexane Plus	%	NA	ND	NA	NA	ND	ND	NA
$\delta^{13}C_{CH4}$	‰	NA	-38.24	NA	NA	-29.95	-27.22	NA
$\delta^{2}H_{CH4}$	‰	NA	-201.9	NA	NA	-136.2	-138.8	NA
$\delta^{13}C_{C2H6}$	‰	NA	NR	NA	NA	NR	NA	NA
$\delta^{13}C_{DIC}$	‰	NA	-12.30	NA	NA	-17.66	-17.2	NA
Specific Gravity		NA	0.607	NA	NA	0.966	0.973	NA
BTU		NA	897	NA	NA	66	41	NA
Helium dilution factor		NA	0.49	NA	NA	0.71	0.65	NA

Table B-8 Sample Results - Isotech Gas Isotopes (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW08 NA Round 1	GW08 4/27/12 Round 2	GW08 5/11/13 Round 3	GW09 NA Round 1	GW09 4/27/12 Round 2	GW09 5/9/13 Round 3	GW10 NA Round 1	GW10 4/24/12 Round 2	GW10 5/11/13 Round 3
Helium	%	NA	NR	NR	NA	NR	NA	NA	NR	NA
Hydrogen	%	NA	ND	ND	NA	NA	NA	NA	NA	NA
Argon	%	NA	0.703	0.716	NA	NA	NA	NA	NA	NA
Oxygen	%	NA	1.27	1.23	NA	NA	NA	NA	NA	NA
Carbon dioxide	%	NA	0.053	0.054	NA	NA	NA	NA	NA	NA
Nitrogen	%	NA	34.66	36.42	NA	NA	NA	NA	NA	NA
Carbon monoxide	%	NA	ND	ND	NA	NA	NA	NA	NA	NA
Methane	%	NA	63.30	61.57	NA	NA	NA	NA	NA	NA
Ethane	%	NA	0.0118	0.0135	NA	NA	NA	NA	NA	NA
Ethene	%	NA	ND	ND	NA	NA	NA	NA	NA	NA
Propane	%	NA	ND	ND	NA	NA	NA	NA	NA	NA
Propylene	%	NA	ND	ND	NA	NA	NA	NA	NA	NA
Isobutane	%	NA	ND	ND	NA	NA	NA	NA	NA	NA
Normal Butane	%	NA	ND	ND	NA	NA	NA	NA	NA	NA
Isopentane	%	NA	ND	ND	NA	NA	NA	NA	NA	NA
Normal Pentane	%	NA	ND	ND	NA	NA	NA	NA	NA	NA
Hexane Plus	%	NA	ND	ND	NA	NA	NA	NA	NA	NA
$\delta^{13}C_{CH4}$	‰	NA	-49.96	-48.85	NA	NA	NA	NA	NA	NA
$\delta^{2}H_{CH4}$	‰	NA	-228.7	-221.1	NA	NA	NA	NA	NA	NA
$\delta^{13}C_{C2H6}$	‰	NA	NR	NA	NA	NA	NA	NA	NA	NA
$\delta^{13}C_{DIC}$	‰	NA	-14.06	-13.4	NA	NA	-14.8	NA	NA	-19.2
Specific Gravity		NA	0.711	0.718	NA	NA	NA	NA	NA	NA
BTU		NA	642	624	NA	NA	NA	NA	NA	NA
Helium dilution factor		NA	0.46	0.37	NA	NA	NA	NA	NA	NA

Table B-8 Sample Results - Isotech Gas Isotopes (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW11 NA Round 1	GW11 4/27/12 Round 2	GW11 5/9/13 Round 3	GW12 NA Round 1	GW12 5/11/13 Round 3	GW13 NA Round 1	GW13 4/28/12 Round 2
Helium	%	NA	NR	NR	NA	NA	NA	NR
Hydrogen	%	NA	ND	ND	NA	NA	NA	ND
Argon	%	NA	1.42	1.44	NA	NA	NA	0.582
Oxygen	%	NA	3.32	1.44	NA	NA	NA	1.60
Carbon dioxide	%	NA	0.12	0.13	NA	NA	NA	0.51
Nitrogen	%	NA	79.76	81.71	NA	NA	NA	28.30
Carbon monoxide	%	NA	ND	ND	NA	NA	NA	ND
Methane	%	NA	15.38	15.28	NA	NA	NA	68.21
Ethane	%	NA	0.0050	0.0047	NA	NA	NA	0.793
Ethene	%	NA	ND	ND	NA	NA	NA	ND
Propane	%	NA	ND	ND	NA	NA	NA	0.0037
Propylene	%	NA	ND	ND	NA	NA	NA	ND
Isobutane	%	NA	ND	ND	NA	NA	NA	ND
Normal Butane	%	NA	ND	ND	NA	NA	NA	ND
Isopentane	%	NA	ND	ND	NA	NA	NA	ND
Normal Pentane	%	NA	ND	ND	NA	NA	NA	ND
Hexane Plus	%	NA	ND	ND	NA	NA	NA	ND
$\delta^{13}C_{CH4}$	‰	NA	-73.52	-73.90	NA	NA	NA	-33.01
$\delta^{2}H_{CH4}$	‰	NA	-252.8	-251.0	NA	NA	NA	-166.0
$\delta^{13}C_{C2H6}$	‰	NA	NR	NA	NA	NA	NA	-37.16
$\delta^{13}C_{DIC}$	‰	NA	-14.14	-13.5	NA	-14.3	NA	-18.36
Specific Gravity		NA	0.915	0.913	NA	NA	NA	0.693
BTU		NA	156	155	NA	NA	NA	705
Helium dilution factor		NA	0.64	0.64	NA	NA	NA	0.46

Table B-8 Sample Results - Isotech Gas Isotopes (Northeastern Pennsylvania)

	Sample	GW14	GW14	GW14	GW15	GW15	GW15	GW16	GW16	GW16
	Sample Date	NA	4/24/12	5/9/13	NA	4/30/12	5/14/13	NA	4/30/12	5/14/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Helium	%	NA	NR	NA	NA	NR	NA	NA	NR	NR
Hydrogen	%	NA	NA	NA	NA	ND	NA	NA	ND	ND
Argon	%	NA	NA	NA	NA	1.78	NA	NA	1.19	1.19
Oxygen	%	NA	NA	NA	NA	3.57	NA	NA	2.03	2.09
Carbon dioxide	%	NA	NA	NA	NA	0.66	NA	NA	0.42	0.35
Nitrogen	%	NA	NA	NA	NA	90.34	NA	NA	59.81	65.42
Carbon monoxide	%	NA	NA	NA	NA	ND	NA	NA	ND	ND
Methane	%	NA	NA	NA	NA	3.64	NA	NA	36.33	30.8
Ethane	%	NA	NA	NA	NA	0.0111	NA	NA	0.215	0.144
Ethene	%	NA	NA	NA	NA	ND	NA	NA	ND	ND
Propane	%	NA	NA	NA	NA	0.0003	NA	NA	0.0034	0.0024
Propylene	%	NA	NA	NA	NA	ND	NA	NA	ND	ND
Isobutane	%	NA	NA	NA	NA	ND	NA	NA	ND	ND
Normal Butane	%	NA	NA	NA	NA	ND	NA	NA	ND	ND
Isopentane	%	NA	NA	NA	NA	ND	NA	NA	ND	ND
Normal Pentane	%	NA	NA	NA	NA	ND	NA	NA	ND	ND
Hexane Plus	%	NA	NA	NA	NA	ND	NA	NA	ND	ND
$\delta^{13}C_{CH4}$	‰	NA	NA	NA	NA	-42.17	NA	NA	-39.41	-40.91
$\delta^{2}H_{CH4}$	‰	NA	NA	NA	NA	-176.7	NA	NA	-170.4	-169.0
$\delta^{13}C_{C2H6}$	‰	NA	NA	NA	NA	NR	NA	NA	-37.7	-37.3
$\delta^{13}C_{DIC}$	‰	NA	NA	-17.4	NA	-15.88	-15.4	NA	-16.26	-15.8
Specific Gravity		NA	NA	NA	NA	0.968	NA	NA	0.827	0.850
BTU		NA	NA	NA	NA	37	NA	NA	372	314
Helium dilution factor		NA	NA	NA	NA	0.70	NA	NA	0.64	0.62

Table B-8 Sample Results - Isotech Gas Isotopes (Northeastern Pennsylvania)

	Sample	GW17	GW17	GW18	GW18	GW19	GW20	GW20	GW21	GW22
	Sample Date	NA	4/30/12	NA	4/28/12	NA	10/31/11	4/28/12	NA	NA
Parameter	Unit	Round 1	Round 2	Round 1	Round 2	Round 1	Round 1	Round 2	Round 1	Round 1
Helium	%	NA	NR	NA	NR	NA	NA	NR	NA	NA
Hydrogen	%	NA	ND	NA	ND	NA	ND	ND	NA	NA
Argon	%	NA	0.524	NA	1.16	NA	1.07	0.659	NA	NA
Oxygen	%	NA	1.27	NA	2.41	NA	4.00	1.69	NA	NA
Carbon dioxide	%	NA	0.14	NA	0.50	NA	0.55	0.35	NA	NA
Nitrogen	%	NA	27.21	NA	61.04	NA	55.90	30.00	NA	NA
Carbon monoxide	%	NA	ND	NA	ND	NA	ND	ND	NA	NA
Methane	%	NA	70.82	NA	34.36	NA	37.98	66.58	NA	NA
Ethane	%	NA	0.0364	NA	0.535	NA	0.495	0.714	NA	NA
Ethene	%	NA	ND	NA	ND	NA	ND	ND	NA	NA
Propane	%	NA	0.0003	NA	ND	NA	0.0007	0.0026	NA	NA
Propylene	%	NA	ND	NA	ND	NA	ND	ND	NA	NA
Isobutane	%	NA	ND	NA	ND	NA	ND	ND	NA	NA
Normal Butane	%	NA	ND	NA	ND	NA	ND	ND	NA	NA
Isopentane	%	NA	ND	NA	ND	NA	ND	ND	NA	NA
Normal Pentane	%	NA	ND	NA	ND	NA	ND	ND	NA	NA
Hexane Plus	%	NA	ND	NA	ND	NA	ND	ND	NA	NA
$\delta^{13}C_{CH4}$	‰	NA	-46.46	NA	-31.82	NA	-32.32	-33.32	NA	NA
$\delta^{2}H_{CH4}$	‰	NA	-202.3	NA	-168.0	NA	-165.4	-173.7	NA	NA
$\delta^{13}C_{C2H6}$	‰	NA	-38.2	NA	-36.2	NA	-36.3	-36.4	NA	NA
$\delta^{13}C_{DIC}$	‰	NA	-12.91	NA	-17.48	NA	-17.78	-17.62	NA	NA
Specific Gravity		NA	0.679	NA	0.837	NA	0.824	0.700	NA	NA
BTU		NA	718	NA	357	NA	393	687	NA	NA
Helium dilution factor		NA	0.33	NA	0.63	NA	0.58	0.53	NA	NA

Table B-8 Sample Results - Isotech Gas Isotopes (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW23 NA Round 1	GW24 NA Round 1	GW25 NA Round 1	GW26 NA Round 1	GW26 4/24/12 Round 2	GW26 5/15/13 Round 3	GW27 NA Round 1	GW27 4/24/12 Round 2	GW27 5/9/13 Round 3
Helium	%	NA	NA	NA	NA	NR	NA	NA	NR	NA
Hydrogen	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Argon	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Oxygen	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon dioxide	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon monoxide	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethene	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propane	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propylene	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isobutane	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Normal Butane	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isopentane	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Normal Pentane	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexane Plus	%	NA	NA	NA	NA	NA	NA	NA	NA	NA
$\delta^{13}C_{CH4}$	‰	NA	NA	NA	NA	NA	NA	NA	NA	NA
$\delta^{2}H_{CH4}$	‰	NA	NA	NA	NA	NA	NA	NA	NA	NA
$\delta^{13}C_{C2H6}$	‰	NA	NA	NA	NA	NA	NA	NA	NA	NA
$\delta^{13}C_{DIC}$	‰	NA	NA	NA	NA	NA	-14.6	NA	NA	-15.1
Specific Gravity		NA	NA	NA	NA	NA	NA	NA	NA	NA
BTU		NA	NA	NA	NA	NA	NA	NA	NA	NA
Helium dilution factor		NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B-8 Sample Results - Isotech Gas Isotopes (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW28 NA Round 1	GW28 5/15/13 Round 3	GW29 NA Round 1	GW29 5/1/12 Round 2	GW29 5/14/13 Round 3	GW30 NA Round 1	GW31 11/4/11 Round 1
Helium	%	NA	NA	NA	NR	NA	NA	NR
Hydrogen	%	NA	NA	NA	ND	NA	NA	ND
Argon	%	NA	NA	NA	1.68	NA	NA	1.58
Oxygen	%	NA	NA	NA	2.78	NA	NA	1.05
Carbon dioxide	%	NA	NA	NA	2.11	NA	NA	4.10
Nitrogen	%	NA	NA	NA	93.42	NA	NA	84.26
Carbon monoxide	%	NA	NA	NA	ND	NA	NA	0.079
Methane	%	NA	NA	NA	0.0110	NA	NA	8.91
Ethane	%	NA	NA	NA	ND	NA	NA	0.0174
Ethene	%	NA	NA	NA	ND	NA	NA	0.0003
Propane	%	NA	NA	NA	ND	NA	NA	0.0003
Propylene	%	NA	NA	NA	ND	NA	NA	ND
Isobutane	%	NA	NA	NA	ND	NA	NA	ND
Normal Butane	%	NA	NA	NA	ND	NA	NA	ND
Isopentane	%	NA	NA	NA	ND	NA	NA	ND
Normal Pentane	%	NA	NA	NA	ND	NA	NA	ND
Hexane Plus	%	NA	NA	NA	ND	NA	NA	ND
$\delta^{13}C_{CH4}$	‰	NA	NA	NA	NR	NA	NA	-57.50
$\delta^{2}H_{CH4}$	‰	NA	NA	NA	NR	NA	NA	-156.3
$\delta^{13}C_{C2H6}$	‰	NA	NA	NA	NR	NA	NA	NR
$\delta^{13}C_{DIC}$	‰	NA	-13.2	NA	-15.07	-14.8	NA	-24.38
Specific Gravity		NA	NA	NA	0.990	NA	NA	0.961
BTU		NA	NA	NA	0	NA	NA	91
Helium dilution factor		NA	NA	NA	0.68	NA	NA	0.68

Table B-8 Sample Results - Isotech Gas Isotopes (Northeastern Pennsylvania)

	Sample	GW32	GW32	GW32	GW33	GW33	GW33	GW36	GW36	GW37
	Sample Date	11/4/11	4/30/12	5/10/13	NA	4/30/12	5/10/13	4/26/12	5/13/13	5/10/13
Parameter	Unit	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 2	Round 3	Round 3
Helium	%	NR	NR	NR	NA	0.0137	0.0117	NR	NA	NR
Hydrogen	%	ND	ND	ND	NA	ND	ND	ND	NA	ND
Argon	%	1.65	1.50	1.57	NA	0.423	0.373	1.54	NA	0.613
Oxygen	%	6.85	5.33	5.02	NA	1.65	0.84	3.66	NA	2.39
Carbon dioxide	%	1.57	1.32	1.31	NA	0.085	0.10	2.99	NA	1.11
Nitrogen	%	86.54	78.21	84.78	NA	23.21	19.55	91.80	NA	30.82
Carbon monoxide	%	0.011	ND	ND	NA	ND	ND	ND	NA	ND
Methane	%	3.38	13.63	7.32	NA	74.56	79.04	0.0093	NA	64.16
Ethane	%	0.0010	0.0062	0.0026	NA	0.0540	0.0829	ND	NA	0.903
Ethene	%	ND	ND	ND	NA	ND	ND	ND	NA	ND
Propane	%	ND	ND	ND	NA	ND	0.0005	ND	NA	0.0006
Propylene	%	ND	ND	ND	NA	ND	ND	ND	NA	ND
Isobutane	%	ND	ND	ND	NA	ND	ND	ND	NA	ND
Normal Butane	%	ND	ND	ND	NA	ND	ND	ND	NA	ND
Isopentane	%	ND	ND	ND	NA	ND	ND	ND	NA	ND
Normal Pentane	%	ND	ND	ND	NA	ND	ND	ND	NA	ND
Hexane Plus	%	ND	ND	ND	NA	ND	ND	ND	NA	0.0004
$\delta^{13}C_{CH4}$	‰	-27.7	-38.80	-32.34	NA	-38.49	-38.30	NR	NA	-31.92
$\delta^{2}H_{CH4}$	‰	-79	-190.5	-145.1	NA	-217.5	-215.2	NR	NA	-163.3
$\delta^{13}C_{C2H6}$	‰	NR	NR	NA	NA	-28.0	-30.6	NR	NA	-37.1
$\delta^{13}C_{DIC}$	‰	-17.52	-17.71	-17.3	NA	-15.76	-14.9	-15.94	-15.4	-19.0
Specific Gravity		0.978	0.932	0.958	NA	0.663	0.644	0.995	NA	0.715
BTU		34	138	74	NA	757	803	0	NA	666
Helium dilution factor		0.71	0.65	0.68	NA	NR	NA	0.66	NA	0.47

Table B-8 Sample Results - Isotech Gas Isotopes (Northeastern Pennsylvania)

Parameter	Sample Sample Date Unit	GW38 5/10/13 Round 3	SW01 NA Round 1	SW01 4/30/12 Round 2	SW01 5/14/13 Round 3	SW02 NA Round 1	SW03 4/25/12 Round 2	SW04 4/25/12 Round 2	SW05 4/26/12 Round 2	SW06 4/26/12 Round 2
Helium	%	NR	NA	NR	NA	NA	NR	NR	NR	NR
Hydrogen	%	ND	NA	NA	NA	NA	NA	NA	NA	NA
Argon	%	0.742	NA	NA	NA	NA	NA	NA	NA	NA
Oxygen	%	1.23	NA	NA	NA	NA	NA	NA	NA	NA
Carbon dioxide	%	0.26	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen	%	37.73	NA	NA	NA	NA	NA	NA	NA	NA
Carbon monoxide	%	ND	NA	NA	NA	NA	NA	NA	NA	NA
Methane	%	59.24	NA	NA	NA	NA	NA	NA	NA	NA
Ethane	%	0.791	NA	NA	NA	NA	NA	NA	NA	NA
Ethene	%	ND	NA	NA	NA	NA	NA	NA	NA	NA
Propane	%	0.0025	NA	NA	NA	NA	NA	NA	NA	NA
Propylene	%	ND	NA	NA	NA	NA	NA	NA	NA	NA
Isobutane	%	ND	NA	NA	NA	NA	NA	NA	NA	NA
Normal Butane	%	ND	NA	NA	NA	NA	NA	NA	NA	NA
Isopentane	%	ND	NA	NA	NA	NA	NA	NA	NA	NA
Normal Pentane	%	ND	NA	NA	NA	NA	NA	NA	NA	NA
Hexane Plus	%	ND	NA	NA	NA	NA	NA	NA	NA	NA
$\delta^{13}C_{CH4}$	‰	-32.22	NA	NA	NA	NA	NA	NA	NA	NA
$\delta^{2}H_{CH4}$	‰	-163.9	NA	NA	NA	NA	NA	NA	NA	NA
$\delta^{13}C_{C2H6}$	‰	-37.4	NA	NA	NA	NA	NA	NA	NA	NA
$\delta^{13}C_{DIC}$	‰	-17.7	NA	NA	-15.4	NA	NA	NA	NA	NA
Specific Gravity		0.729	NA	NA	NA	NA	NA	NA	NA	NA
BTU		614	NA	NA	NA	NA	NA	NA	NA	NA
Helium dilution factor		0.47	NA	NA	NA	NA	NA	NA	NA	NA

Appendix C
Background Data
Retrospective Case Study in Northeastern Pennsylvania

U.S. Environmental Protection Agency
Office of Research and Development
Washington, DC

May 2015
EPA/600/R-14/088

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C.1. Land Use

This section presents descriptions of land uses in Bradford and Susquehanna counties as a whole, followed by descriptions of land uses in and around the sampling points of this study. Building on information provided in the Study Area Background section in the main body of this report, information on the use of agricultural land was obtained from the Cropland Data Layer, produced by the US Department of Agriculture's National Agricultural Statistics Service, which contains data on agricultural uses of land based on satellite imagery and extensive agricultural ground checking of the imagery. This layer provides data on agricultural uses of land. Figures C1a and C1b show land uses, including the agricultural uses of land, in Bradford and Susquehanna counties in 2012. Tables C1a and C1b show the percentages of county land devoted to the largest agricultural uses. Other hay/non-alfalfa (i.e., animal fodder), corn, and fallow/idle cropland were the largest uses of agricultural land in both counties.

While the data from the National Land Cover Database for 1992 and 2006 are not directly comparable, it is possible to compare data from 1992 to that from 2001, and to then compare data from 2001 to that from 2006 to identify land use changes (Multi-Resolution Land Characteristics Consortium, 2013.) Figures C2a and C2b show changes in land use in Bradford and Susquehanna counties between 1992 and 2001 and between 2001 and 2006, respectively. Tables C2a and C2b present data on the changes in land use in the two counties in the two sub-periods. It can be seen from the tables that only a tiny proportion of the land in the counties changed use in either sub-period.

Figures C3a and C3b show population totals for Bradford and Susquehanna counties (i.e., an indicator of the intensity of land use) for each census year from 1950 to 2010. (US Census Bureau, 2013a-e) Prior to 1980, the population of Bradford County was growing slightly, and since 1980 it has declined slightly. The population of Susquehanna County has grown at a modest rate throughout the period (i.e., at an annual average growth rate of approximately 0.5 per cent per year over the period 1980 to 2010). In 2011, the population density in Bradford County was approximately 55 persons per square mile, and the population density in Susquehanna County was approximately 53 persons per square mile, whereas the population density for the entire state was approximately 285 persons per square mile (US Census, 2012a). In 2010, the percentages of the land taken up by urban areas (another indicator of the intensity of land use) in Bradford and Susquehanna counties were 0.9% and 0.5%, respectively, as compared to 10.5 per cent for the entire state (US Census Bureau, 2012b).

Employment is another broad indicator of land use in a county. Table C3 shows the largest industries, by employment, in Bradford and Susquehanna counties. The production industries (i.e., manufacturing and mining) accounted for 23% of employment in Bradford County and 15% of employment in Susquehanna County.

C.2. Search Areas

The record search areas were based on 1- and 3-mile-radius areas centered around a single EPA sampling point or a cluster of EPA sampling points. These search areas were chosen based on professional judgment considering the large size of the study area, as described below. One- to 3-mile-radius search areas were used to acquire environmental data search reports and for oil and gas well inventory searches; however, only 1-mile-radius search areas were used for notices of violations searches (as described in the sections below). Land use data was collected on a countywide basis, and descriptions of land use were provided for each search area. In general, each 1- to 3-mile-radius search area extended outward from either a specific sampling location or the mean center point of a cluster of sampling locations.

In Bradford County, four 3-mile search areas and four 1-mile search areas were used to capture the EPA sampling points. In Susquehanna County, one 3-mile search area and one 1-mile search area were used to capture the EPA sampling points.

C.2.1. Land Use

Figures C4 through C13, which were created using data from the National Land Cover Database, present land use maps of Bradford County Search Areas A, B, C, D, E, F, G, and H and Susquehanna County Search Areas A and B, respectively, for 1992 and 2006. Tables C4 through C13 present data on land use in Bradford County Search Areas A, B, C, D, E, F, G, and H and Susquehanna County Search Areas A and B, respectively, for 1992 and 2006. Bearing in mind that the land use data for the two years are not comparable due to methodological differences, they do, however, indicate that forest cover and planted/cultivated land accounted for the vast majority of land use in all of the search areas in both years.

C.2.2. Crop Land

Figures C14 through C23 show land uses, including the agricultural uses of land, in Bradford County Search Areas A, B, C, D, E, F, G, and H and Susquehanna County Search Areas A and B, respectively, in 2012. Tables C14 through C23 show, respectively, the percentages of land in Bradford County Search Areas A, B, C, D, E, F, G, and H and Susquehanna County Search Areas A and B devoted to the largest agricultural uses. Other hay/non-alfalfa (i.e., animal fodder), corn, and fallow/idle cropland were typically the largest uses of agricultural land in each of the search areas.

C.2.3. Land Use Changes

Figures C24 through C33 show land use changes in Bradford County Search Areas A, B, C, D, E, F, G, and H and Susquehanna County Search Areas A and B, respectively, between 1992 and 2001 and between 2001 and 2006. Tables C24 through C33 present data on the changes in land use in the two sub-periods. It can be seen from the tables that, in general, either only a tiny proportion of the land in each search area changed use in both sub-periods or there was little change in the sub-period 1992 to 2001 and no change in the sub-period 2001 to 2006.

C.3. Environmental Records Search

Environmental record searches for the Bradford County and Susquehanna County areas were performed by Environmental Data Resources, Inc. (EDR). EDR provides a service for searching publically available databases and also provides data from their own proprietary databases. The database searches included records reviews of several federal, state, tribal, and EDR proprietary environmental databases for the two study areas with regard to the documented use, storage, or release of hazardous materials or petroleum products (see Attachment 1).[1]

The identified records included historically contaminated properties; businesses that use, generate, transport, or dispose of hazardous materials or petroleum products in their operations; active contaminated sites that are currently under assessment and/or remediation; sites that have NPDES and SPDES permits; and active and abandoned mines and landfills. All properties listed on the Environmental Records Search Report were reviewed and screened based on the EDR record search findings to determine whether they are potential candidate causes. The criteria used for the screening include relevant environmental information (including, but not limited to, notices of relevant violations [i.e., violations that could result in contamination to the environment as opposed to administrative violations], current and historical use of the site, materials and wastes at the site, and releases and/or spills) and distance from the sampling points. As a general rule, sites that were more than 1.5 miles from a particular sampling point were generally not considered as a potential candidate cause because of the long travel time necessary for the contaminant to migrate. However, sites at greater distances were considered based on the magnitude and type of the release.

Sites that EDR could not automatically map due to poor or inadequate address information in the searched databases were not included on the EDR Radius Map. However, EDR determined that, based on the limited address information available, it is possible that these sites could be located within the stated search radius (e.g., zip code listed within searched radius) and are, therefore, listed on the Environmental Records Search Report as "orphan" sites. All of the orphan sites were screened to the extent possible based on limited information on those sites available through additional searches of the databases listed above and information obtained through Internet searches (EPA website and state websites). Additionally, through a more extensive review of the available records (including EnviroFacts, business listings, etc.), a location was determined for most orphan sites, and their approximate distance from the sampling points was measured on a map.

C.3.1. Oil and Gas Well Inventory

Well inventories were prepared for the same search areas described above for the EDR reports. All oil and gas wells within these areas were selected for review. Specific focus was placed on wells within 1 mile of EPA sampling locations.

C.3.2. State Record Summary

The Pennsylvania Department of Environmental Protection (PADEP) Web site containing Pennsylvania's Environment Facility Application Compliance Tracking System (eFACTS at http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_site.aspx) was used to find up-to-date well records for

[1] Note: Environmental Data Resources, Inc. (EDR) does not search the EnviroFacts and its associated EnviroMapper databases; however, it searches 19 of the 20 environmental databases covered by EnviroFacts, either as standalone databases (such as CERCLIS, RCRA, TSCA, etc.) or as databases searched as part of the Facility Index System/Facility Registry System (FINDS) database. The only EnviroFacts database that is not reviewed as part of an EDR search is the Cleanups in My Community (Cleanup) database, which maps and lists areas where hazardous waste is being or has been cleaned up throughout the United States. However, it is likely the information in the Cleanup database is also found in other databases that are part of EDR searches.

wells within the search radii. The database provides information on inspection and pollution prevention visits, including a listing of all inspections that have occurred at each well on record, whether violations were noted, and any enforcement that may have resulted. The system provides multiple options to search for records. Due to the large number of wells in each study area, the record search was performed only on oil and gas wells within a 1-mile radius of each EPA sampling point.

C.4. Evaluation of Data for Bradford County

C.4.1. Environmental Records Search Report Summary

Eight separate search radii (search areas A through H) were established to perform database searches that captured the Bradford County sampling points (see Figure C34a). The search radii for Search Areas A through H ranged from 1 mile to 3 miles; Areas A, B, C, and F each had a 3-mile radius, and Areas D, E, G, and H each had a 1-mile radius. The database search located 15 mapped records within these search areas. An additional 104 orphan sites were identified during the searches. Some of the records were identified in more than one database; therefore, the actual number of sites is less than the 119 records identified. Orphan sites are those sites with poor locational information in the databases that may or may not exist outside the actual search radius. An attempt was made to locate these sites with information available in the reports and through Internet searches to aid in determining the potential of these sites as a candidate cause. The evaluations of these sites are summarized in Table C34.

Thirty-one incident/record/sites identified in the EDR databases were retained as potential candidate causes, as described below:

- **Historic Landfills (HIST LF) –** This database contains a listing of inactive nonhazardous facilities, solid waste facilities, or abandoned landfills, although portions of this database are no longer maintained by the PADEP. Landfills are potential sources of methane. One HIST LF site, an abandoned landfill about 1.4 miles east of NEPAGW31, was retained.
- **Leaking Storage Tanks –** Includes sites listed in one of three databases: Underground Storage Tank (UST) contains a list of registered USTs regulated under the Resource Conservation and Recovery Act (RCRA); Leaking Underground Storage Tank (LUST) Incident Reports contains an inventory of reported leaking USTs that comes from the Department of Environmental Resources' list of confirmed releases; and Aboveground Storage Tank (AST) contains a list of registered ASTs from PADEP's listing of Pennsylvania regulated ASTs. A total of 14 UST and two AST sites were retained. Four of the sites are located near NEPAGW31 (one site is 1.10 miles northwest, two sites are about 0.80 miles north, and one site is 0.97 miles northeast). The other 12 sites were orphans included as potential contributors to groundwater quality impacts due to their proximity to the nearest sampling point or because the location could not be determined.
- **Facility Index System (FINDS) -** This database contains both facility information and other sources of information from the EPA/ National Technical Information Service (NTIS). A total of three FIND sites were retained: one site 0.98 miles northeast of NEPAGW31 has ignitable and reactive wastes; one site about 0.88 miles north of NEPAGW31 had a PAH and Fuel Oil No. 2 soil cleanup; and one site, a quarry west of Towanda on the north side of Route 6, could not be ruled out as potential contributor without knowing the location of the quarry.

- **Federal RCRA Generators List (RCRA-CESQG) –** This database is EPA's information system on sites that generate transport, store, treat, and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small-quantity generators (CESQGs) generate less than 100 kilograms (kg) of hazardous waste per month. A total of four RCRA sites were retained: one site about 1.06 miles northeast of NEPAGW31 generates cadmium, lead, benzene, methyl ethyl keytone (MEK), tetrachloroethylene (PCE), and trichloroethylene (TCE); the locations of the other three sites are unknown. Without further information about these three sites, particularly their locations, they cannot be ruled out as potential contributors to groundwater quality impacts.
- **Voluntary Cleanup Program (VCP) List –** This database lists sites involved in the Land Recycling Program that encourages the voluntary cleanup and reuse of contaminated commercial and industrial sites. A total of five VCP sites were retained: one site located about 0.4 miles northwest of NEPAGW26, 0.5 miles west of NEPAGW25, and 0.5 miles northwest of NEPAGW27 involves a brine water release from a tractor trailer in August 2010. The locations of the other four sites are unknown. Without further information about these three sites, particularly their locations, they cannot be ruled out as potential contributors to groundwater quality impacts.
- **EDR Hist Auto –** This database is a select list of business directories of potential gas station/filling station/service station sites that were available to EDR that may not show up in current government record searches. One EDR HIST Auto site, a potential gas station/filling station/service station site located about 0.8 miles north of NEPAGW31, was retained.
- **CERC-NFRAP (CERCLIS No Further Remedial Action Planned) -** This database contains sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL) unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that no hazard is associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site. One CERC-NFRAP site (Herrick Township Fill site) was retained as a potential candidate cause because it could be as close as 1 mile from NEPAGW31.

C.4.2. Oil and Gas Well Inventory Summary

As described above, the EPA sampling locations were compared with the inventory of wells identified in the EPA geographic information system (GIS) database files and PADEP database files as of June 1, 2013 (see Table C35).

There are 156 oil and gas wells in the Bradford County search areas (A through H). Of these wells, 75 are within 1 mile of an EPA sampling location (see Table C36). (Note: since some of the search areas overlap, the total number of wells in Table C35, which breaks down the number of wells by search area, is slightly more than the total number of wells in Table C36.)

In summary, there are numerous oil and gas production wells in the study area. The presence of numerous oil and gas wells increase the probability of one or more of these features being a potential candidate cause for methane migration.

C.4.3. State Record Summary

Notice of Violations (NOVs). All oil and gas wells within a 1-mile radius of EPA sampling points were researched for NOVs (see Table C37) by accessing Pennsylvania Department of Environmental Protection (PADEP) websites (NOV records as accessed in the eFACTS Facility Search website [http://www.ahs.dep.pa.gov/eFACTSWeb] and oil and gas compliance reports presented in website http://www.depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?/Oil_Gas/OG_Compliance). A list of notable violations indicating a potential candidate cause was also compiled (see Table 38).

PADEP NOV records and compliance reports indicated the following instances of discharges (drill cuttings/fluids/brine/residual waste) to Waters of the Commonwealth of Pennsylvania (see Table C38):

- **VANNOY 627108 2 and VANNOY 627108 3 –** NEPAGW03, NEPASW03, and NEPASW04 are approximately 0.1 miles southeast of these wells, and NEPAGW01 and NEPAGW02 are approximately 0.6 miles west of these wells. Several notable violations recorded during different inspections are listed below.
    - March 3, 2009, inspection (VANNOY 627108 2 only): Discharge of pollutional material to Waters of the Commonwealth. Compliance records indicated a Section 401 violation of fresh water flowing from two 500-barrel tanks located on site, eroding the ground surface and causing elevated turbidity in a nearby pond.
    - March 20, 2009, inspection: Failure to construct properly plugged fracturing brine pits; impoundment not structurally sound, impermeable, third-party protected, greater than 20 inches of seasonal high ground water table; Clean Streams Law - General (used only when a specific CLS code cannot be used); discharge of pollutional material to Waters of the Commonwealth. The associated compliance records indicate that hydrochloric acid was not contained in the pit, tank, or series of pits and tank, and a spill occurred on-site. The associated emergency response inspection of the hydrochloric acid spill at the site lead to multiple violations cited in the NOV issued on April 2, 2009, in conjunction with the March 27, 2009, follow-up inspection. The compliance record for an on-site meeting conducted on April 1, 2009, to discuss the previous acid spill and violations, noted that 21 roll-offs of acid-impacted soils had been removed and that the hydrochloric acid release was estimated at 10 barrels, with further enforcement pending.
    - July 23, 2009, inspection: O&G Act 223 - General violation (used only when a specific O&G Act code cannot be used). The compliance record noted the following: By allowing drill cuttings and fluid to be in direct contact with the ground surface without containment, and thus threatening Waters of the Commonwealth, Chesapeake Appalachia, LLC has violated 25 PA Code § 78.56(a), Section 301 of the Solid Waste

Management Act, 35 P.S § 6018.301, Section 307(a) of the Clean Streams Law, 35 P.S. §691.307(a), Section402(a) of the Clean Streams Law, 35 P.S. §691.402(a) and the rules and regulations of the PADEP.

  - November 5, 2009, inspection: Discharge of pollutional material to Waters of Commonwealth; Clean Streams Law-General violation; O&G Act 223 - General violation. The compliance record indicates pond impact (Waters of the Commonwealth): the pond adjacent to well pad was sampled and found to have low pH and oil and gas constituents.

- **CRANRUN 2H –** Industrial waste discharged without permit was cited on October 20, 2010. NEPAGW36 is approximately 0.3 miles northwest of this well, and NEPAGW07 is approximately 1.0 mile east-northeast of this well.
- **ATGAS 2H –** Pit and tanks not constructed with sufficient capacity to contain pollutional substances; discharge of pollutional material to Waters of Commonwealth; and stream discharge of industrial waste, including drill cuttings, oil, brine, and/or silt. These violations were cited on April 22, 2011. In July 2012, the following violations were cited: failure to adopt pollution prevention measures required or prescribed by PADEP by handling materials that create a danger of pollution; and failure to properly control or dispose of industrial or residual waste to prevent pollution of the Waters of the Commonwealth. The associated compliance records indicated a 30-gallon flowback spill. NEPAGW36 is approximately 1.1 miles east-northeast of this well, and NEPAGW07 is approximately 0.1 miles northwest of this well.
- **WELLES 1 3H and WELLES 1 5H –** Site conditions present a potential for pollution to Waters of the Commonwealth; Clean Streams Law - General violation; and O&G Act 223 - General violation. Inspection comments on the compliance record indicate a self-reported pit leak that was fixed. Soil analytical results reviewed on September 2, 2009, reported barium at 171 milligrams per kilogram (mg/kg) (less than Act 2 standard [8,200 mg/kg]) and chloride at 170 mg/kg (no Act 2 standard). No remediation needed. Additional information in the compliance record includes the following comments: failure to manage residual waste; unpermitted discharge of industrial waste; failure to follow discharge requirements; and discharge of drilling-contaminated fluids to the ground. These violations were cited on August 7, 2009. NEPAGW18 and NEPAGW19 are approximately 0.8 miles southeast of these wells; NEPAGW20 is approximately 0.9 miles southeast of these wells; NEPAGW13 is approximately 0.9 miles southeast of these well; and NEPA GW31 is approximately 2.1 miles northeast of these wells.
- **WELLES 3 2H –** On September 25, 2013, the PADEP arrived at the site at 11:20 p.m. in response to a 25-gallon spill of an unknown material. Chesapeake reported the spill incident to the Department at 6:42 p.m. on September 25, 2013. The Marcellus incident report indicates the spill occurred as Chesapeake was getting ready to move fracturing equipment. The crew was moving a dumpster not on containment and in the process of cleaning it out. The report alleges a liquid, most likely water, leaked out of the container. The liquid impacted the soil around the dumpster, and Chesapeake already scraped the soil and staged it on containment for removal. The following violations were cited during the follow-up inspection on November 25, 2013: failure to adopt pollution prevention measures required or prescribed by the PADEP by handling

materials that create a danger of pollution; pit and tanks not constructed with sufficient capacity to contain pollutional substances; and failure to properly store, transport, process, or dispose of a residual waste. The associated compliance records indicate that Chesapeake submitted a report to the PADEP on November 18, 2013, in relation to the September 25, 2013, brine spill of approximately 25 gallons released to the soil. The PADEP reviewed the post-excavation sampling results on November 22, 2013, and concluded that although some evidence of the spill may remain, there are no compounds of concern above their relevant cleanup standards, and there is no need for additional soil remediation with respect to this spill. This well is approximately 1.5 miles west of NEPAGW31; 0.7 miles north of NEPAGW18 and NEPAGW19; 0.8 miles north of NEPAGW20; and 0.9 miles north of NEPAGW13.

- **OTTEN 626935 1H –** NEPAGW06 is approximately 0.7 miles east-northeast of this well; NEPAGW05 is approximately 0.9 miles east-northeast of this well; NEPAGW27 is approximately 1.5 miles northeast of this well; and NEPAGW25 and NEPAGW26 are 1.6 miles northeast of this well. Several notable violations recorded during different inspections are listed below.
    - February 19, 2009, inspection: O&G Act 223 - General. The associated compliance record indicates the presence of residual waste on ground surface and failure to report a release. Additionally, comments from the subsequent July 1, 2009, compliance evaluation inspection indicate that, during a site inspection on February 19, 2009, it was noted that uncontained drilling fluids were located on the surface of the well pad and also located off-site, downgradient of the fill slope. During the compliance evaluation inspection, it was verified that the previously spilled drilling fluids had been excavated as previously indicated; however, the fill slope had not been properly stabilized, and the silt fence at the base of the fill slope was not properly installed to minimize erosion potential. A subsequent compliance evaluation inspection on August 21, 2009, indicated that all spill areas were checked and appeared to be in order.
    - June 15, 2010, inspection: Discharge of pollutional material to Waters of Commonwealth; and Administrative Code - General. The associated compliance record indicates brine spill outside of secondary containment.
    - August 19, 2010, inspection: Failure to properly store, transport, process, or dispose of a residual waste. Compliance record indicates presence of waste all over ground at the site.
    - June 7, 2011, inspection: A complaint was filed with the PADEP regarding potential contamination at this site. During the inspection, a small area approximately 1 to 2 feet in diameter with approximately 2 to 3 gallons of standing water was noted below a clean-out in the pipeline area, relatively close to the site entrance. An EXTECH meter was used to measure conductivity of the water. The meter read (OL), which means over the limit in conductivity. Sample analysis of the water was performed using SAC 046. No violations were cited for this inspection.
- **CLAUDIA 2H –** Polluting substance(s) allowed to discharge into Waters of the Commonwealth; Clean Streams Law - General; and site conditions present a potential for pollution to Waters of the Commonwealth. The associated compliance records indicate that frac-out had released bore gel to stream, and petroleum product spilled to the ground with potential to enter the

stream. Violation comments noted adequate company response and that the bore gel amount was unknown but was estimated to be small based on similar incidents. These violations were cited on May 7, 2010. NEPAGW10 is approximately 1.0 miles east-northeast of this well; NEPAGW14 is approximately 1.1 miles northeast of this well; NEPAGW25 is approximately 0.8 miles west-northwest of this well; NEPAGW26 is approximately 0.9 miles west of this well; NEPAGW27 is approximately 0.8 miles west-southwest of this well; NEPAGW05 is approximately 1.5 miles southwest of this well; and NEPAGW06 is approximately 1.6 miles southwest of this well.

- **Dave 2H –** on April 28, 2011, the following violations were noted in the record:
    - Discharge of pollutional material to waters of the Commonwealth; and
    - There is a potential for polluting substance(s) reaching Waters of the Commonwealth and may require a permit.
- **Dave 2H –** on May 4, 2011, polluting substance(s) allowed to discharge into Waters of the Commonwealth.

Additionally, the following inspection and NOVs of insufficient or improperly cemented casing and reports of excessive casing seat pressure, which could lead to methane contamination, were considered notable violations even though a confirmed release was not found in the records.

- **Balduzzi 2H –** Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Compliance record indicates 100% LEL spike off of 13⅜-inch vent port, and 90% LEL combustible gas constant off of 13⅜-inch vent port. The date of the violation was May 18, 2011. A subsequent inspection (6/17/11) noted 80% combustible gas vented off of 13⅜-inch vent port. This well is approximately 0.4 miles southeast of NEPAGW12.
- **Balduzzi 5H** – Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Compliance records indicate 10% combustible gas coming off of the 13⅜-inch vent port. The date of the violation was June 17, 2011. This well is approximately 0.4 miles southeast of NEPAGW12.
- **Stalford 5H –** Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Compliance record indicates three-string design and 13⅜-inch port venting 60% combustible gas, and 9⅝-inch port venting 90-100% combustible gas. Date of the violation was June 17, 2011. This well is approximately 0.9 miles southwest of NEPAGW11.
- **Coates 2H** – Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Compliance records indicate 60% combustible gas off of vent. Violation was reported on August 18, 2011. This well is located approximately 0.9 miles southeast of NEPAGW29 and 1.1 miles southwest of NEPAGW28.
- **Brackman 2H –** Excessive casing seat pressure reported on July 1, 2010. This well is approximately 0.6 miles northwest of NEPAGW36 and 1.7 miles west-northwest of NEPAGW07.

- **ANDRUS UNIT 1H –** Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Violation was cited on February 28, 2012. This well is approximately 0.3 miles east of NEPAGW04, NEPASW05, and NEPASW06.
- **Schlapfer S BRA 2H –** On August 31, 2012, failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days.
- **Crawford 4H – O**n March 4 and April 8, 2011, failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Compliance records indicate: Bubbling in cellar. 0% combustible gas coming off annuli. Needs further investigation and follow-up inspection.
- **Dave 2H** – On February 10, 2012, failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days.

Additionally, the following NOVs were issued for violations that could potentially lead to releases, but for which there were no documented discharges to Waters of the Commonwealth of Pennsylvania in the records:

- Failure to properly control or dispose of industrial or residual waste to prevent pollution of Waters of the Commonwealth.
- Failure to maintain 2 feet of freeboard in an impoundment.
- Failure to minimize accelerated erosion, implement Erosion and Sediment Control (E & S) plan, and maintain E&S controls. Failure to stabilize site until total site restoration.
- Failure to properly store, transport, process, or dispose of a residual waste.
- No Control and Disposal/Preparedness, Prevention, and Contingency (PPC) plan or failure to implement PPC plan.
- Failure to maintain control of anticipated gas storage reservoir pressures while drilling through reservoir or protective area.
- Improperly lined pit.
- Industrial waste was discharged without permit.

C.5. Evaluation of Data for Susquehanna County

C.5.1. Environmental Records Search Report Summary

One 3-mile search radius and one 1-mile search radius (search areas) were established to perform database searches that captured the EPA sampling points (see Figure C34b).

The database search identified 12 mapped records within this search area. An additional 52 orphan sites were identified during the searches. Some of the records were identified in more than one database; therefore, the actual number of sites is less than the 64 records identified. Orphan sites are those sites with poor locational information in the databases that may or may not exist outside the actual search radius. An attempt was made to locate these sites with information available in the reports and through Internet searches to aid in determining the potential of these sites as a candidate cause. The evaluations of these sites are summarized in Table C39.

Candidate causes:

- **US HIST AUTO STAT –** This database lists sites that are historical gas or service stations. Three sites (Steve's Auto Body, and two facilities called Rich's Auto Services) were retained because they were within 1 mile of NEPAGW24. Although no details were available, they were retained because they may have had petroleum releases.
- **UNREG LTANKS –** This database lists sites with leaking unregulated storage tanks. One site (Betty J. Scalzo residence) and one orphan site (Thomas Franks residence) were retained as potential candidate causes due to a fuel oil No. 2 releases. Date and other details for the releases are unknown.
- **Orphan LUST, UST –** This database lists sites with storage tank releases. Two sites were retained (Great Bend Travel Plaza and Exxon Service Station) as potential candidate causes because both are within 1 mile of NEPAGW24 and both had either diesel or gasoline releases.
- **Orphan: Voluntary Cleanup Program (VCP) List –** This database lists sites involved in the Land Recycling Program, which encourages the voluntary cleanup and reuse of contaminated commercial and industrial sites. A total of six VCP sites were retained. The Teel Property, located 2 miles southwest of NEPAGW21, had violations for allowing the discharge of polluting substances into Waters of the Commonwealth. The R Hull 2H Well Site, located about 1.5 miles northwest of NEPAGW21 and NEPAGW22, mentioned soil, diesel fuel, and inorganics contamination and had violations for allowing the discharge of polluting substances into Waters about 1.2 miles northwest of NEPAGW21 and NEPAGW22, involve soil cleanups and had violations for impoundments and for allowing the discharge of polluting substances into Waters of the Commonwealth. The Eugene Lecher residence, located less than 1 mile from NEPAGW24, had a kerosene spill that impacted soils. This spill was closed on February 27, 2001. This site was also listed in the unregulated leaky tanks database. Lastly, violations at the Knapik well pad are unknown, and without further information about this site, particularly the location, it cannot be ruled out as a potential contributor to groundwater quality impacts.

C.5.2. Oil and Gas Well Inventory Summary

As described above, the EPA sampling locations were compared with the inventory of wells identified in the EPA GIS database files and PADEP database files as of June 1, 2013 (see Table C40).

There are 111 oil and gas wells in the Susquehanna County search areas (A and B), 30 of which are within 1 mile of EPA sampling points (see Table C36).

In summary, there are numerous oil and gas production wells in the study area. The presence of numerous oil and gas wells increase the probability of one or more of these features being a potential candidate cause for methane migration.

C.5.3. State Record Summary

Notice of Violations (NOVs). All oil and gas wells within a 1-mile radius of EPA sampling points were researched for NOVs (see Table C41) by accessing PADEP's eFACTS and oil and gas compliance reports online. A list of notable violations indicating a potential candidate cause was also compiled (see Table

42). Several NOVs were identified that could potentially lead to discharges but were not linked to documented discharges to Waters of the Commonwealth of Pennsylvania, including:

- Failure to design, implement, or maintain best management practices (BMPs) to minimize the potential for accelerated erosion and sedimentation.
- Failure to properly control or dispose of industrial or residual waste to prevent pollution of Waters of the Commonwealth.
- Failure to maintain 2 feet of freeboard in an impoundment.
- Pit and tanks not constructed with sufficient capacity to contain polluting substances.
- Failure to properly store, transport, process, or dispose of a residual waste.
- No Control and Disposal/PPC plan or failure to implement a PPC plan.

Reported violations indicated the following documented discharges to Waters of the Commonwealth of Pennsylvania:

- **Gesford 3 –** Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. This was reported on May 5, 2009. This well is 0.9 miles west-southwest of NEPAGW23 and 1.1 miles north-northwest of NEPAGW21 and NEPAGW22 (see Table C41). Compliance records indicate defective casing or cementing; failure to prevent migration of gas or other fluids into sources of fresh groundwater; and O&G Act 601.201(f) failure to submit written notice of intent to plug well or amend plat. Methane was detected at an elevated level only in NEPAGW23.
- **Gesford 9 –** Compliance records indicated a spill of approximately 100 gallons of diesel on pad; day tank on Air Pak unit overflowed; GDS soaked up fuel with pads and scraped up soil. The spill occurred on August 19, 2009, at approximately 9:00 a.m. This well is approximately 0.9 miles west-south west of NEPAGW23; 1.1 miles north-northwest of NEPAGW22; and 1.1 miles north-northwest of NEPAGW21.
- **Teel Unit 1H –** Compliance records for an inspection on April 30, 2010, indicate a previous citation for cuttings blown beyond reserve pit and cuttings have not been cleaned up (continuing violation of 25Pa section 78.54); a tear was observed in the reserve pit liner, approximately 8 inches above fluid level (violation of 78.56 a(2)). This well is approximately 1.8 miles southwest of NEPAGW23; 0.5 miles southwest of NEPAGW22; and 0.4 miles southwest of NEPAGW21.
- **Teel Unit 2H –** This well is approximately 1.6 miles southwest of NEPAGW23; 0.3 miles southwest of NEPAGW22; and 0.3 miles southwest of NEPAGW21. There were several instances of discharges, including the following:
  - Discharge of pollutional material to Waters of the Commonwealth. This was reported on July 21, 2010.
  - There is a potential for polluting substance(s) to reach Waters of the Commonwealth and may require a permit. This was reported on January 10, 2011. Compliance records indicated a self-reported spill of approximately 150 barrels of treated and untreated flow-back from a partially open valve on blender, partially on containment, response

recovering unfrozen material, contaminated material to be removed and Act 2 characterization to be performed.

- o Discharge of industrial waste to Waters of the Commonwealth without a permit. This was reported on January 31, 2011. Compliance records indicate contractor discharging flow-back onto ground surface while PADEP on site; less than 5 gallons observed; and no containment in area of discharge.

- **Teel 5 –** Nonadministrative violations included: failure to minimize accelerated erosion, implement an E & S plan, maintain E & S controls, and stabilize the site until total site restoration under O & G Act Section 206(c)(d) on June 3, 2008; and failure to maintain 2 feet of freeboard on an impoundment on September 3, 2008. This well is located 1.7 miles southwest of NEPAGW23 and 0.4 miles southeast of NEPAGW21 and NEPAGW22.
- **Teel Unit 4 –** Discharge of industrial waste to Waters of the Commonwealth without a permit. This was reported on January 31, 2011. Compliance records indicated operator discharging flow-back to site; less than 5 gallons observed being discharged to ground; no containment in place. Based on the small amount discharged, this NOV is not considered a notable violation.
- **Teel 2 –** Nonadministrative violations included: failure to maintain 2 feet of freeboard on an impoundment on April 7, 2008; and failure to minimize accelerated erosion, implement an E & S plan, maintain E & S controls, and stabilize the site until total site restoration under O & G Act Section 206(c)(d) on September 10, 2008. This well is located 1.6 miles southwest of NEPAGW23 and 0.3 miles southeast of NEPAGW21 and NEPAGW22.
- **Lewis 1 –** Discharge of pollutional material to Waters of the Commonwealth. This was reported on August 20, 2008. This well is approximately 1.6 miles southwest of NEPAGW23; 0.7 miles northwest of NEPAGW22; and 0.7 miles northwest of NEPAGW21. Compliance records indicated that the violation was noted and immediately corrected.
- **ELY 7H SE –** No Control and Disposal/PPC plan or failure to implement a PPC plan. Compliance records indicated an unpermitted discharge of diesel fuel at the site on August 6, 2009 (violation of Chapter 78.54 of the Rules and Regulations of the Environmental Quality Board, 25 PA Code, § 78.54 General Requirements). Violation was immediately corrected. It was reported on August 6, 2009. This well is located approximately 0.5 miles southwest of NEPAGW23, 1.1 miles north-northeast of NEPAGW22, and 1.1 miles north-northeast of NEPAGW21.
- **ELY 4 –** Compliance records indicated a spill of approximately 100 gallons, a violation of SWMA Section 301 for disposing diesel fuel to the ground. The spill was reported on February 2, 2009. This well is located approximately 1.0 mile southwest of NEPAGW23, 0.4 miles north-northeast of NEPAGW22, and 0.4 miles north-northeast of NEPAGW21.
- **ELY 4H –** Compliance records indicate the following: On August 20, 2009, a call was received reporting a spill of approximately 25 gallons of drilling mud on the location. The spill occurred due to a leaking mud hose on the rig. It was reported that the drilling mud was immediately contained and cleaned up and the leaking hose was replaced. The area where the drilling mud spilled was scraped with a backhoe, and the soil and mud was disposed of in the reserve pit on site. At the time of inspection, the area appeared to be clean and free of drilling mud. Some of the spilled drilling mud was contained in the cellar of the well. This mud was being pumped out

and into the reserve pit. The investigation revealed that an unpermitted discharge of drilling mud had occurred at the site. Such a discharge is a violation of Chapter 78.54. The violation was immediately corrected. This well is located 1 mile southwest of NEPAGW23, 0.4 miles northeast of NEPAGW21, and 0.3 miles northeast of NEPAGW22.

- **ELY 1H –** Compliance records indicated an un-permitted discharge of drilling mud occurred at the site (violation of Chapter 78.54). Violation was immediately corrected. A spill of approximately 25 gallons of drilling mud on location due to a leaking mud hose on the rig was reported on August 20, 2009 at approximately 10:00 a.m. It was reported that the drilling mud was immediately contained and cleaned up and the leaking hose was replaced; the area where the drilling mud spilled was scraped with a backhoe, and the soil and mud was disposed of in the reserve pit on site. At the time of inspection, the area appeared to be clean and free of drilling mud. Some of the spilled drilling mud was contained in the cellar of the well. This mud was being pumped out and into the reserve pit. Based on the small amount discharged, this NOV is not considered a notable violation.
- **Costello 1 –** Clean Streams Law - General (used only when a specific CLS code cannot be used); and O&G Act 223 - General (used only when a specific O&G Act code cannot be used). Compliance records indicate: SWMA 6018.401 violation for discharge of hazardous waste. It was reported on June 2, 2011. This well is approximately 1.1 miles southwest of NEPAGW23; 0.7 miles northwest of NEPAGW22; and 0.8 miles northwest of NEPAGW21.
- **Black 1H –** Non-administrative violations included: failure to maintain 2 feet of freeboard on an impoundment on July 30, 2008; failure to minimize accelerated erosion, implement an E & S plan, maintain E & S controls, and stabilize the site until total site restoration under O & G Act Section 206(c)(d) on September 10, 2008; and failure to properly store, transport, process, or dispose of a residual waste on March 15, 2011. This well is located approximately 1.7 miles south-southwest of NEPAGW23, 0.6 miles southeast of NEPAGW22, and 0.6 miles southeast of NEPAGW21.
- **Black 2H –** Inspection conducted on September 24, 2008, indicated the discharge of pollutional material to Waters of the Commonwealth and an improperly lined pit. Compliance record indicated solid waste on ground. This well is located approximately 1.7 miles south-southwest of NEPAGW23, 0.6 miles southeast of NEPAGW22, and 0.6 miles southeast of NEPAGW21.
- **Brooks 1H –** Discharge of pollutional material to Waters of the Commonwealth; stream discharge of industrial waste, including drill cuttings, oil, brine, and/or silt; and improperly lined pit. These were reported on June 18, 2009. This well is approximately 2.1 miles south-southwest of NEPAGW23; 1.0 miles southeast of NEPAGW22; and 0.9 miles southeast of NEPAGW21.
- **Ratzel 1H –** Non-administrative violations included: failure to minimize accelerated erosion, implement an E & S plan, maintain E & S controls, and stabilize the site until total site restoration under O & G Act Section 206(c)(d) on September 3, 2008, and May 13, 2011; and failure to maintain 2 feet of freeboard on an impoundment on April 13, 2010. On the back of the well pad is a small poly-lined reserve pit. A portion of the liner has sloughed into the fluid in the reserve pit. Based on inspection, the liner in the reserve pit has not been properly

maintained, and the reserve pit is currently in violation of freeboard requirements. This well is located approximately 0.2 miles west/northwest of NEPAGW23, 1.4 miles northeast of NEPAGW22, and 1.3 miles northeast of NEPAGW21.

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Appendix C Tables

Table C1a Major Agricultural Land Uses in Bradford County

Use	% of County Land
Other hay/non-alfalfa	24.8
Corn	3.9
Fallow/idle cropland	0.7
Alfalfa	0.4

Source: U.S. Department of Agriculture, 2012.

Table C1b Major Agricultural Land Uses in Susquehanna County

Use	% of County Land
Other hay/non-alfalfa	20.3
Corn	1.2
Fallow/idle cropland	0.4

Source: U.S. Department of Agriculture, 2012.

Table C2a Changes in Land Use, 1992 to 2001 and 2001 to 2006, in Bradford County

	% of County Land Area	
Change in Land Use	1992 to 2001	2001 to 2006
No change	98.5	99.7
Change in land use	1.5	0.3
- to agriculture	1.0	0.0
- to forest	0.3	0.1
- to urban	0.1	0.0
- other changes	0.1	0.2

Source US Geological Survey, 2012.
Note: Percentages may not sum to 100% due to rounding.

Table C2b Changes in Land Use, 1992 to 2001 and 2001 to 2006, in Susquehanna County

	% of County Land Area	
Change in Land Use	1992 to 2001	2001 to 2006
No change	97.2	99.8
Change in land use	2.8	0.2
- to agriculture	2.3	0.0
- to urban	0.2	0.0
- other changes	0.3	0.2

Source US Geological Survey, 2012.
Note: Percentages may not sum to 100% due to rounding.

Table C3 Largest Industries, by Employment, in Bradford and Susquehanna Counties

	Bradford County			Susquehanna County		
Industry	Number of Employees	Rank	% of All Industries Employment	Number of Employees	Rank	% of All Industries Employment
Health care and social assistance	5,087	1	21.0	1,309	1	13.7
Manufacturing	4,199	2	17.3	590	6	6.2
Retail trade	2,980	3	12.3	1,273	2	13.3
Accommodation and food services	1,414	4	5.8	974	4	10.2
Mining	1,337	5	5.5	822	5	8.6
Public administration	1,214	6	5.0	448	7	4.7
Transportation and warehousing	1,187	7	4.9	316	9	3.3
Construction	938	8	3.9	1,039	3	10.9
Professional, scientific, and technical services	668	9	2.8			
Other services (except public administration)				340	8	3.6%

Note: Data relate to the final quarter of 2012

Sources: Employment by Industry: Pennsylvania Department of Labor and Industry (2013), All Industries Employment: Bureau of Labor Statistics (2013)

Table C4 Land Use in Bradford County, Search Area A in 1992 and 2006

	1992		2006	
Land Use	Square Miles	% of Total	Square Miles	% of Total
Deciduous forest	13.1	46	9.6	34
Pasture/hay	5.0	18	1.9	7
Mixed forest	4.2	15	5.7	20
Evergreen forest	3.5	12	4.0	14
Row/cultivated crops	1.3	5	4.2	15
Open water	0.6	2	0.6	2
Developed	0.4	2	1.5	5
Other	0.3	0	0.9	3
Total	**28.4**	**100**	**28.4**	**100**

Source: US Geological Survey, 2012.

Note: Totals may not sum exactly due to rounding.

Table C5 Land Use in Bradford County, Search Area B in 1992 and 2006

Land Use	1992 Square Miles	1992 % of Total	2006 Square Miles	2006 % of Total
Deciduous forest	11.2	39	7.4	26
Pasture/hay	9.0	32	6.0	21
Row/cultivated crops	2.6	9	6.1	21
Mixed forest	2.2	8	3.6	13
Evergreen forest	1.6	6	1.8	6
Open water	1.2	4	1.1	4
Developed	0.3	1	1.6	6
Other	0.3	1	0.8	3
Total	**28.4**	**100**	**28.4**	**100**

Source: US Geological Survey, 2012.
Note: Totals may not sum exactly due to rounding.

Table C6 Land Use in Bradford County, Search Area C in 1992 and 2006

Land Use	1992 Square Miles	1992 % of Total	2006 Square Miles	2006 % of Total
Deciduous forest	12.2	43	7.8	27
Pasture/hay	8.4	30	6.0	21
Mixed forest	2.7	9	4.3	15
Row/cultivated crops	2.1	7	5.5	19
Evergreen forest	1.9	7	1.9	7
Open water	0.8	3	0.7	3
Developed	0.2	1	1.6	6
Other	0.1	0	0.6	2
Total	**28.4**	**100%**	**28.4**	**100**

Source: US Geological Survey, 2012.
Note: Totals may not sum exactly due to rounding.

Table C7 Land Use in Bradford County, Search Area D in 1992 and 2006

Land Use	1992		2006	
	Square Miles	% of Total	Square Miles	% of Total
Deciduous forest	1.5	46	1.1	34
Pasture/hay	0.8	26	0.5	14
Mixed forest	0.3	11	0.7	24
Evergreen forest	0.3	9	0.2	5
Row/cultivated crops	0.1	5	0.2	8
Developed	0.1	2	0.4	13
Other	0.0	1	0.0	2
Total	**3.1**	**100**	**3.1**	**100**

Source: US Geological Survey, 2012.
Note: Totals may not sum exactly due to rounding.

Table C8 Land Use in Bradford County, Search Area E in 1992 and 2006

Land Use	1992		2006	
	Square Miles	% of Total	Square Miles	% of Total
Pasture/hay	2.2	69	1.6	49
Deciduous forest	0.4	13	0.4	11
Evergreen forest	0.3	9	0.2	5
Mixed forest	0.2	5	0.3	9
Row/cultivated crops	0.1	4	0.6	20
Developed	0.0	0	0.2	5
Other	0.0	0	0.0	1
Total	**3.1**	**100**	**3.1**	**100**

Source: US Geological Survey, 2012.
Note: Totals may not sum exactly due to rounding

Table C9 Land Use in Bradford County, Search Area F in 1992 and 2006

Land Use	1992		2006	
	Square Miles	% of Total	Square Miles	% of Total
Pasture/hay	11.9	42	7.9	28
Deciduous forest	10.6	38	9.6	34
Evergreen forest	2.6	9	1.3	5
Row/cultivated crops	1.5	5	4.2	15
Mixed forest	1.5	5	3.7	13
Open water	0.1	1	0.2	1
Woody wetlands	0.1	0	0.2	1
Developed	0.0	0	1.1	4
Other	0.0	0	0.2	0
Total	**28.3**	**100%**	**28.4**	**100**

Source: US Geological Survey, 2012.
Note: Totals may not sum exactly due to rounding.

Table C10 Land Use in Bradford County, Search Area G in 1992 and 2006

Land Use	1992		2006	
	Square Miles	% of Total	Square Miles	% of Total
Pasture/hay	1.1	35.1	0.7	24.1
Deciduous forest	1.0	33.2	0.7	21.4
Evergreen forest	0.3	8.4	0.3	9.0
Row/cultivated crops	0.3	9.7	0.8	24.4
Mixed forest	0.4	11.9	0.5	14.8
Open water	0.1	1.4	0.1	1.4
Emergent herbaceous wetlands	>0.1	0.1	>0.1	0.6
Developed	>0.1	0.2	0.1	3.3
Other	0.0	0.0	>0.1	1.0
Total	**3.2**	**100.0%**	**3.2**	**100.0%**

Source: US Geological Survey, 2012.
Note: Totals may not sum exactly due to rounding.

Table C11 Land Use in Bradford County, Search Area H in 1992 and 2006

Land Use	1992		2006	
	Square Miles	% of Total	Square Miles	% of Total
Pasture/hay	0.9	28.0	0.2	7.5
Deciduous forest	1.7	54.6	1.8	56.1
Evergreen forest	0.1	2.6	0.1	2.7
Row/cultivated crops	0.2	6.6	0.6	18.8
Mixed forest	0.2	7.6	0.3	10.5
Open water	>0.1	0.4	>0.1	0.4
Developed	0.0	0.0	0.1	3.1
Other	>0.1	0.2	0.1	0.9
Total	**3.2**	**100.0%**	**3.2**	**100.0**

Source: US Geological Survey, 2012.
Note: Totals may not sum exactly due to rounding.

Table C12 Land Use in Susquehanna County, Search Area A in 1992 and 2006

Land Use	1992		2006	
	Square Miles	% of Total	Square Miles	% of Total
Deciduous forest	12.7	45	7.5	26
Pasture/hay	8.8	31	4.3	15
Mixed forest	2.8	10	4.3	15
Evergreen forest	1.9	7	2.0	7
Row/cultivated crops	1.7	6	8.3	29
Open water	0.4	1	0.4	1
Developed	0.1	0	1.1	4
Other	0.0	0	0.5	3
Total	**28.4**	**100**	**28.4**	**100**

Source: US Geological Survey, 2012.
Note: Totals may not sum exactly due to rounding.

Table C13 Land Use in Susquehanna County, Search Area B in 1992 and 2006

Land Use	1992 Square Miles	1992 % of Total	2006 Square Miles	2006 % of Total
Deciduous forest	1.2	38.5	1.0	30.4
Pasture/hay	0.4	12.9	0.4	11.7
Mixed forest	0.4	11.1	0.5	15.8
Evergreen forest	0.3	9.7	0.3	8.6
Row/cultivated crops	0.1	4.6	0.1	3.0
Open water	0.1	3.8	0.1	4.3
Developed	0.6	18.2	0.7	21.1
Emergent herbaceous wetlands	>0.1	0.4	0.1	2.8
Other	0.1	0.8	>0.1	2.3
Total	**3.2**	**100.0%**	**3.2**	**100.0%**

Source: US Geological Survey, 2012.
Note: Totals may not sum exactly due to rounding.

Table C14 Major Agricultural Land Uses in Bradford County, Search Area A

Use	% of Land
Other hay/non-alfalfa	14.1
Corn	2.1
Fallow/idle cropland	0.6
Soybeans	0.3

Source: US Department of Agriculture, 2012.

Table C15 Major Agricultural Land Uses in Bradford County, Search Area B

Use	% of Land
Other hay/non-alfalfa	24.9
Corn	6.5
Fallow/idle cropland	0.8
Soybeans	0.6
Alfalfa	0.5

Source: US Department of Agriculture, 2012.

Table C16 Major Agricultural Land Uses in Bradford County, Search Area C

Use	% of Land
Other hay/non-alfalfa	24.9
Corn	4.3
Fallow/idle cropland	0.9
Alfalfa	0.4

Source: US Department of Agriculture, 2012.

Table C17 Major Agricultural Land Uses in Bradford County, Search Area D

Use	% of Land
Other hay/non-alfalfa	11.5
Corn	3.2
Fallow/idle cropland	0.4

Source: US Department of Agriculture, 2012.

Table C18 Major Agricultural Land Uses in Bradford County, Search Area E

Use	% of Land
Other hay/non-alfalfa	50.7
Corn	8.3
Alfalfa	0.9
Fallow/idle cropland	0.6

Source: US Department of Agriculture, 2012.

Table C19 Major Agricultural Land Uses in Bradford County, Search Area F

Use	% of Land
Other hay/non-alfalfa	31.9
Corn	5.3
Fallow/idle cropland	0.5
Alfalfa	0.4

Source: US Department of Agriculture, 2012.

Table C20 Major Agricultural Land Uses in Bradford County, Search Area G

Use	% of Land
Other hay/non-alfalfa	39.4
Corn	0.8
Fallow/idle cropland	0.5
Alfalfa	0.1

Source: US Department of Agriculture, 2012.

Table C21 Major Agricultural Land Uses in Bradford County, Search Area H

Use	% of Land
Other hay/non-alfalfa	15.9
Corn	2.0
Fallow/idle cropland	1.4
Alfalfa	0.1
Soybeans	0.1

Source: US Department of Agriculture, 2012.

Table C22 Major Agricultural Land Uses in Susquehanna County, Search Area A

Use	% of Land
Other hay/non-alfalfa	31.2
Corn	1.1
Fallow/idle cropland	0.5

Source: US Department of Agriculture, 2012.

Table C23 Major Agricultural Land Uses in Susquehanna County, Search Area B

Use	% of Land
Other hay/non-alfalfa	10.2
Corn	0.8
Fallow/idle cropland	0.3
Alfalfa	0.1
Soybeans	0.1

Source: US Department of Agriculture, 2012.

Table C24 Changes in Land Use, 1992 to 2001 and 2001 to 2006, Bradford County, Search Area A

Change in Land Use	% of Land	
	1992 to 2001	2001 to 2006
No change	98.2	99.6
Change in land use:	1.8	0.4
- to agriculture	1.1	0.1
- to forest	0.2	0.0
- to grassland/shrub	0.2	0.0
- to urban	0.1	0.0
- to wetlands	0.1	0.0
- to open water	0.1	0.2
- to barren	0.1	0.1

Source: US Geological Survey, 2012.
Note: Percentages may not sum to 100% due to rounding.

Table C25 Changes in Land Use, 1992 to 2001 and 2001 to 2006, Bradford County, Search Area B

Change in Land Use	% of Land	
	1992 to 2001	2001 to 2006
No Change	98.6	100.0
Change in land use:	1.4	0.0
- to agriculture	0.8	0.0
- to wetlands	0.2	0.0
- to forest	0.1	0.0
- to urban	0.1	0.0
- to open water	0.1	0.0

Note: Percentages may not sum to 100% due to rounding.

Table C26 Changes in Land Use, 1992 to 2001 and 2001 to 2006, Bradford County, Search Area C

Change in Land Use	% of Land	
	1992 to 2001	2001 to 2006
No change	98.4	99.9
Change in land use:	1.6	0.1
- to agriculture	1.2	0.0
- to urban	0.2	0.0
- to forest	0.1	0.0

Source: US Geological Survey, 2012.
Note: Percentages may not sum to 100% due to rounding.

Table C27 Changes in Land Use, 1992 to 2001 and 2001 to 2006, Bradford County, Search Area D

Change in Land Use	% of Land	
	1992 to 2001	2001 to 2006
No change	99.5	99.8
Change in land use:	0.5	0.2
- to agriculture	0.4	0.0
- to grassland/shrub	0.1	0.0
- to barren	0.0	0.2

Source: US Geological Survey, 2012.
Note: Percentages may not sum to 100% due to rounding.

Table C28 Changes in Land Use, 1992 to 2001 and 2001 to 2006, Bradford County, Search Area E

Change in Land Use	% of Land	
	1992 to 2001	2001 to 2006
No Change	98.8	100.0
Changed land use:	1.2	0.0
- to agriculture	1.1	0.0
- to forest	0.1	0.0

Source: US Geological Survey, 2012.
Note: Percentages may not sum to 100% due to rounding.

Table C29 Changes in Land Use, 1992 to 2001 and 2001 to 2006, Bradford County, Search Area F

Change in Land Use	% of Land	
	1992 to 2001	2001 to 2006
No change	99.4	99.9
Change in land use:	0.6	0.1
- to agriculture	0.4	0.0
- to open water	0.1	0.0
- to forest	0.1	0.0

Note: Percentages may not sum to 100% due to rounding.

Table C30 Changes in Land Use, 1992 to 2001 and 2001 to 2006, Bradford County, Search Area G

Change in Land Use	% of Land	
	1992 to 2001	2001 to 2006
No change	97.6	99.7
Change in land use:	2.4	0.3
- to agriculture	2.1	0.0
- to urban	0.1	0.0
- to forest	0.2	0.0
- to barren land	0.0	0.3

Note: Percentages may not sum to 100% due to rounding.

Table C31 Changes in Land Use, 1992 to 2001 and 2001 to 2006, Bradford County, Search Area H

Change in Land Use	% of Land	
	1992 to 2001	2001 to 2006
No change	98.3	99.7
Change in land use:	1.7	0.3
- to agriculture	1.6	0.0
- to grassland/shrub	0.1	0.0
- to forest	0.0	0.3

Note: Percentages may not sum to 100% due to rounding.

Table C32 Changes in Land Use, 1992 to 2001 and 2001 to 2006, Susquehanna County, Search Area A

Change in Land Use	% of Land	
	1992 to 2001	2001 to 2006
No Change	96.4	99.8
Change in land use:	3.6	0.2
- to agriculture	3.3	0.0
- to urban	0.1	0.0
- to forest	0.1	0.0
- to grassland/shrub	0.1	0.0

Source: US Geological Survey, 2012.
Note: Percentages may not sum to 100% due to rounding.

Table C33 Changes in Land Use, 1992 to 2001 and 2001 to 2006, Susquehanna County, Search Area B

Change in Land Use	% of Land	
	1992 to 2001	2001 to 2006
No Change	97.1	99.8
Change in land use:	2.9	0.2
- to agriculture	1.0	0.0
- to urban	1.4	0.0
- to open water	0.3	0.0
- to wetlands	0.2	0.0
- to barren land	0.0	0.2

Source: US Geological Survey, 2012.

Note: Percentages may not sum to 100% due to rounding.

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes/ No	Potential Candidate Cause: Justification	Groundwater Wells	Search Area
RCRA-CESQG, ARCHIVE UST, MANIFEST, US AIRS, NPDES, PA-EFACTS, PCS	Arrow United Industries Inc.	314 Riverside Dr. Wyalusing, PA 18853	1.10 mi. NNW of NEPAGW31	Yes	AIR Permit Lists: in compliance (VOC and particulate matter) Conditionally Exempt Small Quantity Generator. Facility has received violations: 1/9/2007 - Containers of hazardous waste not labeled to accurately identify contents. 1/9/2007 - There is no maintenance of daily records of weight or volume of waste processed, method and location of processing or disposal facilities, waste handling problems or emergencies. ARCHIVE UST - Heating oil. Site included due to proximity to site and potential for contamination.	Search Area: 7 Federal USGS Wells 0 Federal FRDS Public Water Supply System 96 State Wells	A
RCRA-CESQG	Taylor McCarty & Sons Inc.	214 Main St. Wyalusing, PA 18853	0.98 mi. NNE of NEPAGW31	No	Conditionally Exempt Small Quantity Generator. No violations found. Hazardous Waste Summary - Lead, Tetrachloroethylene (PCE). Not a likely source of contaminants or issues found in nearby EPA sample points.		A
RCRA-CESQG, LUST, NCDB, NEI, US EPA TRIS, NPDES, PA EFACTS, ICIS, PCS, RMP	Cargill Meat Solutions	124 Taylor Avenue Wyalusing, PA 18853	2.34 mi. NNE of NEPAGW31	No	Conditionally Exempt Small Quantity Generator. Facility has received notices of violations; 7/25/2012 - Industrial waste was discharged without a permit. 6/21/2012 - Effluent limit(s) were violated. 5/2/2012 - Industrial waste was discharged without a permit. 8/22/2009 - Incident response to accident or event. 10/22/2009 - Incident response to accident or event. 4/28/2003 - Industrial waste was discharged without permit. 10/7/2003 - Industrial waste was discharged without a permit. 1/13/2000 - Failure to prevent sediment or other pollutant discharge into waters of the Commonwealth. 5/26/2000 - Effluent Limits for Fecal Coliform bacteria were violated. LUST - Cleanup completed 4/20/1999. AST - 8 tanks currently in use containing 'Hazardous Substance'. UST - 20,000 gallon diesel fuel, 2,000 gallon gasoline, both currently in use. Not a likely source of contamination due to distance from nearest sampling point.		A

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes/No	Potential Candidate Cause: Justification	Groundwater Wells	Search Area
RCRA-CESQG	Steeles Automotive Inc.	110 Marsh St. Wyalusing, PA 18853	1.06 mi. NNE of NEPAGW31	Yes	Conditionally Exempt Small Quantity Generator. Hazardous Waste Summary - Cadmium, Lead, Benzene, Methyl Ethyl Keytone, Tetrachloroethylene, Trichloroethylene. Violation Status - No violations found. Site included due to proximity to site and potential for contamination.		A
UST	Dandy Mini Mart 15	223 State St. Wyalusing, PA 18853	>0.80 mi. N of NEPAGW31	Yes	UST - 8,000 gallon gasoline; currently in use, 10,000 gallon gasoline; currently in use, 2,000 gallon kerosene; currently in use. Facility Violations: 2/20/2004 - Failure to comply with underground storage tank system reporting and record keeping requirements; Failure to comply with underground storage tank system release detection requirements; Failure to meet performance standards for new/upgraded tanks. 6/2/2004 - Failure to meet performance standards for new/upgraded tanks. Site included due to proximity to site and potential for contamination.		A
ARCHIVE UST	Wyalusing Area Sch Dist	115 Main St. Wyalusing, PA 18853	0.97 mi. NNE of NEPAGW31	Yes	ARCHIVE UST - 10,000 gallon heating oil. Site included due to proximity to site and potential for contamination.		A
ARCHIVE UST, EDR US HIST AUTO STATION	A-Z Auto	304 State St. Wyalusing, PA 18853	>0.80 mi. N of NEPAGW31	Yes	ARCHIVE UST - 12,000 gallon gasoline; 6,000 gallon gasoline, 2,000 gallon kerosene . Site included due to proximity to site and potential for contamination.		A
US MINES	Bill Johnson II Quarries	Latitude: 41.668056 Longitude: -76.261944	0.97 mi. NNE of NEPAGW31	No	Violation Summary - 13 104(a) violations between 2005 and 2011. NOTE: Location data does not appear to be accurate based on aerial imagery. Not a likely source of contaminants or issues found in nearby EPA sample points.		A
US MINES	Bob Johnson Flagstone Inc.	Latitude: 41.668056 Longitude: -76.261944	0.97 mi. NNE of NEPAGW31	No	Violation Summary - 17 104(a) violations, and 3 104(d)(1) violations between 2004 and 2011. NOTE: Location data does not appear to be accurate based on aerial imagery. Not a likely source of contaminants or issues found in nearby EPA sample points.		A
EDR US HIST AUTO	Wayne Carstar Collision Service	304 State St. Wyalusing, PA 18853	>0.80 mi. N of NEPAGW31	Yes	Site in historical directory as a potential gas station/filling station/service station sites. Site included due to potential for contamination.		A

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes/ No	Potential Candidate Cause: Justification	Groundwater Wells	Search Area
ORPHAN VCP	Gary Alexander Prop - Cleanup	RD1 Box 207 New Albany, PA 18853	NI	Yes	Could not find actual site address. Voluntary Cleanup Program for soil and groundwater contaminated with #2 diesel fuel. Violations (2003) included: Polluting substance(s) allowed to discharge into Waters of the Commonwealth; Industrial waste was discharged without permit. Waste site location could not be determined. Site included due to potential for contamination.		A, B, C
ORPHAN VCP	Eastern Industries Truck Accident	Route 1 Wyalusing, PA 18853	NI	Yes	Truck spill containing used motor oil. Waste site location could not be determined. Site included due to potential for contamination.		A, B, C
ORPHAN AST UST MANIFEST	Cargill Meat Solutions	Route 706	1.4 mi. E of NEPAGW31	Yes	Eight ASTs (currently in use - unspecified hazardous substances) and USTs (diesel and gasoline) MANIFEST listings for D001, D005, D006, D007, F005, F003 wastes. eFACTS noted a diesel release. Site included due to potential for contamination.		A, B, C, H
ORPHAN MANIFEST	Taylor Packing Co., Inc.	Wyalusing, PA 18853	NI	No	Waste Code: F003 Manifest Year: 2008 New Jersey Manifest Data MANIFEST listing and/or violations not likely sources for study issues.		A, B, C, H
ORPHAN HIST LF (in PA HIST LF ALI: Abandoned Landfill Inventory and PA HIST LF INACTIVE: Inactive Facilities List)	Taylor Packing Co., Inc.	1252 Route 706 Wyalusing, PA 18853	1.4 mi. E of NEPAGW31	Yes	This site may be affiliated with Cargill Meat Solutions. eFACTS violations: *Standards for Contaminants, Odor Emissions, Limitations. Failure to control malodorous air contaminants. *Standards for Contaminants, Visible Emissions, Limitations. Failure to prevent visible emissions into the atmosphere. *Construction, Modification, Reactivation and Operation of Sources, Operating Permit Requirements, Compliance requirements. Landfills are potential sources of methane. Site included due to potential for contamination.		A, B, C
ORPHAN HIST LF (in PA HIST LF ALI: Abandoned Landfill Inventory and PA HIST LF INACTIVE: Inactive Facilities List)	Taylor Packing Co., Inc.	Route 76 Wyalusing, PA 18853	3.5 mi. E of NEPAGW09	No	HIST LF, Facility is listed in the county/local unique database (LOCAL), there are no hazardous materials listed for the site. Not a likely source of contamination due to distance from nearest sampling point.		A, B, C
ORPHAN Archive UST, LUST	CC Allis & Sons, Inc.	Route 1010 Wyalusing, PA 18853	>3.35 mi. of NEPA GW28	No	ARCHIVE UST - 4,000 gallon gasoline; 1,000 gallon gasoline Not a likely source of contamination due to distance from nearest sampling point.		A, B, C

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes/ No	Potential Candidate Cause: Justification	Groundwater Wells	Search Area
ORPHAN UST	JJS	Route 414 Franklindale, PA 18853	NI	Yes	UST: gasoline, diesel Waste site location could not be determined. Site included due to potential for contamination.		A, B, C, H
ORPHAN RCRA NonGen / NLR, FINDS	Tewkskys Garage	Route 6 Box 745 Wyalusing, PA 18853	NI	Yes	RCRA NLR - Handler, Non-Generator Hazardous Waste Summary - Lead, Benzene Violations Status - No violations found. Waste site location could not be determined. Site included due to potential for contamination.		
ORPHAN RCRA-CESQG, FINDS, MANIFEST, US AIRS	B & K Equipment Co.	40851 Route 6 Wyalusing, PA 18853	1 mi. NE of NEPAGW31	No	RCRA-CESQG - Conditionally exempt small quantity generator note EDR lists FINDS and PA MANIFEST information for a Safety Kleen facility in Dolton, IL. Violation Status - No violations found.		A, B, C, H
ORPHAN UST	Pen Mart Texaco	Route 6 Wyalusing, PA 18853	NI	Yes	UST - 3 x 10,000 gallons gasoline; 10,000 gallons diesel; 2,000 gallons kerosene; 5,000 gallons heating oil. Tank Status - all 6 USTs currently active. Waste site location could not be determined. Site included due to potential for contamination.		A, B, C, H
ORPHAN Archive UST, LUST	Friedy Country Mart	Route 6 Wyalusing, PA 18853	NI	Yes	Archive UST - 8,000 gallons gasoline; 12,000 gallons diesel Tank Status - Not reported Waste site location could not be determined. Site included due to potential for contamination.		A, B, C
ORPHAN RCRA NonGen / NLR, FINDS	Bates Willard & Son	Latitude: 41.732778 Longitude: -76.281667	1.3 mi. NE of NEPAGW12 1.5 mi. SE of NEPAGW08	No	Note facility map/address in EPA Envirofacts website shows facility on PA Route 409 however the coordinates plot in a wooded area on aerial photos. Facility is listed as a Non-Generator of hazardous wastes.		A, B, C
ORPHAN MANIFEST	PA Game Commission C/O D&A Environmental	Ely Rd. Wyalusing, PA 18853	> 9 mi. SW of NEPAGW15	No	Appears that site listed because of NY MANIFEST database listing. Not a likely source of contamination due to distance from nearest sampling point.		A, B, C
ORPHAN FINDS, RCRA-CESQG, MANIFEST	Williams Auto Plaza II	123 Main St. Wyalusing, PA 18853	0.98 mi. NE of NEPAGW31	Yes	Waste codes listed: D001 and D003, no violations found; NY MANIFEST lists 36 pounds of unknown waste in metal drums, barrels listed 13 times; 5 gallons Tetrachloroethylene (0.73 mg/L TCLP) listed 6 times; 112 pounds listed twice and 72 pounds listed once of unknown waste in metal drums. Site included due to proximity to site and potential for contamination.		A
ORPHAN MANIFEST	PA Department of Transportation	SR 706 Section 8 PM Wyalusing, PA 18853	NI	No	PA MANIFEST Site lists 7,500 pounds of lead in metal drums, barrels, kegs from a facility listed within the EDR as located in York, PA. Not a likely source of contaminants due to no release or incident reported.		A, B, C

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes/No	Potential Candidate Cause: Justification	Groundwater Wells	Search Area
RCRA-CESQG, MANIFEST, AFS, NEI	Tennessee Gas Pipeline Co.	Spring Hill Rd. Wyalusing, PA	4.4 mi. SW of NEPASW02	No	Used oil specification marketer, ignitable flammable waste, arsenic, chromium, lead, benzene; metal drums, barrels, kegs; Not a likely source of contamination due to distance from nearest sampling point.	Search Area B: 16 Federal USGS Wells 1 Federal FRDS Public Water Supply System 81 State Wells	B
US MINES	B & P Inc. (Old Beebe Mine)	Marshview Rd. Towanda, PA	2.31 mi. NE of NEPAGW25	No	This is an abandoned mine that produced crushed and broken stone. Not a likely source of contamination due to distance from nearest sampling point.		B
ORPHAN MANIFEST	PA Game Commission C/O D&A Environmental	Route 6 Burlington, PA 18848	>3.70 mi. N of NEPAGW02	No	Appears that site listed because of NY MANIFEST database listing. Not a likely source of contamination due to distance from nearest sampling point.		B
ORPHAN LUST, ARCHIVE UST, LAST	Welles Mill	Route 6 Wyalusing, PA 18853	>1.30 mi. NE of NEPAGW31	Yes	Three USTS, 2 - 30,000 gallons; heating oil, 1 - 20,000 gallsons; diesel. LUST: Contained petroluem, cleanup completed, cause was containment/sump failure. LAST: Cleanup competed. PA eFACTS: 02/16/2005; Polluting substance(s) allowed to discharge into Waters of the Commonwealth.		B, H
ORPHAN AST	Bradford County Quarry	1883 Route 6, Main St. Towanda, PA 18848	4.9 mi. N of NEPAGW17	No	Two ASTs are on site with 12,000 and 15,000 gallon capacities, are currently in use, and contain diesel fuel. Both tanks were installed in 2011. The site is also listed as a mine for crushed, broken sandstone. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN MANIFEST	Towanda Elementary School	State and Western Ave. Towanda, PA 18848	4.49 mi. NE of NEPAGW17	No	Facility is listed in the county/local unique database (LOCAL), 200 pounds of ignitable waste in metal drums, barrels, or kegs; 1,000 pounds ignitable waste in fiber or plastic boxes, cartons, cases; 200 pounds corrosive waste in metal drums, barrels, or kegs. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN ARCHIVE UST	PA Game Commission State Game Land 172	RR 1 Wyalusing, PA 18805	0.5 mi. SW of NEPAGW13	Yes	Facility is listed in the county/local unique database (LOCAL), 1,000 gallon tank for gasoline. Site included due to proximity to site and potential for contamination.		B
ORPHAN FINDS, VCP	St. Marys Church of the Assumption Parish	3rd and State St. Wyalusing, PA 18853	0.88 mi. N of NEPAGW31	Yes	Facility is listed in the county/local unique database (LOCAL), Cleanup records for PAH and Fuel Oil No. 2 from soil. Site included due to proximity to site and potential for contamination.		B

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes/No	Potential Candidate Cause: Justification	Groundwater Wells	Search Area
ORPHAN VCP	Wickwire Property	Cross Road at Susquehanna St. Wysox, PA 18854	4.6 mi. NE of NEPAGW17	No	Facility is listed in the county/local unique database (LOCAL), Cleanup is listed as site in progress for soil and groundwater, no contaminant listed. Not a likely source of contamination due to distance from nearest sampling point.		B
ORPHAN FINDS, US AIRS	New Enterprise Stone & Lime D/B/A	SR2032 Masonite Rd. Wysox, PA 18854	4.4 mi. WSW of NEPAGW29	No	Facility is listed for criteria and hazardous air pollutant inventory and air synthetic. Not a likely source of contamination due to distance from nearest sampling point.		B
ORPHAN MANIFEST	PA Department of Transportation	SR 1021 Section 8 PM Wysox, PA 18854	NI	No	PA MANIFEST Site lists 1,500 pounds of lead in metal drums, barrels, kegs from a facility listed within the EDR as located in York, PA. Not a likely source of contaminants due to no release or incident reported.		B,C
ORPHAN ARCHIVE UST	PA Game Commission State Game Land 289	US Route 6 Burlington, PA 18848	3.7 mi. N of NEPASW06	No	Two USTs are reported. 2,000 gallon gasoline tank and a 2,000 gallon diesel tank. No other information is available regarding these tanks. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN FTTS, HIST FTTS, FINDS	Bradford County Area VO-TECH H.S. (Bradford County Area Vocational Technical School)	Rd #1 Towanda, PA 18848	Approx. 4.5 mi. WSW of NEPAGW29	No	Listed because it is in the National Compliance Data Base (NCDB) that supports implementation of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Toxic Substances Control Act (TSCA). Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN FINDS	Bradford County Quarry PLT 37	RR1 Box 254 Towanda, PA 18848	NI	No	Listed as "Other crushed and broken stone mining and quarrying". Site is 9 miles west of Towanda on north side of Route 6. Not a likely source of contaminants or issues found in nearby EPA sample points.		B, C
ORPHAN VCP	Excalibur Energy Site	19850 Route 187 Towanda, PA 18848	3.7 mi. W of NEPAGW08 4.3 mi. NNW of NEPAGW11	No	Voluntary Cleanup Program - Diesel Fuel, no other information provided. Note location may not be correct but have no better information. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN VCP	Excalibur Energy Brine Water Release	Route 187 North Asylum Township PA near Moody Road intersection	0.4 mi. NW of NEPAGW26 and 0.5 mi. W of NEPAGW25 and NW of NEPAGW27, respectively	Yes	In August 2010 A tractor-trailer hauling brine water from a wellpad spilled an estimated 4,800 gallons of brine water onto private property when the truck rolled over on U.S. Route 187 in Asylum Township (http://thedailyreview.com/news/estimated-4800-gallons-of-brine-water-spilled-in-asylum-township-crash-1.970596) eFACTS violation: There is a potential for polluting substance(s) reaching Waters of the Commonwealth and may require a permit. Site included due to potential for contamination.		B, C

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes/ No	Potential Candidate Cause: Justification	Groundwater Wells	Search Area
ORPHAN MANIFEST	Rob Elliotts Body Shop	19496 Route 187 Towanda, PA 18849	4.3 mi. NNW of NEPAGW11 3.8 mi. W of NEPAGW08	No	PA Manifest lists the following: 36 pounds of D003 in 2007; 36 pounds of D001 in 2007; 36 pounds of F005 in 2007; 36 pounds of D018 in 2007. Note location may not be correct, but have no better information. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN AST	Heckmann Water Resources	21114 Route 187 Towanda, PA 18848	4.3 mi. NNW of NEPAGW11 3.8 mi. W of NEPAGW08	No	6,000 gallon capacity tank for diesel fuel listed as currently in use. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN ARCHIVE UST	Towanda Township Elementary School	RR2 Route 220 S Towanda, PA 18848	NI	Yes	Heating Oil 5,000 gallons. Cannot find a location or any other information on this school. Internet searches come up with Towanda Elementary School which is listed above at State and Western Ave. Waste site location could not be determined. Site included due to potential for contamination.		B, C
ORPHAN FINDS	Bradford County Conservation District	RR 5 Box 5030-C Towanda, PA 18848	NI	No	In Drinking Water Program (PWSID-2080843) Not a likely source of contaminants or issues found in nearby EPA sample points.		B, C
ORPHAN RCRA-SQG, FINDS	Benson Oldsmobile Buick GMC	Route 6 Towanda, PA 18848	NI	Yes	RCRA-SQG of D001. No violations found. Waste site location could not be determined. Site included due to potential for contamination.		B, C
ORPHAN RCRA-SQG, FINDS, MANIFEST	Williams Auto Plaza	Route 6 Box 6030 Towanda, PA 18848	NI	Yes	Lead, Benzene, Tetrachloroethylene. Waste site location could not be determined. Site included due to potential for contamination.		B, C
ORPHAN LUST, UST, AST	Williams Oil	York Avenue North Towanda, PA 18848	5.8 mi. W of NEPAGW29	No	1- closed LUST with a confirmed release on 8/5/1989. The LUST contained petroleum, 6 - open UST's (3 gasoline, 1 diesel, 1 heating oil, and 1 kerosene), 5 - open AST's (2 gasoline, 1 diesel, 1 other, and 1 kerosene). Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN MANIFEST	Saco Hill Furniture Restoration	3726 Covered Bridge Road Towanda, PA 18848	10 mi. W of NEPAGW29	No	Waste manifest (D001, D005, D006, and D007), no violations listed. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN MANIFEST	Agway Energy Products	Route 6 Towanda, PA 18848 Approx. Coordinates Latitude: 41.767601, Longitude: -76.442987	4.6 mi. NE of NEPAGW17	No	Waste manifest (D001), no violations. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN FINDS	Bradford County Outboard Motor Water Sys	P.O. Box 303 Towanda, PA 18848	NI	No	In Drinking Water Program (PWSID-2080370) Not a likely source of contaminants or issues found in nearby EPA sample points.		B, C

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes/ No	Potential Candidate Cause: Justification	Groundwater Wells	Search Area
ORPHAN TSCA	Osram Sylvania Products - Towanda	3 Hawes St. Towanda, PA 18848	5.6 mi. W of NEPAGW29 > 5 mi. N of NEPAGW17	No	Manufacturer of various products (including light bulbs) (chemicals listed include several metals, acids, salts, strontium mixtures, etc.). No violations. Not a likely source of contamination due to distance from nearest sampling point.		B, C, D
ORPHAN FINDS	PA Elec Towanda OFC	Plaza Dr. Towanda, PA 18848 Latitude: 41.78232 Longitude: -76.45344	6.0 mi. W of NEPAGW29	No	No violations. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN RCRA-CESQG, FINDS	Towanda Borough Treatment Plant	River St. Towanda, PA 18848 Latitude: 41.760908 Longitude: -76.441607	4.1 mi. NE of NEPAGW17	No	Sewage treatment facility, Conditionally Exempt Small Quantity Generator, NPDES permit, In FINDS database, no violations. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN RCRA NonGen / NLR, FINDS	Five Star Equipment, Inc.	Route 187 Wysox, PA 18854 Latitude: 41.798268 Longitude: -76.378687	2 mi. W of NEPAGW29	No	Listed as Non-Generator. No violations found. Not a likely source of contaminants or issues found in nearby EPA sample points.		B, C
ORPHAN ARCHIVE UST	Wysox Elementary School	100 Route 187 Wysox, PA 18854	3.2 mi. W of NEPAGW29	No	Former elementary school, heating oil tank, no violations. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN VCP	Atlantic Star Trucking Accident Mercury Hill Road Cleanup	Route 3 Wysox, PA 18854	NI	Yes	Truck spill site. Information on the exact location or nature of the spill could not be identified. Internet search revealed that it resulted in remediation of contaminated soil from fuel spill. Waste site location could not be determined. Site included due to potential for contamination.		B, C
ORPHAN RCRA-LQG, FINDS	Welles Mill Co	RR 6 Box 6024 Towanda, PA 18848	4.6 mi. NE of NEPAGW17	No	Large quantity generator of RCRA hazardous waste, multiple RCRA compliance violations, waste types not specified. Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN UST	Wysox Exxon	Route 6 E Wysox, PA 18848	NI	Yes	Exxon fuel station could not be found in Wysox, PA, 4 - open UST's (3 gasoline and 1 diesel). Waste site location could not be determined. Site included due to potential for contamination.		B, C
ORPHAN ARCHIVE UST	Sunoco 0443 3827 (Dandy's Mini Mart)	Route 6 Wysox, PA 18854	4.3 mi. NE of NEPAGW17	No	Four out of use UST's (2 gasoline, 1 kerosene, and 1 diesel). Not a likely source of contamination due to distance from nearest sampling point.		B, C
ORPHAN VCP	Clarks Moving SR3032 Accident Cleanup	Troy, PA 16947	NI	Yes	Diesel spill near Troy, PA, Exact location could not be verified. Waste site location could not be determined. Site included due to potential for contamination.		B, C
US MINES	L.W. Flagstone	Latitude: 41.778611 Longitude: -76.339722	1.05 mi. S of NEPAGW29	No	Listed as Non-coal mining, quarry. Not a likely source of contaminants or issues found in nearby EPA sample points.		C
US MINES	Dunn Bluestone	Latitude: 41.803056 Longitude: -76.352222	0.94 mi. NW of NEPAGW29	No	Listed as Non-coal mining, quarry. Not a likely source of contaminants or issues found in nearby EPA sample points.		C

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause		Groundwater Wells	Search Area
				Yes/ No	Justification		
ORPHAN MANIFEST	PA Department of Transportation	SR 187 006 Wysox, PA 18854	>2.1 mi. W of NEPAGW29	No	PA MANIFEST Site lists 25 metal boxes, cartons, and cases (including roll-offs) of lead on 9/29/2010 and 12 metal boxes, cartons, and cases (including roll-offs) of lead on 9/28/2010 from a facility listed within the EDR as located in York, PA. Not a likely source of contaminants due to no release or incident reported and distance from nearest sampling point.	Search Area C: 10 Federal USGS Wells 0 Federal FRDS Public Water Supply System 101 State Wells	C
ORPHAN LUST, UST, ARCHIVE UST	Pit Stop	Route 6 & Sullivan St. Wysox, PA	4.7 mi. NE of NEPAGW17	No	4- closed LUST with confirmed releases on 2/12/2001 and 6/15/2001, 5 - open UST's (2 gasoline, 2 diesel, and 1 kerosene). Not a likely source of contamination due to distance from nearest sampling point.		C
ORPHAN HIST LF	Wysox Twp Fill	Laning Creek Rd. Wysox, PA	4 mi. W of NEPAGW29	No	Historic Landfill, exact location unknown. Not a likely source of contamination due to distance from nearest sampling point.		C
ORPHAN UST	Dandy Mini Mart 36	509 James Monroe Ave. Monroeton, PA 18832	0.6 mi. N of NEPAGW17	Yes	4 USTs on site, all currently in use: 1 x 8,000 gallon Gasoline, 2 x 4,000 gallon Gasoline, and 1 x 2,000 gallon Kerosene. Site included due to proximity to site and potential for contamination.	Search Area D: 1 Federal USGS Well 1 Federal FRDS Public Water Supply System Wells 13 State Wells	D
ORPHAN FINDS, US AIRS	Chief Gathering LLC/Bradford Comp	1935 Allen Meadow Rd. Granville Summit, PA 16926	1.4 mi. NNE of NEPAGW04	No	Site listed in AFS (Aerometric Information Retrieval System (AIRS) Facility Subsystem) . Not a likely source of contaminants or issues found in nearby EPA sample points.	Search Area E: 1 Federal USGS Well 0 Federal FRDS Public Water Supply System Wells 4 State Wells	E, F
ORPHAN FINDS, US AIRS	NTSWA/Bradford Cnty Ldfl 101243	US Route 6 East of Troy West Burlington, PA 16947	4.1 mi. N of NEPAGW02	No	Solid Waste Landfill; No other information reported. Although landfills can be a source of methane, it is likely not a likely source of contamination due to distance from nearest sampling point.		E
ORPHAN NPDES, ARCHIVE UST, FINDS	Bradford County Manor	Latitude: 41.774242 Longitude: -76.621893	9.3 mi. NW of NEPAGW17	No	Community water system, NPDES permit. No violations cited. Not a likely source of contamination due to distance from nearest sampling point.		E
ORPHAN VCP	PPL Bradford Cnty Extens - Hg Meter Site	Route 14 Troy, PA 16947	NI	No	Mercury cleanup site, exact location unknown. Not a likely source of contaminants or issues found in nearby EPA sample points.		E
ORPHAN ARCHIVE UST	Van Dyne Oil Bulk Plt	116 Center St. Troy, PA 16947 (mailing address)	NI	Yes	4 - UST's (2 gasoline, 1 diesel, and 1 kerosene), unknown status, location of facility unknown. Site included due to potential for contamination.		E

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes/ No	Potential Candidate Cause: Justification	Groundwater Wells	Search Area
ORPHAN ARCHIVE UST	Troy Citgo	Troy, PA 16947	NI	Yes	3 - out of use UST's (3 gasoline), exact location unknown. Site included due to potential for contamination.		E
ORPHAN ARCHIVE UST	Calkins Motors	510 Elmira Street Troy, PA 16947	17.1 mi. NW of NEPAGW17	No	3 - Archive UST's (3 gasoline). Not a likely source of contamination due to distance from nearest sampling point.		E
ORPHAN HIST LF, FINDS	Bradford County Sanitary Landfill	108 Steam Hollow Rd. Troy, PA 16947 Latitude: 41.77431 Longitude: -76.63192	4.4 mi. N of NEPAGW05	No	Industry type(s): Stationary Combustion, Municipal Landfill. Not a likely source of contamination due to distance from nearest sampling point.		E
ORPHAN RCRA NonGen/ NLR, FINDS	Bradford Cnty Ldfl 2						
ORPHAN UST	Milky Way Farms	Phinney Drive Troy, PA 16947	17.9 mi. NW of NEPAGW17	No	1 - active UST containing diesel, no violations. Not a likely source of contamination due to distance from nearest sampling point.		E
ORPHAN UST	Williams Oil Bulkplant	Near Troy, PA	NI	Yes	3 - active UST's (diesel, heating oil, and kerosene), no violations. Waste site location could not be determined. Site included due to potential for contamination.		E
ORPHAN AST	Stockpile (DOT Maintenance Facility)	Near Troy, PA	NI	Yes	1 - active AST containing diesel, no violations, exact location unknown. Site included due to potential for contamination.		E
ORPHAN FINDS	Bradford Co - W Burlington Stp	Latitude: 41.774175 Longitude: -76.621871	9.3 mi. NW of NEPAGW17	No	"Clean Watersheds Needs Survey 2008", no violations. Not a likely source of contaminants or issues found in nearby EPA sample points.		E
ORPHAN FINDS	Bradford Baskets MFG	US Route 14 North Latitude: 41.773666 Longitude: -76.791861	17.3 mi. NW of NEPAGW17	No	In FINDS database for selling wooden baskets, no violations. Not a likely source of contaminants or issues found in nearby EPA sample points.		E
ORPHAN MANIFEST	PA DOT Bradford County	Gulf Rd. & Route 6 Troy, PA 16947	Approx. 14.5 mi. NW of NEPAGW17	No	Waste manifest with waste code "unknown", exact location unknown. Not a likely source of contamination due to distance from nearest sampling point.		E
ORPHAN MANIFEST	PA Department of Transportation	SR 3010 Section 8 PM Summit, PA 16926	Facility appears to be located in another part of the state.	No	Facility is listed in the county/local unique database (LOCAL), Facility Address is listed as 730 Vogelsong Rd, York PA which is another part of Pennsylvania and in aerial photos appears likely to be a facility that would be expected to have drums. The manifest list 6 metal drums, barrels, or kegs that contain 4,500 pounds of materials with a hazardous waste code for lead (D008). Not a likely source of contamination due to distance from nearest sampling point.		E, F
UST	Leroy Twp	8453 Route 414 Canton, PA 17724	3.6 mi. W of NEPAGW36	No	1 UST on site, currently in use, 500 gallon capacity and contains diesel fuel. Not a likely source of contamination due to distance from nearest sampling point.	Search Area F: 14 Federal USGS Well 0 Federal FRDS Public Water Supply System Wells 50 State Wells	F

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause		Groundwater Wells	Search Area
				Yes/ No	Justification		
ORPHAN MANIFEST	PA Department of Transportation	SR 3001 Section 374, Laceyville, PA	NI	No	50 containers (metal boxes, cartons, cases [including roll-offs]) on 2010. Generator EPA ID: PADEP0015304; TSD Facility: Envirite of Pennsylvania Inc. No other details available. Laceyville is approximately 5.5 miles east of NEPAGW31.	Search Area G: 1 Federal USGS Well 7 State wells	A, G
ORPHAN RGA LUST; ICIS; FINDS	Bluhms Shopping Center	Route 6, Laceyville, PA	NI	No	Enforcement Action No.: 03-2007-0112; No additional details available. Laceyville is approximately 5.5 miles east of NEPAGW31.		A, G
ORPHAN RGA LUST	Bennetts Airline Texaco	Route 6, Laceyville, PA	NI	No	Release date: 08/05/89; Interim or Remedial Actions initiated; Status: 06/13/14; soils and groundwater impacted by unleaded gasoloine; 6 tank closures. No additional details available. Laceyville is approximately 5.5 miles east of NEPAGW31.		A, G
ORPHAN UST	Airline Bulk PLT	Route 6, Laceyville, PA	NI	No	The facility had a 20,000 water tank; a 10,000 gallon water tank; and a 10,000 diesel tank. All thanks are in use and insepected on 4/30/14. No other details available. Laceyville is approximately 5.5 miles east of NEPAGW31.		A, G
ORPHAN ICIS; FINDS	Russel Hill Water Co.	Route 6, West Gateway Development, Laceyville, PA	NI	No	Enforcement Action Type: SDWA 1423 AO For Comp And/Or Pen (UIC). Program ID: FRS 110010717796. No other details available. Laceyville is approximately 5.5 miles east of NEPAGW31.		A, G
ORPHAN ARCHIVE UST	Braintrim Baptist Church	Church Street, Laceyville, PA	NI	No	No details available. Laceyville is approximately 5.5 miles east of NEPAGW31.		A, G
ORPHAN ARCHIVE UST, UST	Benscoter Forest Pride	Old Route 6, Laceyville, PA	NI	No	There appears to be 4 tanks, but may only be two (two may be a repeat of the other two). The records list an 8000 gallonn diesel fuel tank installed September 26, 2005 and inspected 9/11/12. Teh second tank is a 4000 gallonw diesel fuel tank installed 9/25/14. The other two taks are listed as 6000 galllon diesel fuel tanks. No insstallation or inspection dates.No other details available. Laceyville is approximately 5.5 miles east of NEPAGW31.		A, G
ORPHAN ARCHIVE UST, FINDS, US AIRS	Cornell Manufacturing Inc.	Old Route 6, Laceyville, PA	NI	No	Sawmill and Woodworking Machinery Manufacturing. Two 8,000 gallon heating oil tanks. Potential uncontrolled emmissions <100 tons/yr. No other details available. Laceyville is approximately 5.5 miles east of NEPAGW31.		A, G
ORPHAN SSTS	Agway COOP Inc, Laceyville	Old Route 6, Laceyville, PA	NI	No	Herbicides and insecticides; status: inactive: Report Year: 1990. No other details available. Laceyville is approximately 5.5 miles east of NEPAGW31.		A,G
ORPHAN UST	New Albany Mobil	Route 220, New Albany, PA	NI	No	5 USTs, 3 installed in 1992 and 2 installed in 1995. All inspection in 2012, no leaks reported. Location unknown, but New Albany is >3 miles WSW of NEPAGW32/33.	Search Area H: 4 State wells	H
ORPHAN CERC-NFRAP	Herman Rynnelds & Son Corp	TWP Route 378, New Albany, PA	NI	No	No details available. Location unknown, but New Albany is > 3 miles WSW of NEPAGW32/33.		H

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes/No	Potential Candidate Cause: Justification	Groundwater Wells	Search Area
ORPHAN LUST	Freidy Country Mart	Route 6 Wyalusing, PA	NI	No	Spill of unleaded gasoline on 8/5/89. Clean-up completed on 10/16/02. Location unknown. Wyalusing, PA is 1 mile NE of NEPAGW31, and <7.5 miles NE of NEPA GW-32/33.		A, H
ORPHAN NDPES	Commpressor Station 319	Off State Route 1004 Wyalusing, PA	NI	No	Permit to discharge to Wyalusing Creek effective 04/01/10, expires 03/31/15. Status is minor. No other details available. Wyalusing, PA is 1 mile NE of NEPAGW31, and <7.5 miles NE of NEPA GW-32/33.		A, H
ORPHAN NDPES	Central NY O and G Marc Hubline	State Route 2010, Wyalusing, PA	NI	No	Permit to discharge to unnamed tributary to Panther Lick Creek effective 09/01/12, expires 08/31/17. Status is minor. No other details available. Wyalusing, PA is 1 mile NE of NEPAGW31, and <7.5 miles NE of NEPA GW-32/33.		A, H
ORPHAN FINDS and US AIRS	Applachia Midstream SVC/LLC Stagecoach	Off State Route 1004 Wyalusing, PA	NI	No	Potential uncontrolled emmissions <100 tons/yr. No other details available. Wyalusing, PA is 1 mile NE of NEPAGW31, and <7.5 miles NE of NEPA GW-32/33.		A, H
ORPHAN CERC-NFRAP	Herrick Township Fill	TWP Route 616, Wyalusing, PA	NI	Yes	No details available. Wyalusing, PA is 1 mile NE of NEPAGW31, and <7.5 miles NE of NEPA GW-32/33.		A, H

Primary Source: Environmental records search report by Environmental Data Resources, Inc. (EDR)
Other Sources: Pennsylvania eFacts website, EPA envirofacts website, and http://mines.findthedata.org/d/s/Pennsylvania. Last accessed in January 2014.

Notes:

ORPHAN SITE: A site of potential environmental interest that appear in the records search but due to incomplete location information (i.e., address and coordinates) is unmappable and not included in the records

Search Area A
EDR Inquiry Number:3600692.2
EDR Search Radius: 3 mi.
Search Center: Lat. 41.6313000 (41° 37' 53.76'') Long.76.2786000 (76° 16' 42.96'')

Search Area B
EDR Inquiry Number: 3600692.8
EDR Search Radius: 3 mi.
Search Center: Lat. 41.6946000 (41° 41' 40.56'') Long.76.3224000 (76° 19' 20.64'')

Search Area C
EDR Inquiry Number: 3600692.14
EDR Search Radius: 3 mi.
Search Center: Lat. 41.7699000 (41° 46' 11.64'') Long.76.3190000 (76° 19' 8.40'')

Search Area D
EDR Inquiry Number: 3600692.20
EDR Search Radius: 1 mi.
Search Center: Lat. 41.7033000 (41° 42' 11.88'') Long.76.4693000 (76° 28' 9.48'')

Search Area E
EDR Inquiry Number: 3600692.26
EDR Search Radius: 1 mi.
Search Center: Lat. 41.7136000 (41° 42' 48.96'') Long.76.6376000 (76° 38' 15.36'')

Search Area F
EDR Inquiry Number: 3600692.32
EDR Search Radius: 3 mi.
Search Center: Lat. 41.6845000 (41° 41' 4.20'') Long.76.7028000 (76° 42' 10.08'')

Key:

AFS = Aerometric Information Retrieval System Facility Subsystem.
AST = Above ground storage tank.
FRDS = Federal Reporting Data System.
mi = Mile.
N = North.
NE = Northeast.
NI = No information.
NW = Northwest.
NPDES = National Pollutant Discharge Elimination System.
PA = Pennsylvania.
RCRA = Resource Conservation and Recovery Act
USGS = United States Geological Survey.
W = West.
WSW = West-southwest.

Table C-34 Environmental Database Review Summary, Bradford County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause Yes/ No	Potential Candidate Cause Justification	Groundwater Wells	Search Area

Databases:

ARCHIVE UST: Local list of Archived Underground Storage Tank Sites
AST: Listing of Pennsylvania Regulated Aboveground Storage Tanks
FINDS: Facility Index System/Facility Registry System
FTTS : FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act) Tracking System
HIST FTTS - FIFRA/TSCA Tracking System Administrative Case Listing
HIST LF: Abandoned Landfill Inventory
ICIS: Compliance Information System
LUST: Leaking Underground Storage Tank Sites
MANIFEST: Hazardous waste manifest information
containing public health, safety, and public welfare problems created by past coal mining.
NCDB: National Compliance Database
NEI: National Emissions Inventory
NPDES: National Pollutant Discharge Elimination System Permit Listing
PA eFACTS: Pennsylvania Environmental Facility Application Compliance Tracking System
PCS: Permit Compliance System
RCRA-CESQG: Federal RCRA (Resource Conservation and Recovery Act) Conditionally Exempt Small Quantity Generator List
RCRA-LQG: RCRA - Large Quantity Generators List
RCRA NonGen / NLR: RCRA: Non Generators List
RMP: Risk Management Plans Records
TRIS: Toxics Release Inventory System
TSCA: Toxic Substances Control Act
US AIRS: Aerometric Information Retrieval System Facility Subsystem
US HIST AUTO STATION: EDR exclusive database of listings of potential gas station, filling station, or service station sites .
US MINES: Mines Master Index File. The source of this database is the Dept. of Labor, Mine Safety and Health Administration
UST: Listing of Pennsylvania Regulated Underground Storage Tanks
VCP: Voluntary Cleanup Sites

Waste Codes:

Waste Code D001 - Ignitable waste
Wast Code D003 - Reactive waste
Waste Code D005 - Barium
Waste Code D006 - Cadmium
Waste CodeD007 - Chromium
Waste Code D008 - Lead
Wast Code D018 - Benzene
Waste Code F003 - The following spent non-halogenated solvents: Xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and, a total of 10 percent or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

Waste Code F005 - The following spent nonhalogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above nonhalogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

Table C-35 Well Inventory Summary

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CHESAPEAKE APPALACHIA LLC	WELLES 1 5H OG WELL	717905	716602	986459	015-20242	Active	4	YES	A	41.649436	-76.307575
CHESAPEAKE APPALACHIA LLC	WELLES 1 3H OG WELL	717901	716597	986454	015-20244	Active	4	YES	A	41.649433	-76.307519
CHESAPEAKE APPALACHIA LLC	WELLES 2 2H OG WELL	721118	719509	991860	015-20314	Active	4	NO	A	41.646025	-76.322794
CHESAPEAKE APPALACHIA LLC	WELLES 2 5H OG WELL	721120	719510	991861	015-20315	Active	4	YES	A	41.645986	-76.322794
CHESAPEAKE APPALACHIA LLC	WELLES 3 2H OG WELL	721356	719711	992291	015-20334	Active	4	YES	A	41.653736	-76.295592
CHESAPEAKE APPALACHIA LLC	WELLES 3 5H OG WELL	721361	719715	992301	015-20335	Active	4	YES	A	41.653653	-76.295594
CHESAPEAKE APPALACHIA LLC	WELLES 4 2H OG WELL	724260	722249	997713	015-20416	Active	4	YES	A	41.658044	-76.286719
CHESAPEAKE APPALACHIA LLC	WELLES 4 5H OG WELL	724262	722254	997717	015-20417	Active	4	YES	A	41.658061	-76.286769
CHESAPEAKE APPALACHIA LLC	WELLES 5 2H OG WELL	724263	722257	997720	015-20418	Active	4	YES	A	41.657947	-76.275425
CHESAPEAKE APPALACHIA LLC	WELLES 5 5H OG WELL	724265	722260	997729	015-20419	Active	4	YES	A	41.657983	-76.275447
CHESAPEAKE APPALACHIA LLC	WELLES 5 6H OG WELL	724783	722749	998633	015-20432	Operator reported not drilled	4	YES	A	41.657889	-76.275472
CHESAPEAKE APPALACHIA LLC	MOBEAR 5H OG WELL	746852	740537	1039970	015-21666	Active	4	YES	A	41.600153	-76.245683
CHESAPEAKE APPALACHIA LLC	MOBEAR 5H OG WELL	746852	740537	1039971	015-21666	Active	4	YES	A	41.600153	-76.245683
CHESAPEAKE APPALACHIA LLC	MOBEAR 1H OG WELL	746935	740604	1040074	015-21670	Active	4	YES	A	41.600100	-76.245667
CHESAPEAKE APPALACHIA LLC	BURKMONT FARMS BRA 2H OG WELL	747685	741251	1041661	015-21704	Active	4	NO	A	41.602128	-76.267647
CHESAPEAKE APPALACHIA LLC	BURKMONT FARMS BRA 5H OG WELL	747763	741342	1041823	015-21705	Active	4	NO	A	41.602061	-76.267636
CHESAPEAKE APPALACHIA LLC	BURKMONT FARMS BRA 1H OG WELL	747882	741468	1042035	015-21717	Active	4	YES	A	41.602108	-76.267600
CHESAPEAKE APPALACHIA LLC	WALKER BRA 5H OG WELL	748052	741596	1042308	015-21719	Active	4	YES	A	41.614819	-76.296222
CHESAPEAKE APPALACHIA LLC	WALKER BRA 5H OG WELL	748052	741596	1059951	015-21719	Active	4	YES	A	41.614819	-76.296222
CHESAPEAKE APPALACHIA LLC	WALKER BRA 2H OG WELL	748054	741598	1042310	015-21720	Active	4	YES	A	41.614886	-76.296158
CHESAPEAKE APPALACHIA LLC	CUTHBERTSON BRA 2H OG WELL	749217	742547	1044459	015-21797	Active	4	YES	A	41.617167	-76.288783
CHESAPEAKE APPALACHIA LLC	VRGC BRA 2H OG WELL	749219	742549	1044461	015-21798	Active	4	YES	A	41.627839	-76.282375
CHESAPEAKE APPALACHIA LLC	VRGC BRA 5H OG WELL	749221	742550	1044463	015-21799	Active	4	YES	A	41.627756	-76.282394
CHESAPEAKE APPALACHIA LLC	VRGC BRA 6H OG WELL	749223	742553	1044465	015-21800	Active	4	YES	A	41.627767	-76.282464
CHESAPEAKE APPALACHIA LLC	WALKER S BRA 3H OG WELL	749674	742904	1045270	015-21830	Active	4	YES	A	41.614853	-76.296192
CHESAPEAKE APPALACHIA LLC	WALKER S BRA 4H OG WELL	749811	743022	1060867	015-21832	Active	4	YES	A	41.617142	-76.288864
CHESAPEAKE APPALACHIA LLC	WALKER S BRA 4H OG WELL	749811	743022	1045583	015-21832	Active	4	YES	A	41.617142	-76.288864
CHESAPEAKE APPALACHIA LLC	WALKER S BRA 1H OG WELL	750925	743949	1047553	015-21889	Active	4	YES	A	41.614822	-76.296136
CHESAPEAKE APPALACHIA LLC	WALKER N BRA 3H OG WELL	750926	743950	1047554	015-21890	Active	4	YES	A	41.614856	-76.296103
CHESAPEAKE APPALACHIA LLC	CUTHBERTSON BRA 1H OG WELL	751645	744532	1048690	015-21917	Active	4	YES	A	41.617181	-76.288850
CHESAPEAKE APPALACHIA LLC	ALEXANDER NE BRA 1H OG WELL	752327	745047	1049955	015-21965	Active	4	YES	A	41.612803	-76.312358
CHESAPEAKE APPALACHIA LLC	ALEXANDER NW BRA 3H OG WELL	752328	745048	1049959	015-21966	Active	4	YES	A	41.612756	-76.312292
CHESAPEAKE APPALACHIA LLC	ALEXANDER NW BRA 4H OG WELL	752329	745049	1049963	015-21967	Active	4	YES	A	41.612794	-76.312411
CHESAPEAKE APPALACHIA LLC	ALEXANDER NW BRA 4H OG WELL	752329	745049	1063274	015-21967	Active	4	YES	A	41.612794	-76.312411
CHESAPEAKE APPALACHIA LLC	ALEXANDER SW BRA 4H OG WELL	752404	745120	1050081	015-21977	Active	4	YES	A	41.612806	-76.312303
CHESAPEAKE APPALACHIA LLC	ALEXANDER SE BRA 1H OG WELL	752397	745113	1050073	015-21978	Active	4	YES	A	41.612742	-76.312400
CHIEF OIL & GAS LLC	AMBROSIUS UNIT A 1H OG WELL	754458	746793	1060315	015-22051	Active	4	YES	A	41.592628	-76.282225
CHIEF OIL & GAS LLC	AMBROSIUS UNIT A 1H OG WELL	754458	746793	1060316	015-22051	Active	6	YES	A	41.592628	-76.282225
CHIEF OIL & GAS LLC	AMBROSIUS UNIT A 2H OG WELL	754461	746794	1060317	015-22052	Active	4	YES	A	41.592631	-76.282281

Table C-35 Well Inventory Summary

Bradford County, Pennsylvania

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CHESAPEAKE APPALACHIA LLC	DULCEY BRA 5H OG WELL	755688	747752	1064883	015-22080	Active	4	YES	A	41.592772	-76.303067
CHESAPEAKE APPALACHIA LLC	DULCEY BRA 5H OG WELL	755688	747752	1062581	015-22080	Active	4	YES	A	41.592772	-76.303067
CHESAPEAKE APPALACHIA LLC	ALKAN S BRA 2H OG WELL	755780	747844	1062785	015-22087	Active	4	YES	A	41.628447	-76.271922
CHESAPEAKE APPALACHIA LLC	ALKAN N BRA 2H OG WELL	755788	747848	1062795	015-22088	Active	4	YES	A	41.628406	-76.271911
CHESAPEAKE APPALACHIA LLC	CALMITCH BRA 2H OG WELL	758040	749783	1071263	015-22143	Active	4	YES	A	41.601472	-76.278194
CHESAPEAKE APPALACHIA LLC	CALMITCH BRA 6H OG WELL	758761	750378	1072836	015-22168	Active	4	YES	A	41.601492	-76.278242
CHESAPEAKE APPALACHIA LLC	KATHRYN BRA 5H OG WELL	758797	750411	1073044	015-22171	Active	4	YES	A	41.626869	-76.251211
CHESAPEAKE APPALACHIA LLC	KATHRYN BRA 5H OG WELL	758797	750411	1073045	015-22171	Active	4	YES	A	41.626869	-76.251211
CHESAPEAKE APPALACHIA LLC	REDBONE BRA 2H OG WELL	760548	751880	1076433	015-22223	Active	4	YES	A	41.631783	-76.244953
CHESAPEAKE APPALACHIA LLC	REDBONE BRA 5H OG WELL	760550	751883	1076436	015-22224	Active	4	YES	A	41.631789	-76.245006
CHESAPEAKE APPALACHIA LLC	BROWN HOMESTEAD E BRA 1H OG WELL	763135	754094	1081213	015-22243	Active	4	YES	A	41.660336	-76.245967
CHESAPEAKE APPALACHIA LLC	BROWN HOMESTEAD SW BRA 4H OG WELL	763317	754260	1081580	015-22246	Active	4	YES	A	41.660364	-76.245886
CHESAPEAKE APPALACHIA LLC	BROWN HOMESTEAD SW BRA 5H OG WELL	763340	754262	1081591	015-22247	Active	4	YES	A	41.660417	-76.245939
CHESAPEAKE APPALACHIA LLC	BROWN HOMESTEAD NW BRA 4H OG WELL	763341	754264	1081596	015-22248	Active	4	YES	A	41.660322	-76.245900
CHESAPEAKE APPALACHIA LLC	BROWN HOMESTEAD NW BRA 5H OG WELL	763342	754266	1081600	015-22249	Active	4	YES	A	41.660378	-76.245953
CHESAPEAKE APPALACHIA LLC	CUTHBERTSON LOCATION & WALKER LOCATION	744201	756409	1086576	015-22310	Active	4	YES	A	41.617181	-76.288850
CHESAPEAKE APPALACHIA LLC	BURKMONT FARMS LOCATION	741463	757942	1090356	015-22392	Active	4	YES	A	41.602086	-76.267553
CHESAPEAKE APPALACHIA LLC	WELLES 5 BRA 3H	725830	758914	1092713	015-22476	Active	4	YES	A	41.657908	-76.275406
CHESAPEAKE APPALACHIA LLC	ALKAN LOCATION	754147	759011	1093006	015-22494	Active	4	YES	A	41.628486	-76.271936
CHESAPEAKE APPALACHIA LLC	MOBEAR LOCATION	741720	759013	1093008	015-22495	Active	4	YES	A	41.600108	-76.245614
CHESAPEAKE APPALACHIA LLC	WELLES 3 BRA 3H OG WELL	767804	759034	1093118	015-22499	Active	4	YES	A	41.653736	-76.295647
CHESAPEAKE APPALACHIA LLC	WELLES 4 & 5	725830	759057	1093163	015-22500	Active	4	YES	A	41.658075	-76.286822
CHESAPEAKE APPALACHIA LLC	DULCEY LOCATION	754457	759444	1094173	015-22513	Active	4	YES	A	41.592769	-76.302997
CHESAPEAKE APPALACHIA LLC	WELLES 1 BRA 1H OG WELL	768211	759562	1094570	015-22523	Active	4	YES	A	41.649367	-76.307625
CHESAPEAKE APPALACHIA LLC	ALEXANDER LOCATION	750785	759656	1094748	015-22528	Active	4	YES	A	41.612747	-76.312347
CHESAPEAKE APPALACHIA LLC	KATHRYN LOCATION	755878	761865	1099848	015-22604	Active	4	YES	A	41.626867	-76.251264
SHELL OIL CO	RALPH KISSELL UNIT 1 OG WELL	13420	15171	28701	015-20009	Inactive/plugged well	361	YES	B	41.699138	-76.342493
CHESAPEAKE APPALACHIA LLC	EVANCHICK 1 OG WELL	703989	704999	966673	015-20084	Active	4	YES	B	41.715000	-76.366397
CHESAPEAKE APPALACHIA LLC	CHANCELLOR 626893 1 OG WELL	704495	705398	967228	015-20085	Active	4	YES	B	41.709721	-76.369085
CHESAPEAKE APPALACHIA LLC	OTTEN 626935 1H OG WELL	713476	712706	979888	015-20118	Active	4	YES	B	41.672524	-76.364502
CHESAPEAKE APPALACHIA LLC	OTTEN 627016 2H OG WELL	713479	712709	979892	015-20119	Active	4	YES	B	41.672455	-76.364449
CHESAPEAKE APPALACHIA LLC	JOHN BARRETT 627210 2H OG WELL	713973	713184	980718	015-20133	Active	4	YES	B	41.684032	-76.356923
CHESAPEAKE APPALACHIA LLC	JOHN BARRETT 627215 1H OG WELL	713974	713185	980720	015-20134	Active	4	YES	B	41.684102	-76.356979
CHESAPEAKE APPALACHIA LLC	EVANCHICK 627146 2H OG WELL	714802	713872	981879	015-20150	Active	4	YES	B	41.714961	-76.366378

Table C-35 Well Inventory Summary

Bradford County, Pennsylvania

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CHESAPEAKE APPALACHIA LLC	JOHN BARRETT 627220 6H OG WELL	714986	714044	982145	015-20155	Operator reported not drilled	4	YES	B	41.684049	-76.357004
CHESAPEAKE APPALACHIA LLC	HERSHBERGER 2H OG WELL	720942	719344	991583	015-20296	Active	4	YES	B	41.684208	-76.336308
CHESAPEAKE APPALACHIA LLC	SOLOWIEJ 5H OG WELL	721420	719765	992392	015-20320	Active	4	YES	B	41.712511	-76.299233
CHESAPEAKE APPALACHIA LLC	SOLOWIEJ 6H OG WELL	721422	719767	992398	015-20321	Active	4	YES	B	41.712467	-76.299183
CHESAPEAKE APPALACHIA LLC	HERSHBERGER 5H OG WELL	721445	719785	992428	015-20330	Active	4	YES	B	41.684167	-76.336306
CHESAPEAKE APPALACHIA LLC	CLAUDIA 1H OG WELL PAD	721449	719790	992433	015-20331	Active	401	YES	B	41.683100	-76.322331
CHESAPEAKE APPALACHIA LLC	CLAUDIA 4H OG WELL PAD	721449	719789	992432	015-20332	Active	4	YES	B	41.683144	-76.322256
CHESAPEAKE APPALACHIA LLC	ROSELYN 3H OG WELL	722129	720380	993637	015-20381	Active	4	YES	B	41.709381	-76.323353
CHESAPEAKE APPALACHIA LLC	ROSELYN 2H OG WELL	722131	720381	993638	015-20382	Active	4	YES	B	41.709267	-76.323186
CHESAPEAKE APPALACHIA LLC	ROSELYN 1H OG WELL	722132	720383	993641	015-20383	Active	4	YES	B	41.709344	-76.323325
CHESAPEAKE APPALACHIA LLC	POTTER 5H OG WELL	722701	720841	994700	015-20402	Active	4	YES	B	41.684228	-76.291192
CHESAPEAKE APPALACHIA LLC	CLAUDIA 5H OG WELL PAD	721449	721119	995344	015-20405	Operator reported not drilled	401	YES	B	41.683075	-76.322261
CHESAPEAKE APPALACHIA LLC	CLAUDIA 2H OG WELL PAD	721449	721121	995347	015-20406	Active	4	YES	B	41.683183	-76.322275
CHESAPEAKE APPALACHIA LLC	POTTER 3H OG WELL	725259	723195	999685	015-20449	Operator reported not drilled	4	YES	B	41.684214	-76.291244
CHESAPEAKE APPALACHIA LLC	SOLOWIEJ 5H OG WELL	725878	723680	1000700	015-20470	Active	4	YES	B	41.712467	-76.299183
CHESAPEAKE APPALACHIA LLC	HARPER 5H OG WELL	726989	724577	1002521	015-20541	Active	4	YES	B	41.681017	-76.310900
CHESAPEAKE APPALACHIA LLC	ACLA 2H OG WELL	729728	726769	1006847	015-20640	Active	4	YES	B	41.681744	-76.343978
CHESAPEAKE APPALACHIA LLC	ACLA 6H OG WELL	729733	726771	1006851	015-20641	Active	4	YES	B	41.681767	-76.344025
CHESAPEAKE APPALACHIA LLC	PAULINY 5H OG WELL	729748	726790	1006887	015-20646	Active	4	YES	B	41.686247	-76.302247
CHESAPEAKE APPALACHIA LLC	HARPER 4H OG WELL	729862	726881	1007070	015-20649	Active	4	YES	B	41.681036	-76.310950
CHESAPEAKE APPALACHIA LLC	POTTER 4H OG WELL	730453	727336	1007918	015-20691	Active	4	YES	B	41.684200	-76.291294
CHESAPEAKE APPALACHIA LLC	POTTER 6H OG WELL	730456	727340	1007920	015-20692	Active	4	YES	B	41.684214	-76.291244
CHESAPEAKE APPALACHIA LLC	WAY 5H OG WELL	730626	727477	1008120	015-20715	Active	4	NO	B	41.718519	-76.274075
CHESAPEAKE APPALACHIA LLC	BALDUZZI 5H OG WELL	730646	727499	1008144	015-20719	Active	4	NO	B	41.714689	-76.290681
CHESAPEAKE APPALACHIA LLC	BALDUZZI 2H OG WELL	730647	727500	1008145	015-20720	Active	4	NO	B	41.714731	-76.290683
CHESAPEAKE APPALACHIA LLC	WAY 6H OG WELL	731092	727877	1008882	015-20729	Active	4	YES	B	41.718472	-76.274108
CHESAPEAKE APPALACHIA LLC	STALFORD 5H OG WELL	731446	728198	1009443	015-20771	Active	4	NO	B	41.711967	-76.320275
CHESAPEAKE APPALACHIA LLC	WAY 1H OG WELL	732669	729221	1011169	015-20857	Active	4	NO	B	41.718500	-76.274028
CHESAPEAKE APPALACHIA LLC	DONNA 2H OG WELL	737094	732669	1017574	015-21144	Active	4	YES	B	41.686128	-76.281133
CHESAPEAKE APPALACHIA LLC	DONNA 5H OG WELL	737172	732717	1017679	015-21147	Active	4	YES	B	41.686167	-76.281206
CHESAPEAKE APPALACHIA LLC	PAULINY 2H OG WELL	737180	732724	1017697	015-21150	Active	4	YES	B	41.686311	-76.302233
CHESAPEAKE APPALACHIA LLC	CURTIS 5H OG WELL	739923	734882	1021683	015-21293	Active	4	YES	B	41.722522	-76.341614
CHESAPEAKE APPALACHIA LLC	CURTIS 4H OG WELL	740040	734978	1021846	015-21308	Active	4	YES	B	41.722556	-76.341581
CHESAPEAKE APPALACHIA LLC	BURLEIGH 4H OG WELL	740200	735081	1022070	015-21316	Active	4	YES	B	41.720186	-76.283864
CHIEF OIL & GAS LLC	PMG GOD UNIT 1H OG WELL	740541	735371	1022677	015-21344	Active	4	YES	B	41.715303	-76.341069
CHESAPEAKE APPALACHIA LLC	BURLEIGH 3H OG WELL	742095	736584	1024960	015-21420	Active	4	YES	B	41.720225	-76.283886
CHESAPEAKE APPALACHIA LLC	BURLEIGH 5H OG WELL	742099	736590	1024969	015-21421	Active	4	YES	B	41.720283	-76.283842

Table C-35 Well Inventory Summary

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CHESAPEAKE APPALACHIA LLC	ZALESKI 3H OG WELL	742353	736809	1025320	015-21436	Active	4	YES	B	41.715258	-76.355744
CHESAPEAKE APPALACHIA LLC	ZALESKI 2H OG WELL	742424	736903	1025502	015-21442	Active	4	YES	B	41.715297	-76.355792
CHESAPEAKE APPALACHIA LLC	BURLEIGH 2H OG WELL	742432	736909	1025516	015-21446	Operator reported not drilled	401	YES	B	41.720264	-76.283906
CHESAPEAKE APPALACHIA LLC	ZALESKI 5H OG WELL	742525	736995	1025643	015-21455	Active	4	YES	B	41.715325	-76.355753
CHESAPEAKE APPALACHIA LLC	ROEBER 5H OG WELL	742579	737051	1025753	015-21463	Active	4	YES	B	41.716072	-76.312203
CHESAPEAKE APPALACHIA LLC	ZALESKI 6H OG WELL	743738	738016	1034249	015-21532	Active	4	YES	B	41.715286	-76.355706
CHIEF OIL & GAS LLC	PMG GOD UNIT A 2H OG WELL	746915	740586	1040053	015-21667	Active	4	YES	B	41.715381	-76.341103
CHIEF OIL & GAS LLC	PMG GOD UNIT A 3H OG WELL	746916	740587	1040054	015-21668	Active	4	YES	B	41.715356	-76.341092
CHIEF OIL & GAS LLC	PMG GOD UNIT A 4H OG WELL	746918	740588	1040055	015-21669	Active	4	YES	B	41.715328	-76.341081
CHESAPEAKE APPALACHIA LLC	CLAUDIA BRA 3H OG WELL PAD	721449	755347	1084112	015-22278	Operator reported not drilled	4	YES	B	41.683106	-76.322239
CHESAPEAKE APPALACHIA LLC	ACLA BRA 3H OG WELL	764879	755686	1084958	015-22287	Active	4	YES	B	41.681786	-76.344072
CHESAPEAKE APPALACHIA LLC	OTTEN BRA 3H OG WELL	765001	755803	1085418	015-22288	Active	4	YES	B	41.672661	-76.364417
CHESAPEAKE APPALACHIA LLC	BALDUZZI BRA 3H	734912	756723	1087329	015-22331	Active	4	YES	B	41.714772	-76.290683
CHESAPEAKE APPALACHIA LLC	HARPER BRA 3H OG WELL	766263	757153	1088298	015-22344	Active	4	YES	B	41.681056	-76.310997
CHESAPEAKE APPALACHIA LLC	EVANCHICK BRA 3H OG WELL	766719	757659	1089444	015-22373	Active	4	YES	B	41.714956	-76.366406
CHESAPEAKE APPALACHIA LLC	BURLEIGH BRA 2H	738134	757973	1090420	015-22393	Operator reported not drilled	4	YES	B	41.720264	-76.283906
CHESAPEAKE APPALACHIA LLC	BURLEIGH BRA 2H	NI	772290	1124536	015-22818	Permit pending	NI	NI	Na[a]	NI	NI
CHESAPEAKE APPALACHIA LLC	SOLOWIEJ BRA 2H	726297	758002	1090529	015-22394	Proposed but never materialized	4	YES	B	41.712467	-76.299292
CHESAPEAKE APPALACHIA LLC	WAY 1H-6H	729906	758231	1091060	015-22410	Active	4	YES	B	41.718478	-76.273981
CHESAPEAKE APPALACHIA LLC	HERSHBERGER BRA 3H OG WELL	767411	758533	1091774	015-22446	Active	4	YES	B	41.684128	-76.336300
CHESAPEAKE APPALACHIA LLC	POTTER BRA 1H	723793	759030	1093113	015-22498	Active	4	YES	B	41.684278	-76.291214
CHESAPEAKE APPALACHIA LLC	JOHN BARRETT BRA 3H OG WELL	767962	759258	1093674	015-22509	Active	4	YES	B	41.684178	-76.356997
CHESAPEAKE APPALACHIA LLC	ZALESKI LOCATION	740587	759442	1094176	015-22514	Active	4	YES	B	41.715353	-76.355711
CHESAPEAKE APPALACHIA LLC	PAULINY BRA 6H	730270	759601	1094652	015-22527	Active	4	YES	B	41.686275	-76.302283
CHESAPEAKE APPALACHIA LLC	DONNA 1H-6H	736151	759992	1095996	015-22539	Active	4	YES	B	41.686117	-76.281186
CHESAPEAKE APPALACHIA LLC	CURTIS 1H-6H	738625	760498	1097016	015-22563	Active	4	YES	B	41.722556	-76.341581
CHIEF OIL & GAS LLC	ALLEN UNIT 1H OG WELL	740535	735367	1022674	015-21341	Active	4	NO	B&C	41.730264	-76.330425
CHIEF OIL & GAS LLC	ALLEN UNIT 2H OG WELL	740538	735369	1022675	015-21342	Active	4	NO	B&C	41.730236	-76.330464
CHIEF OIL & GAS LLC	ALLEN UNIT 3H OG WELL	740540	735370	1022676	015-21343	Active	4	NO	B&C	41.730208	-76.330506
CHIEF OIL & GAS LLC	ALLEN UNIT 4H OG WELL	740874	735597	1023119	015-21351	Active	4	NO	B&C	41.730178	-76.330544
CHIEF OIL & GAS LLC	ALLEN UNIT 5H OG WELL	740877	735598	1023120	015-21352	Active	4	NO	B&C	41.730150	-76.330586
CHIEF OIL & GAS LLC	KERRICK UNIT 1H OG WELL	740890	735612	1023132	015-21355	Active	4	YES	B&C	41.730672	-76.319131
CHIEF OIL & GAS LLC	KERRICK UNIT 3H OG WELL	740912	735620	1023148	015-21357	Active	4	YES	B&C	41.730669	-76.319242
FAIRMAN DRILLING CO	HAROLD W LUNDY 1 OG WELL	13413	15164	28694	015-20002	Inactive/plugged well	361	YES	C	41.783701	-76.325586
CHESAPEAKE APPALACHIA LLC	STEVENS 2H OG WELL	721611	719932	992764	015-20354	Active/Operator reported not drilled	401	YES	C	41.781133	-76.350144

Table C-35 Well Inventory Summary

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CHESAPEAKE APPALACHIA LLC	STEVENS 5H OG WELL	721614	719934	992766	015-20355	Active/Operator reported not drilled	401	YES	C	41.781117	-76.350094
CHESAPEAKE APPALACHIA LLC	SCHOONOVER 2H OG WELL	722126	720379	993635	015-20380	Active/Operator reported not drilled	401	YES	C	41.776506	-76.359094
CHESAPEAKE APPALACHIA LLC	SCHOONOVER 5H OG WELL	722133	720385	993646	015-20384	Active/Operator reported not drilled	401	YES	C	41.776467	-76.359142
CHESAPEAKE APPALACHIA LLC	STEVENS 2H OG WELL	726243	723969	1001289	015-20481	Active	4	YES	C	41.781158	-76.350125
CHESAPEAKE APPALACHIA LLC	STEVENS 5H OG WELL	726474	724148	1001742	015-20495	Active	4	YES	C	41.781172	-76.350175
CHESAPEAKE APPALACHIA LLC	LUNDY 2H	728099	725488	1004315	015-20556	Active	4	YES	C	41.782642	-76.320958
CHESAPEAKE APPALACHIA LLC	LUNDY 5H OG WELL	728101	725490	1004318	015-20557	Active	4	YES	C	41.782600	-76.320944
CHESAPEAKE APPALACHIA LLC	LUNDY BRA 2H	728428	758074	1090690	015-22397	Proposed but never materialized	6	YES	C	41.782561	-76.320928
CHESAPEAKE APPALACHIA LLC	SCHOONOVER 2H OG WELL	730079	727039	1007366	015-20663	Active	4	YES	C	41.780903	-76.361686
CHESAPEAKE APPALACHIA LLC	SCHOONOVER 5H OG WELL	730080	727040	1007367	015-20664	Active	4	YES	C	41.780917	-76.361633
CHESAPEAKE APPALACHIA LLC	BLANNARD 5H OG WELL	730635	727486	1008131	015-20716	Active	4	YES	C	41.784100	-76.311033
CHESAPEAKE APPALACHIA LLC	BLANNARD 2H OG WELL	730639	727492	1008135	015-20717	Operator reported not drilled	401	YES	C	41.784100	-76.311033
CHESAPEAKE APPALACHIA LLC	COATES 2H OG WELL	731103	727887	1008904	015-20732	Active	4	NO	C	41.782903	-76.330942
CHESAPEAKE APPALACHIA LLC	SCHOONOVER 1H OG WELL	731257	728022	1009123	015-20750	Active	4	YES	C	41.780964	-76.361653
CHESAPEAKE APPALACHIA LLC	BALLIBAY 2H OG WELL	731925	728614	1010213	015-20815	Active	4	YES	C	41.750697	-76.283886
CHESAPEAKE APPALACHIA LLC	BLANNARD 1H OG WELL	731930	728618	1010217	015-20817	Active	4	YES	C	41.784081	-76.311083
CHESAPEAKE APPALACHIA LLC	BLANNARD BRA 3H OG WELL	731932	728620	1010220	015-20818	Operator reported not drilled	401	YES	C	41.784061	-76.311131
CHESAPEAKE APPALACHIA LLC	SCHOONOVER 4H OG WELL	732276	728929	1010692	015-20847	Active	4	YES	C	41.780953	-76.361706
CHESAPEAKE APPALACHIA LLC	SCHOONOVER 6H OG WELL	732277	728932	1010694	015-20848	Active	4	YES	C	41.780942	-76.361758
CHESAPEAKE APPALACHIA LLC	THEM 2H OG WELL	733319	729781	1012155	015-20915	Active	4	YES	C	41.779353	-76.368322
CHESAPEAKE APPALACHIA LLC	THEM 5H OG WELL	733325	729784	1012158	015-20916	Active	4	YES	C	41.779322	-76.368358
CHESAPEAKE APPALACHIA LLC	COATES 5H OG WELL	733859	730236	1012995	015-20946	Active	4	YES	C	41.782939	-76.330911
CHESAPEAKE APPALACHIA LLC	COATES 1H OG WELL	735997	731858	1016076	015-21070	Operator reported not drilled	4	YES	C	41.782875	-76.330883
CHESAPEAKE APPALACHIA LLC	COATES 3H OG WELL	736000	731861	1016079	015-21071	Operator reported not drilled	4	YES	C	41.782972	-76.330881
CHESAPEAKE APPALACHIA LLC	COATES 4H OG WELL	736002	731862	1016083	015-21072	Operator reported not drilled	4	YES	C	41.782908	-76.330853
CHESAPEAKE APPALACHIA LLC	COATES 6H OG WELL	736004	731865	1016087	015-21073	Operator reported not drilled	4	YES	C	41.782944	-76.330822
CHESAPEAKE APPALACHIA LLC	SCHEFFLER 2H OG WELL	737746	733173	1018492	015-21178	Active	4	YES	C	41.744992	-76.360753
CHESAPEAKE APPALACHIA LLC	SCHEFFLER 5H OG WELL	738053	733454	1018920	015-21210	Active	4	YES	C	41.744964	-76.360711
CHESAPEAKE APPALACHIA LLC	PRIMROSE 5H OG WELL	742435	736910	1025517	015-21447	Active	4	YES	C	41.784892	-76.342897

Table C-35 Well Inventory Summary

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
SOUTHWESTERN ENERGY PROD CO	ROEHRIG SMITH GAS UNIT 2H OG WELL	743264	737657	1033391	015-21496	Active	4	YES	C	41.781917	-76.268367
SOUTHWESTERN ENERGY PROD CO	ROEHRIG SMITH GAS UNIT 3H OG WELL	743739	738017	1034251	015-21533	Active	4	YES	C	41.781925	-76.268311
CHESAPEAKE APPALACHIA LLC	PRIMROSE 1H OG WELL	744847	738887	1036234	015-21573	Active	4	YES	C	41.784942	-76.342919
CHESAPEAKE APPALACHIA LLC	PRIMROSE 3H OG WELL	744853	738893	1036242	015-21575	Active	4	YES	C	41.784864	-76.343000
CHESAPEAKE APPALACHIA LLC	PRIMROSE 4H OG WELL	744855	738894	1036244	015-21576	Active	4	YES	C	41.784928	-76.342972
CHESAPEAKE APPALACHIA LLC	PRIMROSE 6H OG WELL	744863	738899	1036252	015-21577	Active	4	YES	C	41.784914	-76.343025
SOUTHWESTERN ENERGY PROD CO	ROEHRIG SMITH GAS UNIT 1H OG WELL	748254	741744	1042735	015-21728	Active	4	YES	C	41.781856	-76.268428
CHESAPEAKE APPALACHIA LLC	JONES BRA 5H OG WELL	748859	742282	1043851	015-21760	Active	4	YES	C	41.754056	-76.306769
CHESAPEAKE APPALACHIA LLC	JONES BRA 2H OG WELL	749211	742542	1044453	015-21794	Active	4	YES	C	41.754017	-76.306792
CHESAPEAKE APPALACHIA LLC	JONES BRA 4H OG WELL	749213	742543	1044454	015-21795	Operator reported not drilled	4	YES	C	41.754036	-76.306856
CHESAPEAKE APPALACHIA LLC	JONES BRA 6H OG WELL	749214	742545	1044456	015-21796	Operator reported not drilled	4	YES	C	41.753997	-76.306875
CHESAPEAKE APPALACHIA LLC	HILLIS N BRA 2H OG WELL	752440	745150	1050144	015-21984	Active	4	YES	C	41.748219	-76.290022
CHESAPEAKE APPALACHIA LLC	HILLIS S BRA 2H OG WELL	752445	745156	1050156	015-21985	Active	4	YES	C	41.748253	-76.289989
CHESAPEAKE APPALACHIA LLC	HILLIS N BRA 3H OG WELL	752959	745609	1050956	015-21994	Active	4	YES	C	41.748286	-76.289956
SOUTHWESTERN ENERGY PROD CO	VANORDER PATRICK 1H OG WELL	755074	747289	1061248	015-22067	Active	4	YES	C	41.779061	-76.281231
SOUTHWESTERN ENERGY PROD CO	VANORDER PATRICK 2H OG WELL	755080	747297	1061257	015-22068	Active	4	YES	C	41.779111	-76.281200
SOUTHWESTERN ENERGY PROD CO	VANORDER PATRICK 3H OG WELL	755082	747298	1061259	015-22069	Active	4	YES	C	41.779183	-76.281233
SOUTHWESTERN ENERGY PROD CO	VANORDER PATRICK 4H OG WELL	755083	747300	1061261	015-22070	Active	4	YES	C	41.779233	-76.281200
CHESAPEAKE APPALACHIA LLC	SIMPLEX BRA 1H OG WELL	763134	754092	1081212	015-22242	Active	4	YES	C	41.746947	-76.323408
CHESAPEAKE APPALACHIA LLC	SIMPLEX BRA 2H OG WELL	763950	754766	1082613	015-22262	Active	4	YES	C	41.746883	-76.323250
SOUTHWESTERN ENERGY PROD CO	RABAGO-BIRK (10 PAD)	759111	754876	1082934	015-22266	Active	4	YES	C	41.801439	-76.287531
CHESAPEAKE APPALACHIA LLC	COATES BRA 3H	730266	756407	1086573	015-22307	Active	4	YES	C	41.782972	-76.330881
SOUTHWESTERN ENERGY PROD CO	ROEHRIG-SMITH (S PAD) 1H-6H	741492	756446	1086674	015-22313	Active	4	YES	C	41.781828	-76.268644
SOUTHWESTERN ENERGY PROD CO	ROEHRIG-SMITH (S PAD) 1H-6H	741492	756448	1086677	015-22314	Active	4	YES	C	41.781836	-76.268572
SOUTHWESTERN ENERGY PROD CO	ROEHRIG-SMITH (S PAD) 1H-6H	741492	756449	1086678	015-22315	Active	4	YES	C	41.781844	-76.268500
CHESAPEAKE APPALACHIA LLC	BALLIBAY 1H-6H	731829	756888	1087751	015-22338	Active	4	YES	C	41.750697	-76.283942
CHESAPEAKE APPALACHIA LLC	PRIMROSE BRA 2H	740840	757011	1088019	015-22341	Operator reported not drilled	4	YES	C	41.784878	-76.342950
CHESAPEAKE APPALACHIA LLC	PRIMROSE BRA 2H	NI	772141	1124122	015-22817	Active	NI	NI	Na[a]	NI	NI
CHESAPEAKE APPALACHIA LLC	THEM 1H-6H	730264	757559	1089252	015-22365	Active	4	YES	C	41.779289	-76.368394
CHESAPEAKE APPALACHIA LLC	HILLIS S BRA 3H	751176	758075	1090691	015-22398	Active	4	YES	C	41.748253	-76.289900
CHESAPEAKE APPALACHIA LLC	SCHOONOVER 1H-6H	723980	758782	1092308	015-22474	Active	4	YES	C	41.780892	-76.361739
CHESAPEAKE APPALACHIA LLC	SCHEFFLER 1H-6H	737097	759259	1093675	015-22510	Active	4	YES	C	41.744936	-76.360672
SOUTHWESTERN ENERGY PROD CO	ROEHRIG-SMITH (S PAD) 1H-6H	741492	760442	1096842	015-22558	Active	4	YES	C	41.781792	-76.268489
CHESAPEAKE APPALACHIA LLC	STEVENS BRA 3H OG WELL	770032	761580	1099205	015-22589	Active	4	YES	C	41.781142	-76.350072

Table C-35 Well Inventory Summary

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CHESAPEAKE APPALACHIA LLC **Bradford County, Pennsylvania**	STROM 627237 3H OG WELL	714887	713950	981989	015-20147	Active/Operator reported not drilled	401	YES	D	41.702492	-76.455142
CHESAPEAKE APPALACHIA LLC	STROM 627236 2H OG WELL	714885	713949	981986	015-20148	Active	4	YES	D	41.702439	-76.455175
CHESAPEAKE APPALACHIA LLC	STROM 627235 1H OG WELL	714884	713946	981978	015-20149	Active	4	YES	D	41.702433	-76.455222
CHESAPEAKE APPALACHIA LLC	ARNOLD 1H OG WELL	719216	717752	988349	015-20268	Active	4	YES	D	41.695306	-76.467194
CHESAPEAKE APPALACHIA LLC	ARNOLD 3H OG WELL	720946	719349	991618	015-20299	Active	4	YES	D	41.695358	-76.467111
CHESAPEAKE APPALACHIA LLC	DAN ELLIS 2H OG WELL	726046	723822	1001022	015-20480	Active	4	YES	D	41.691936	-76.466036
CHESAPEAKE APPALACHIA LLC	DAN ELLIS 1H OG WELL	729984	726972	1007259	015-20652	Active	4	YES	D	41.691897	-76.466025
CHESAPEAKE APPALACHIA LLC	DAN ELLIS 3H OG WELL	729988	726973	1007260	015-20653	Active	4	YES	D	41.691858	-76.466011
CHESAPEAKE APPALACHIA LLC	STROM BRA 3H OG WELL	752955	745605	1050948	015-21990	Active	4	YES	D	41.702439	-76.455278
CHESAPEAKE APPALACHIA LLC	STROM BRA 5H OG WELL	765615	756381	1086493	015-22303	Active	4	YES	D	41.702467	-76.455158
CHESAPEAKE APPALACHIA LLC	DAN ELLIS BRA 4H	727856	760287	1096533	015-22548	Active	4	YES	D	41.691925	-76.466103
CHIEF OIL & GAS LLC	ANDRUS UNIT 1H OG WELL	740880	735601	1023123	015-21353	Active	4	NO	E	41.714106	-76.632633
GOODWIN IND INC	LLOYD JONES 1 OG WELL	13424	15175	28705	015-20013	Inactive/plugged well	361	YES	F	41.703044	-76.704950
CHESAPEAKE APPALACHIA LLC	VAN NOY 1 OG WELL	706388	706916	969850	015-20096	Active	4	YES	F	41.709197	-76.682476
CHESAPEAKE APPALACHIA LLC	VARGSON 1H OG WELL	706158	706760	969443	015-20097	Active	4	YES	F	41.710069	-76.694890
CHESAPEAKE APPALACHIA LLC	VANNOY 627108 2 OG WELL	712875	712209	979016	015-20113	Active	4	NO	F	41.709197	-76.682476
CHESAPEAKE APPALACHIA LLC	VANNOY 627109 3 OG WELL	712876	712210	979017	015-20114	Active	4	NO	F	41.709188	-76.682531
CHESAPEAKE APPALACHIA LLC	MAY 627301 1H OG WELL	715008	714066	982172	015-20159	Active	4	YES	F	41.704000	-76.722119
CHESAPEAKE APPALACHIA LLC	MAY 627303 3H OG WELL	715011	714070	982186	015-20161	Active	4	YES	F	41.704039	-76.722131
CHESAPEAKE APPALACHIA LLC	JENNINGS 627527 1 OG WELL	715901	714835	983487	015-20172	Active	4	YES	F	41.684336	-76.704234
CHESAPEAKE APPALACHIA LLC	RHEPPARD 1H OG WELL	718030	716713	986626	015-20247	Active	4	YES	F	41.716633	-76.681453
CHESAPEAKE APPALACHIA LLC	RHEPPARD 2H OG WELL	718033	716716	986631	015-20248	Active	4	YES	F	41.716600	-76.681367
CHESAPEAKE APPALACHIA LLC	MARTIN 2H OG WELL	721659	719984	992836	015-20360	Active	4	YES	F	41.726872	-76.700250
CHIEF OIL & GAS LLC	D JENNINGS UNIT 1H OG WELL	730285	727201	1007696	015-20679	Active	4	YES	F	41.694528	-76.728667
CHESAPEAKE APPALACHIA LLC	BRACKMAN 2H OG WELL	731283	728046	1009159	015-20758	Active	4	NO	F	41.667356	-76.740831
CHESAPEAKE APPALACHIA LLC	MORSE 3H OG WELL	733415	729870	1012280	015-20929	Active	4	YES	F	41.683219	-76.656019
CHESAPEAKE APPALACHIA LLC	MORSE 5H OG WELL	733420	729874	1012285	015-20932	Active	4	NO	F	41.683206	-76.656069
CHESAPEAKE APPALACHIA LLC	MORSE 1H OG WELL	733802	730189	1012914	015-20940	Active	4	YES	F	41.683172	-76.655994
TALISMAN ENERGY USA INC	SHEDDEN 01 075 02 L 2H OG WELL	733835	730216	1012969	015-20947	Active	4	YES	F	41.697275	-76.747439
TALISMAN ENERGY USA INC	SHEDDEN 01 075 03 L 3H OG WELL	733839	730220	1012972	015-20948	Active	4	YES	F	41.697369	-76.747444
TALISMAN ENERGY USA INC	SHEDDEN 01 075 04 L 4H OG WELL	733842	730222	1012976	015-20949	Active	4	YES	F	41.697464	-76.747453
TALISMAN ENERGY USA INC	SHEDDEN 01 075 01 L 1H OG WELL	733830	730212	1012961	015-20950	Active	4	YES	F	41.697178	-76.747431
CHESAPEAKE APPALACHIA LLC	CRANRUN 2H OG WELL	735036	731195	1014812	015-20995	Active	4	YES	F	41.662872	-76.726075
CHESAPEAKE APPALACHIA LLC	CRANRUN 5H OG WELL	735041	731201	1014826	015-20997	Active	4	YES	F	41.662911	-76.726089
CHESAPEAKE APPALACHIA LLC	CRANRUN 4H OG WELL	736105	731944	1016228	015-21074	Active	4	YES	F	41.662925	-76.726022
CHESAPEAKE APPALACHIA LLC	CRANRUN 1H OG WELL	737762	733187	1018510	015-21183	Active	4	YES	F	41.662886	-76.726008
CHESAPEAKE APPALACHIA LLC	PETTY 6H OG WELL	738057	733460	1018940	015-21212	Active	4	YES	F	41.662381	-76.716250
CHESAPEAKE APPALACHIA LLC	ATGAS 2H OG WELL	738481	733808	1019584	015-21237	Active	4	YES	F	41.666425	-76.709769
CHESAPEAKE APPALACHIA LLC	ATGAS 1H OG WELL	738821	734054	1020093	015-21255	Active	4	YES	F	41.666375	-76.709750

Table C-35 Well Inventory Summary

Bradford County, Pennsylvania

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CHESAPEAKE APPALACHIA LLC	ATGAS 3H OG WELL	738824	734058	1020099	015-21256	Active	4	YES	F	41.666450	-76.709667
CHESAPEAKE APPALACHIA LLC	ATGAS 4H OG WELL	738828	734063	1020104	015-21257	Active	4	YES	F	41.666389	-76.709697
CHESAPEAKE APPALACHIA LLC	ATGAS 6H OG WELL	738837	734071	1020114	015-21259	Active	4	YES	F	41.666400	-76.709644
CHESAPEAKE APPALACHIA LLC	PETTY 1H OG WELL	739945	734912	1021730	015-21299	Active	4	YES	F	41.662356	-76.716356
CHESAPEAKE APPALACHIA LLC	PETTY 4H OG WELL	739948	734915	1021733	015-21301	Active	4	YES	F	41.662369	-76.716303
CHESAPEAKE APPALACHIA LLC	PETTY 5H OG WELL	739949	734916	1021735	015-21302	Active	4	YES	F	41.662406	-76.716378
CHESAPEAKE APPALACHIA LLC	NEAL BRA 6H OG WELL	750672	743752	1047143	015-21863	Active	4	YES	F	41.680428	-76.667281
CHESAPEAKE APPALACHIA LLC	NEAL BRA 6H OG WELL	750672	743752	1062523	015-21863	Active	4	YES	F	41.680428	-76.667281
CHESAPEAKE APPALACHIA LLC	ACW BRA 3H OG WELL	750768	743825	1047313	015-21871	Active	4	YES	F	41.669225	-76.700650
CHESAPEAKE APPALACHIA LLC	ACW BRA 5H OG WELL	750769	743827	1047315	015-21872	Active	4	YES	F	41.669144	-76.700650
CHESAPEAKE APPALACHIA LLC	NEAL BRA 2H OG WELL	752333	745053	1049970	015-21958	Active	4	YES	F	41.680475	-76.667214
CHESAPEAKE APPALACHIA LLC	NEAL BRA 3H OG WELL	752334	745054	1049971	015-21959	Active	4	YES	F	41.680433	-76.667211
CHIEF OIL & GAS LLC	YODER UNIT 1H OG WELL	755374	747519	1061928	015-22076	Active	4	NO	F	41.679172	-76.675161
CHIEF OIL & GAS LLC	YODER UNIT 1H OG WELL	755374	747519	1061929	015-22076	Active	4	YES	F	41.679172	-76.675161
CHESAPEAKE APPALACHIA LLC	KRISE BRA 2H OG WELL	756962	748859	1064893	015-22121	Active	4	YES	F	41.673486	-76.689233
CHESAPEAKE APPALACHIA LLC	KRISE BRA 3H OG WELL	756965	748861	1064895	015-22122	Active	4	YES	F	41.673494	-76.689178
CHESAPEAKE APPALACHIA LLC	KRISE BRA 5H OG WELL	756966	748862	1064896	015-22123	Active	4	YES	F	41.673478	-76.689286
CHESAPEAKE APPALACHIA LLC	BRACKMAN BRA 5H OG WELL	765388	756180	1086138	015-22298	Active	4	YES	F	41.667342	-76.740883
CHESAPEAKE APPALACHIA LLC	ATGAS BRA 5H	737673	756597	1086987	015-22318	Active	4	YES	F	41.666436	-76.709719
CHESAPEAKE APPALACHIA LLC	CRANRUN BRA 3H	734465	757663	1089449	015-22375	Active	4	YES	F	41.662950	-76.726103
CHESAPEAKE APPALACHIA LLC	PETTY BRA 3H	734465	758198	1090986	015-22407	Active	4	YES	F	41.662431	-76.716272
CHESAPEAKE APPALACHIA LLC	MARTIN 1H-6H	723631	758578	1091900	015-22445	Active	4	YES	F	41.726833	-76.700244
CHESAPEAKE APPALACHIA LLC	ACW BRA 2H	749619	758618	1092011	015-22453	Operator reported not drilled	4	YES	F	41.669186	-76.700650
CHESAPEAKE APPALACHIA LLC	MORSE 1H-6H	730680	760551	1097096	015-22565	Active	4	YES	F	41.683236	-76.655967
CHESAPEAKE APPALACHIA LLC	BENNETT 2H	738071	733483	1018961	015-21213	Active	4	YES	G	41.719147	-76.127738
CHESAPEAKE APPALACHIA LLC	BENNETT 4H	738071	733584	1019096	015-21224	Active	4	YES	G	41.719105	-76.127736
CHESAPEAKE APPALACHIA LLC	BENNETT 3H	738071	733588	1019102	015-21225	Active	4	YES	G	41.719150	-76.127669
CHESAPEAKE APPALACHIA LLC	BENNETT 1H	738071	733590	1019105	015-21226	Operator Reported Not Drilled	401	YES	G	41.719108	-76.127666
CHESAPEAKE APPALACHIA LLC	BENNETT BRA 1H	737436	759214	1093596	015-22508	Operator Reported Not Drilled	401	YES	G	41.719108	-76.127666
CHESAPEAKE APPALACHIA LLC	BENNETT BRA 1H	737436	775139	1132316	015-23026	Active	4	YES	G	41.719108	-76.127666
UNKNOWN OPR	BURBAGE 1	761023	752323	1077243	015-00005	DEP Abandoned List	524	YES	H	41.606969	-76.398469
CHESAPEAKE APPALACHIA LLC	PLYMOUTH 2H	728901	726783	1006870	015-20644	Active	4	YES	H	41.613275	-76.367180
CHESAPEAKE APPALACHIA LLC	PLYMOUTH 5H	728901	726787	1006880	015-20645	Active	4	YES	H	41.613261	-76.367230
CHESAPEAKE APPALACHIA LLC	PLYMOUTH 6H	728901	727042	1007369	015-20666	Operator Reported Not Drilled	401	YES	H	41.613294	-76.367308
CHESAPEAKE APPALACHIA LLC	CRAWFORD 2H	729725	727365	1007954	015-20701	Active	4	YES	H	41.608355	-76.373486
CHESAPEAKE APPALACHIA LLC	CRAWFORD 4H	729725	727366	1007957	015-20702	Active	4	NO	H	41.608344	-76.373538

Table C-35 Well Inventory Summary

Bradford County, Pennsylvania

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CHESAPEAKE APPALACHIA LLC	CRAWFORD 3H	729725	727504	1008149	015-20723	Operator Reported Not Drilled	401	YES	H	41.608333	-76.373591
CHESAPEAKE APPALACHIA LLC	CRAWFORD 5H	729725	731419	1015287	015-21030	Operator Reported Not Drilled	401	YES	H	41.608394	-76.373555
CHESAPEAKE APPALACHIA LLC	DAVE 3H	735709	733281	1018642	015-21206	Active	4	YES	H	41.608733	-76.389447
CHESAPEAKE APPALACHIA LLC	DAVE 1H	735709	733430	1018888	015-21207	Active	4	YES	H	41.608733	-76.389447
CHESAPEAKE APPALACHIA LLC	DAVE 2H	735709	733435	1018895	015-21208	Active	4	YES	H	41.608741	-76.389500
CHESAPEAKE APPALACHIA LLC	DAVE 5H	735709	733451	1018917	015-21209	Proposed But Never Materialized	6	YES	H	41.608791	-76.389486
CHESAPEAKE APPALACHIA LLC	SCHLAPFER N BRA 2H	758015	751191	1075007	015-22202	Active	4	YES	H	41.602180	-76.400727
CHESAPEAKE APPALACHIA LLC	SCHLAPFER S BRA 2H	758015	751886	1076441	015-22226	Active	4	NO	H	41.602150	-76.400763
CHESAPEAKE APPALACHIA LLC	CRAWFORD BRA 3H	729725	756385	1086503	015-22304	Active	4	YES	H	41.608333	-76.373591
CHESAPEAKE APPALACHIA LLC	DAVE BRA 5H	735709	757911	1090258	015-22388	Operator Reported Not Drilled	401	YES	H	41.608783	-76.389430
CHESAPEAKE APPALACHIA LLC	FREED BRA 1H	760561	758530	1091770	015-22443	Regulatory Inactive Status	523	YES	H	41.596686	-76.381422
CHESAPEAKE APPALACHIA LLC	PLYMOUTH BRA 3H	728901	758534	1091775	015-22447	Operator Reported Not Drilled	401	YES	H	41.613247	-76.367280
CHESAPEAKE APPALACHIA LLC	SCHLAPFER N BRA 3H	758015	763432	1103135	015-22634	Active	4	YES	H	41.602122	-76.400802
CHESAPEAKE APPALACHIA LLC	FREED BRA 2H	760561	768487	1114790	015-22730	Active	4	YES	H	41.596655	-76.381383
CHESAPEAKE APPALACHIA LLC	DAVE BRA 5H	735709	773785	1128986	015-22892	Active	4	YES	H	41.608783	-76.389430
CHESAPEAKE APPALACHIA LLC	PLYMOUTH BRA 3H	728901	773796	1129009	015-22896	Active	4	YES	H	41.613247	-76.367280

Source: http://www.pasda.psu.edu/uci/MetadataDisplay.aspx?entry=PASDA&file=OilGasLocations2013_01.xml&dataset=283 (Accessed April 2013)

Notes:

[a] = Search area could not be determined due to the actual location of well being unidentified by lack of latitude and longitude coordinates.

Key:

NA = Not applicable

NI = No information available

Table C-36 Number of Oil and Gas Wells

Search Area Name	Radius (miles)	EPA Samples	Total Number of Oil and Gas Wells	Oil and Gas wells within 1 Mile of EPA Sample Points
Bradford County				
A	3	NEPAGW13 NEPAGW18 NEPAGW19 NEPAGW20/d NEPAGW20d NEPAGW31	34	6
B	3	NEPAGW05 NEPWGW06/d NEPAGW09 NEPAGW10 NEPAGW11 NEPAGW12 NEPAGW14 NEPAGW25	46	24
C	3	NEPAGW08 NEPAGW28 NEPAGW29	33	16
D	1	NEPAGW15 NEPAGW16/d NEPAGW17 NEPASW01/d	6	6
E	1	NEPAGW04 NEPASW05 NEPASW06	1	1
F	3	NEPAGW01 NEPAGW02/d NEPAGW03 NEPAGW07 NEPAGW36 NEPASW03 NEPASW04/d	25	11
G	1	NEPASW02	2	2
H	1	NEPAGW32 NEPAGW33	9	9
Susquehanna County				
A	3	NEPAGW21 NEPAGW22 NEPAGW23	109	28
B	1	NEPAGW24	2	2

Key:

EPA = Environmental Protection Agency

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
ARNOLD 1H	015-20268	0	NA	NA	NA	Operator reported not drilled. 4/7/2009. Technical review 1 completed of the permit review.	Monroe Twp	41.695306	-76.467194	NA	CHESAPEAKE APPALACHIA LLC
ARNOLD 3H	015-20299	0	NA	NA	NA	Operator reported not drilled. 5/28/2009. Technical review 1 completed of the permit review.	Monroe Twp	41.695358	-76.467111	NA	CHESAPEAKE APPALACHIA LLC
VAN NOY 1	015-20096	1	NA	No Violations Noted	NA	Vertical Well	Granville Twp	41.709196	-76.682475	07/07/08	CHESAPEAKE APPALACHIA LLC
VARGSON 1H	015-20097	5	02/25/09	No E&S plan developed, plan not on site.	Comply/Closed	Horizontal Well	Granville Twp	41.710069	-76.694890	08/25/08	CHESAPEAKE APPALACHIA LLC
			02/25/09	No E&S plan developed, plan not on site.	Comply/Closed						
VANNOY 627108 2	015-20113	16	02/25/09	Failure to maintain 2 ft. freeboard in an impoundment.	Yes	Horizontal Well	Granville Twp	41.709196	-76.682475	12/21/08	CHESAPEAKE APPALACHIA LLC
			03/03/09	1) Discharge of pollutional material to waters of Commonwealth. Compliance record: Section 401 - fresh water flowing from two 500 bbl tanks located on site, eroding the ground surface and causing elevated turbidity in a nearby pond.	Administrative Close Out						
			03/27/09	1) Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2) Failure to maintain 2 ft. freeboard in an impoundment. 3) E&S Plan not adequate. Compliance record: Ongoing violations related to 3/20/09 ER inspection, this 3/27/09 inspection conducted from a complaint, related to Inspection ID 1779418 (VANNOY 627108 3) also.	Yes ($27,271.93)						

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
			03/20/09	1) O&G Act 223-General. Used only when a specific O&G Act code cannot be used. 2) Failure to construct properly plug, frac, brine pits. 3) Impoundment not structurally sound, impermeable, 3rd party protected, greater than 20 in. of seasonal high ground water table. 4) Clean Streams Law-General. Used only when a specific Clean Streams Law code cannot be used. 5) Discharge of pollultional material to waters of Commonwealth. Compliance record Violation Comment: HCl not contained in pit, tank or series of pits and tanks, spill occurred on-site, ER inspection. Inspection Comment: ER inspection of HCl spill at site, multiple violations documented and cited in NOV issued on 4/2/09 in conjunction with 3/27/09 follow-up inspection. Inspection information received in NOV issued 4/2/09, greater than 10 days past the date of the ER inspection.	Yes ($27,271.93)						
			04/01/09	On site meeting to discuss previous acid spill and E&S violations, E&S violations remain, portion of drilling fluids pumped from pit closing 78.56 violations, 21 roll-offs HCl impacted soils removed, HCl release estimated at 10 bbls, further enforcement pending.	NA						
			07/23/09	1) O&G Act 223-General. Used only when a specific O&G Act code cannot be used. Compliance record: By allowing drill cuttings and fluid to be in direct contact with the ground surface without containment, and thus threatening the waters of the Commonwealth, Chesapeake Appalachia, LLC has violated 25 PA Code § 78.56(a), Section 301 of the Solid Waste Management Act, 35 P.S. § 6018.301, Section 307(a) of the Clean Streams Law, 35 P.S. §691.307(a), Section402(a) of the Clean Streams Law, 35 P.S. §691.402(a) and the rules and regulations of the Department.	08/06/09 inspection recommend resolving the 7/23/09 violations provided that waste disposal receipts are provided for the pit remediation.						

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
			11/05/09	1) Discharge of pollutional material to waters of Commonwealth. 2) Clean Streams Law-General. Used only when a specific Clean Streams Law code cannot be used. 3) O&G Act 223-General. Used only when a specific O&G Act code cannot be used. Compliance record Violation comment: pond impact (waters of the commonwealth) Inspection Comment: sampled pond adjacent to well pad. low pH and Oil & Gas constituents. Historical NOVs associated with site.	Resolution not listed						
VANNOY 627109 3	015-20114	14	02/04/09	1) Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2) Drillers Log not on site.	Yes	Horizontal Well	Granville Twp	41.709188	-76.682531	01/22/09	CHESAPEAKE APPALACHIA LLC
			03/27/09	1) Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2) E&S Plan not adequate. 3) Failure to maintain 2 ft. freeboard in an impoundment. Compliance record indicates: Ongoing violations related to 3/20/09 ER inspection, this 3/27/09 inspection conducted from a complaint, related to Inspection ID 1778894 also.	Yes ($27,271.93)						
			04/01/09	On site meeting to discuss previous acid spill and E&S violations, E&S violations remain, portion of drilling fluids pumped from pit closing 78.56 violations, 21 roll-offs HCl impacted soils removed, HCl release estimated at 10 bbls, further enforcement pending.	NA						
			07/23/09	1) O&G Act 223-General. Used only when a specific O&G Act code cannot be used. Compliance record indicates: By allowing drill cuttings and fluid to be in direct contact with the ground surface without containment, and thus threatening the waters of the Commonwealth, Chesapeake Appalachia, LLC has violated 25 PA Code § 78.56(a), Section 301 of the Solid Waste Management Act, 35 P.S. § 6018.301, Section 307(a) of the Clean Streams Law, 35 P.S. §691.307(a), Section 02(a) of the Clean Streams Law, 35 P.S. §691.402(a) and the rules and regulations of the Department.	Resolution not listed						

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
			03/20/09	1) Impoundment not structurally sound, impermeable, 3rd party protected, greater than 20 in. of seasonal high ground water table. 2) Failure to construct properly plug, frac, brine pits. 3) Discharge of pollultional material to waters of Commonwealth. 4) Clean Streams Law-General. Used only when a specific Clean Streams Law code cannot be used. 5) O&G Act 223-General. Used only when a specific O&G Act code cannot be used. Compliance record indicates: ER inspection of HCl spill at site, multiple violations documented and cited in NOV issued on 4/2/09 in conjunction with 3/27/09 follow-up inspection. Insepection information received in NOV issued 4/2/09, greater than 10 days past the date of the ER inspection. Inspection created with CACP on 12/29/09, late.	Yes ($27,271.93)						
			11/05/09	1) Clean Streams Law-General. Used only when a specific Clean Streams Law code cannot be used. 2) O&G Act 223-General. Used only when a specific O&G Act code cannot be used. 3) Discharge of pollultional material to waters of Commonwealth. Compliance record indicates: pond water quality impacted by well pad activates low pH and Oil & gas constituents. Vanoy 2H inspection duplicate. Certified Mail NOV sent 12/30/2009.	Resolution not listed						
BRACKMAN 2H	015-20758	3	06/08/10	De minimis violations noted	NA	Horizontal Well	Leroy Twp	41.667355	-76.740830	05/14/10	CHESAPEAKE APPALACHIA LLC
			07/01/10	Excessive casing seat pressure.	Resolution not listed						
BRACKMAN BRA 5H	015-22298	1	NA	No Violations Noted	NA	9/18/2013. The technical review and decision review are complete and either the permit decision and/or permit issuance are forthcoming.	Leroy Twp	41.667342	-76.740883	NI	CHESAPEAKE APPALACHIA LLC
CRANRUN 1H	015-21183	1	NA	No Violations Noted	NA	8/23/2010. The technical review and decision review are complete and either the permit decision and/or permit issuance are forthcoming.	Leroy Twp	41.662886	-76.726008	NI	CHESAPEAKE APPALACHIA LLC

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
CRANRUN 2H	015-20995	4	10/20/10	1) Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2) Industrial waste was discharged without permit.	Yes	Horizontal Well	Leroy Twp	41.662872	-76.726075	07/21/10	CHESAPEAKE APPALACHIA LLC
CRANRUN 5H	015-20997	5	NA	No Violations Noted	NA	Horizontal Well	Leroy Twp	41.662911	-76.726088	07/21/10	CHESAPEAKE APPALACHIA LLC
CRANRUN 4H	015-21074	1	NA	No Violations Noted	NA	7/8/2010. Technical review 1 was completed of the permit review.	Leroy Twp	41.662925	-76.726022	NI	CHESAPEAKE APPALACHIA LLC
CRANRUN BRA 3H	015-22375	0	NA	NA	NA	11/19/2012. Technical review 1 was completed of the permit review.	Leroy Twp	41.662950	-76.726103	NI	CHESAPEAKE APPALACHIA LLC
ATGAS 1H	015-21255	1	NA	No Violations Noted	NA	9/30/2010. Technical review 1 was completed of the permit review.	Leroy Twp	41.666375	-76.709750	NI	CHESAPEAKE APPALACHIA LLC
ATGAS 2H	015-21237	11	04/22/11	1) Pit and tanks not constructed with sufficient capacity to contain pollutional substances. 2) Discharge of pollultional material to waters of Commonwealth. 3) Stream discharge of industrial waste, includes drill cuttings, oil, brine and/or silt.	Yes ($190,000)	Horizontal Well	Leroy Twp	41.666425	-76.709769	12/22/10	CHESAPEAKE APPALACHIA LLC
			07/16/12	1) Failure to adopt pollution prevention measures required or prescribed by DEP by handling materials that create a danger of pollution. 2) Failure to properly control or dispose of industrial or residual waste to prevent pollution of the waters of the Commonwealth. 3) Failure of storage operator to maintain and/or submit required information, such as maps, well records, integrity testing information, pressure data. Compliance records: 30 gallon flowback spill	Yes						
ATGAS 3H	015-21256	1	NA	No Violations Noted	NA	9/30/2010. Technical review 1 was completed of the permit review.	Leroy Twp	41.666450	-76.709667	NI	CHESAPEAKE APPALACHIA LLC
ATGAS 4H	015-21257	1	NA	No Violations Noted	NA	9/30/2010. Technical review 1 was completed of the permit review.	Leroy Twp	41.666389	-76.709697	NI	CHESAPEAKE APPALACHIA LLC
ATGAS BRA 5H	015-22318	0	NA	NA	NA	10/3/2013. The technical review and decision review are complete and either the permit decision and/or permit issuance are forthcoming.	Leroy Twp	41.666436	-76.709719	NI	CHESAPEAKE APPALACHIA LLC

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
ATGAS 6H	015-21259	1	NA	No Violations Noted	NA	9/30/2010. Technical review 1 was completed of the permit review.	Leroy Twp	41.666400	-76.709644	NI	CHESAPEAKE APPALACHIA LLC
PETTY BRA 3H	015-22407	0	NA	NA	NA	12/10/2012. The permit application package is complete, has been accepted, and is undergoing technical review.	Leroy Twp	41.662431	-76.716272	NI	CHESAPEAKE APPALACHIA LLC
PETTY 1H	015-21299	0	NA	NA	NA	10/21/2010. Technical review 1 was completed of the permit review.	Leroy Twp	41.662356	-76.716356	NI	CHESAPEAKE APPALACHIA LLC
PETTY 4H	015-21301	0	NA	NA	NA	10/21/2010. Technical review 1 was completed of the permit review.	Leroy Twp	41.662369	-76.716303	NI	CHESAPEAKE APPALACHIA LLC
PETTY 6H	015-21212	0	NA	NA	NA	9/3/2010. Technical review 1 was completed of the permit review.	Leroy Twp	41.662381	-76.716250	NI	CHESAPEAKE APPALACHIA LLC
PETTY 5H	015-21302	4	NA	No Violations Noted	NA	Horizontal Well	Leroy Twp	41.662405	-76.716377	02/08/11	CHESAPEAKE APPALACHIA LLC
ACW BRA 2H	015-22453	0	NA	NA	NA	Operator reported not drilled. 12/4/2012. The permit application package is complete, has been accepted, and is undergoing technical review.	Leroy Twp	41.669186	-76.700650	NA	CHESAPEAKE APPALACHIA LLC
ACW BRA 3H	015-21871	0	NA	NA	NA	8/10/2011. The permit application package is complete, has been accepted, and is undergoing technical review.	Leroy Twp	41.669225	-76.700650	NI	CHESAPEAKE APPALACHIA LLC
ACW BRA 5H	015-21872	1	NA	No Violations Noted	NA	Horizontal Well	Leroy Twp	41.669144	-76.700650	01/16/12	CHESAPEAKE APPALACHIA LLC
ANDRUS UNIT 1H	015-21353	5	04/13/11	Failure to achieve permanent stabilization of earth disturbance activity.	Yes	Horizontal Well	Franklin Twp	41.714105	-76.632633	03/11/11	CHIEF OIL & GAS LLC
			02/28/12	Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days.	Resolution not listed						

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
WELLES 1 5H	015-20242	4	08/07/09	1) Site conditions present a potential for pollution to waters of the Commonwealth. 2) Clean Streams Law-General. Used only when a specific Clean Stream Law code cannot be used. 3) O&G Act 223-General. Used only when a specific O&G Act code cannot be used. Compliance record Inspection comments: Pit leak- self reported. Leak fixed. 3rd page NOV sent. Soil analytical results reviewed 9/2/09, barium 171 mg/kg (< Act 2 8200 mg/kg standard), chloride 170 mg/kg (no Act 2 standard), no remediation needed. Violation comments: Soil analytical results reviewed 9/2/09, barium 171 mg/kg (< Act 2 8200 mg/kg standard), chloride 170 mg/kg (no Act 2 standard), no remediation needed. 25 PA Code §78.56 failure to contain pollutional substances and wastes associated with drilling a well. Solid Waste Management Act 6018.301 failure to manage residual waste. Clean Stream Law 691.307(a) unpermitted discharge of industrial waste. 25 PA Code §78.60(b)(1) failure to follow discharge requirements. 25 PA Code §78.57(a) discharge of drilling contaminated fluids to the ground. Clean Stream Law 691.402(a) potential pollution.	Yes	Horizontal Well	Terry Twp	41.649436	-76.307575	06/15/09	CHESAPEAKE APPALACHIA LLC

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
WELLES 1 3H	015-20244	7	08/07/09	1) Site conditions present a potential for pollution to waters of the Commonwealth. 2) Clean Streams Law-General. Used only when a specific Clean Streams Law code cannot be used. 3) O&G Act 223-General. Used only when a specific O&G Act code cannot be used. Compliance record Inspection comments: Pit leak- self reported. Leak fixed. 3rd page NOV sent. Soil analytical results reviewed 9/2/09, barium 171 mg/kg (< Act 2 8200 mg/kg standard), chloride 170 mg/kg (no Act 2 standard), no remediation needed. Violation comments: Soil analytical results reviewed 9/2/09, barium 171 mg/kg (< Act 2 8200 mg/kg standard), chloride 170 mg/kg (no Act 2 standard), no remediation needed. 25 PA Code §78.56 failure to contain pollutional substances and wastes associated with drilling a well. Solid Waste Management Act 6018.301 failure to manage residual waste. Clean Streams Law 691.307(a) unpermitted discharge of industrial waste. 25 PA Code §78.60(b)(1) failure to follow discharge requirements. 25 PA Code §78.57(a) discharge of drilling contaminated fluids to the ground. Clean Streams Law 691.402(a) potential pollution.	Yes	Horizontal Well	Terry Twp	41.649433	-76.307519	06/16/09	CHESAPEAKE APPALACHIA LLC
			09/29/11	Failure to properly control or dispose of industrial or residual waste to prevent pollution of the waters of the Commonwealth.	Yes						

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
WELLES 3 2H	015-20334	18	09/25/13	Incident- Response to Accident or Event Inspection Comment: Arrived at the site at 11:20 in response to a (25) gallon spill of an unknown material. Chesapeake reported the spill incident to the Department at 6:42 PM on 9/25/13. The Marcellus incident report indicates the spill occurred as Chesapeake was getting ready to move frac equipment. They were moving a dumpster not on containment and in the process of cleaning it out. The report alleges a liquid leaked out of the container and is most likely water. The liquid impacted the soil around the dumpster and Chesapeake already scraped the soil and staged it on containment for removal.	Yes	Horizontal Well	Terry Twp	41.653736	-76.295591	12/13/09	CHESAPEAKE APPALACHIA LLC
			11/25/13	1) Failure to adopt pollution prevention measures required or prescribed by DEP by handling materials that create a danger of pollution. 2) Pit and tanks not constructed with sufficient capacity to contain pollutional substances. 3) Failure to properly store, transport, process or dispose of a residual waste. Compliance record indicates: Chesapeake submitted a report to the Department on 11/8/13 in relation to the spill incident that occurred at the site. The report indicates a brine spill of approximately (25) gallons was released to the soil on 9/25/13 while equipment was being moved after completions activities. The report includes a brief description of the incident and post excavation sampling results. The spill was reported to the Department at 6:42 PM on 9/25/13. Chesapeake originally indicated to the Department the spill was most likely water. The Department reviewed the post excavation sampling results on 11/22/13 and concluded that although there may still be some evidence of the spill remaining, there are no compounds of concern above their relevant cleanup standards and there is no need for additional soil remediation with respect to this spill.							
WELLES 3 5H	015-20335	18	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.653652	-76.295594	12/13/09	CHESAPEAKE APPALACHIA LLC
WELLES 5 2H	015-20418	9	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.657947	-76.275425	03/11/10	CHESAPEAKE APPALACHIA LLC
WELLES 5 5H	015-20419	6	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.657983	-76.275447	03/20/10	CHESAPEAKE APPALACHIA LLC

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
WELLES 1 BRA 1H	015-22523	0	NA	NA	NA	1/11/2013. The permit application package is complete, has been accepted, and is undergoing technical review.	Terry Twp	41.649367	-76.307625	NI	CHESAPEAKE APPALACHIA LLC
WELLES 3 BRA 3H	015-22499	0	NA	NA	NA	12/18/2012. The permit application package is complete, has been accepted, and is undergoing technical review.	Terry Twp	41.653736	-76.295647	NI	CHESAPEAKE APPALACHIA LLC
WELLES 5 BRA 3H	015-22476	0	NA	NA	NA	12/12/2012. The permit application package is complete, has been accepted, and is undergoing technical review.	Terry Twp	41.657908	-76.275406	NI	CHESAPEAKE APPALACHIA LLC
WELLES 5 6H	015-20418	1	NA	No Violations Noted	NA	Operator reported not drilled.	Terry Twp	41.657947	-76.275425	NA	CHESAPEAKE APPALACHIA LLC
OTTEN BRA 3H	015-22288	0	NA	NA	NA	9/20/2012. Technical review 1 completed of permit review	Asylum Twp	41.672661	-76.364417	NI	CHESAPEAKE APPALACHIA LLC

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
OTTEN 626935 1H	015-20118	10	01/16/09	No E&S plan developed, plan not on site.	Yes	Horizontal Well	Asylum Twp	41.672523	-76.364501	12/21/08	CHESAPEAKE APPALACHIA LLC
			02/19/09	1) Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2) Improperly lined pit. 3) O&G Act 223-General. Used only when a specific O&G Act code cannot be used. Compliance record: Residual waste to ground surface and failure to report a release. 07/01/09 Compliance Evaluation Comments: On 2/19/09, site was inspected and noted that uncontained drilling fluids were located on the surface of the well pad and also located off-site, downgradient of the fill slope. In addition, portions of the site were not properly stabilized in accordance with Chapter 102 regulations. It was verified that the previously spilled drilling fluids had been excavated as previously indicated. However, the fill slope was not properly stabilized and the silt fence at the base of the fill slope was not properly installed to minimize erosion potential. Chesapeake indicated that the violations will be corrected by next week. Reinspection required to verify. 08/21/09 Compliance Evaluation Comments: Former spill areas checked, all appeared to be in order.	Yes ($4,250)						
			06/15/10	1) Failure to post pit approval number 2) Discharge of pollultional material to waters of Commonwealth 3) Administrative Code-General. Compliance record indicates: Brine spill outside of secondary containment	Yes ($27,271.93)						

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
			08/19/10	1) Failure to properly store, transport, process or dispose of a residual waste. Compliance record indicates: Waste all over ground at site.	Yes						
			06/07/11	A complaint was filed to the Department regarding potential contamination at this site. Conducted an inspection of the site with Sean VanFleet Solid Waste Specialist, North Central Region. Noted a small area of standing water below a cleanout in the pipeline area relatively close to the site entrance. The area was approximately 1 to 2 feet in diameter and the volume of water was approximately 2 to 3 gallons. Using an EXTECH meter to obtain a conductivity reading of the water. The meter read (OL) which means over the limit in conductivity. Performed sampling analysis of the water using SAC 046. Also noted E&S issues off the northeast corner of the pad behind the production tanks. The berm was noted to contain accelerated erosion causing an erosion channel in this area. E&S issues will be referred to Gene Rickard, Water Quality Specialist, who will conduct a follow up inspection of the site.							
OTTEN 627016 2H	015-20119	4	NA	No Violations Noted	NA	Horizontal Well	Asylum Twp	41.672454	-76.364448	02/23/09	CHESAPEAKE APPALACHIA LLC
JOHN BARRETT 627215 1H	015-20134	4	NA	No Violations Noted	NA	Horizontal Well	Asylum Twp	41.684101	-76.356979	04/18/09	CHESAPEAKE APPALACHIA LLC
JOHN BARRETT 627220 6H	015-20155	0	NA	NA	NA	Operator reported not drilled. 1/9/2009. Technical review 2 completed of permit review.	Asylum Twp	41.684049	-76.357004	NA	CHESAPEAKE APPALACHIA LLC
JOHN BARRETT BRA 3H	015-22509	0	NA	NA	NA	12/28/2012. The permit application package is compete, has been accepted, and is undergoing technical review.	Asylum Twp	41.684178	-76.356997	NI	CHESAPEAKE APPALACHIA LLC
JOHN BARRETT 627210 2H	015-20133	5	07/14/11	Failure to restore site within 9 months of plugging well.	Not resolvable	Horizontal Well	Asylum Twp	41.684032	-76.356923	05/16/09	CHESAPEAKE APPALACHIA LLC

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
HERSHBERGER 2H	015-20296	10	07/14/11	1) Failure to restore site within 9 months of completion of drilling or plugging. 2) Failure to properly store, transport, process or dispose of a residual waste. 3) Solid Waste Management Act 6018.610(1) violation cited, operation of a residual waste processing facility without proper authorization from the Department. Compliance records: Department records indicate that Chesapeake has failed to restore the site within nine (9) months after completion of drilling, since no drilling has occurred at this site since October 10, 2009 and associated stimulation of the Hershberger 2H and 5H wells on the pad was completed on March 5, 2010. This constitutes a violation of Section 206(c) of the Oil and Gas Act, 58 P.S. §601.206(c). The Department has revealed the evidence of fluids being treated and stored at the Hershberger 2H, 5H well pad since no wells have been drilled since October 10, 2009. The site operations constitute an unpermitted residual waste processing facility.	Yes	Horizontal Well	Terry Twp	41.684208	-76.336308	07/28/09	CHESAPEAKE APPALACHIA LLC
			07/26/11	Failure to restore well site within nine months after completion of drilling, failure to remove all pits, drilling supplies and equipment not needed for production.	Yes						
			12/14/11	Failure to properly store, transport, process or dispose of a residual waste.	Yes						
HERSHBERGER BRA 3H	015-22446	0	NA	NA	NA	7/28/2009. Technical review 1 completed of permit review.	Terry Twp	41.684128	-76.336300	NI	CHESAPEAKE APPALACHIA LLC
HERSHBERGER 5H	015-20330	8	10/28/09	1) Failure to maintain 2 ft. freeboard in an impoundment 2) No Control and Disposal/Pollution Prevention Control plan or failure to implement Pollution Prevention Control plan	Yes	Horizontal Well	Terry Twp	41.684166	-76.336305	09/08/09	CHESAPEAKE APPALACHIA LLC

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Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
			07/14/11	1) Failure to restore site within 9 months of completion of drilling or plugging. 2) Failure to properly store, transport, process or dispose of a residual waste. 3) Solid Waste Mnagement Act 6018.610(1) violation cited, operation of a residual waste processing facility without proper authorization from the Department. Compliance record indicates: Department records indicate that Chesapeake has failed to restore the site within nine (9) months after completion of drilling, since no drilling has occurred at this site since October 10, 2009 and associated stimulation of the Hershberger 2H and 5H wells on the pad was completed on March 5, 2010. This constitutes a violation of Section 206(c) of the Oil and Gas Act, 58 P.S. §601.206(c). The Department has revealed the evidence of fluids being treated and stored at the Hershberger 2H, 5H well pad since no wells have been drilled since October 10, 2009. The site operations constitute an unpermitted residual waste processing facility.	Yes						
CLAUDIA 1H	015-20331	2	08/21/09	1) Failure to post permit number, operator name, address, telephone number in a conspicuous manner at the site during drilling. 2) E&S Plan not adequate. 3) Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Horizontal Well	Terry Twp	41.683100	-76.322331	07/12/09	CHESAPEAKE APPALACHIA LLC
			11/16/09	De minimis violations noted	NI						
CLAUDIA BRA 3H	015-22278	0	NA	NA	NA	Operator reported not drilled. 9/20/2012. Technical review 1 was completed of the permit review.	Terry Twp	41.683106	-76.322239	NA	CHESAPEAKE APPALACHIA LLC
CLAUDIA 5H	015-20405	1	NA	No Violations Noted	NA	Operator reported not drilled. 7/24/2009. Technical review 1 was completed of the permit review.	Terry Twp	41.683075	-76.322261	NA	CHESAPEAKE APPALACHIA LLC

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
CLAUDIA 2H	015-20406	8	05/07/10	1) Person constructed, operated, maintained, modified, enlarged or abandoned a water obstruction or encroachment but failed to obtain Chapter 105 permit. 2) Polluting substance(s) allowed to discharge into Waters of the Commonwealth. 3) Clean Streams Law-General. Used only when a specific Clean Streams Law code cannot be used. 4) Industrial waste was discharged without permit. 5) Site conditions present a potential for pollution to waters of the Commonwealth. Compliance records: Encroachment without permit, frac out released bore gel to stream, petroleum product spilled to ground with potential to enter stream. Violation comment: Adequate company response received 6/1/10, Clean Stream Law 401 violation closed. 691.401 - discharge of polluting substance to Waters of the Commonwealth - bore gel - unknown amount, estimated to be a small amount. based on similar incidents.	Yes	Horizontal Well	Terry Twp	41.683183	-76.322275	09/10/09	CHESAPEAKE APPALACHIA LLC
			06/27/11	1) Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). Compliance records Inspection comments: Complaint from property - rusty seep and new berm. Violation comments: 1) not marking east fill slope berm on plan. failure to depict type and location of best management practices, 2) failure to maintain current E&S controls on site, 3) failure to correctly install erosion control matting, 4) failure to provide inspection and monitoring records at the project site.	Yes						
CLAUDIA 4H	015-20332	7	11/13/09	De minimis violations noted	NI	Horizontal Well	Terry Twp	41.683144	-76.322255	09/20/09	CHESAPEAKE APPALACHIA LLC
			08/21/09	1) Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2) E&S Plan not adequate. 3) Failure to post permit number, operator name, address, telephone number in a conspicuous manner at the site during drilling.	Yes						
SOLOWIEJ 5H	015-20470	7	11/17/13	Failure to properly install the permit number, issued by the department, on a completed well.	Yes	Horizontal Well	Wyalusing Twp	41.712466	-76.299183	12/30/09	CHESAPEAKE APPALACHIA LLC

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
SOLOWIEJ BRA 2H	015-22394	1	NA	No Violations Noted	NA	Proposed but never materialized. 12/5/2012. technical review 1 completed of permit review	Wyalusing Twp	41.712467	-76.299292	NA	CHESAPEAKE APPALACHIA LLC
SOLOWIEJ 6H	015-20321	7	11/17/10	Failure to properly install the permit number, issued by the department, on a completed well.	Yes	Horizontal Well	Wyalusing Twp	41.712466	-76.299183	12/30/09	CHESAPEAKE APPALACHIA LLC
HARPER 4H	015-20649	5	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.681036	-76.310950	03/13/10	CHESAPEAKE APPALACHIA LLC
HARPER 5H	015-20541	6	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.681016	-76.310900	12/22/09	CHESAPEAKE APPALACHIA LLC
HARPER BRA 3H	015-22344	0	NA	NA	NA	10/31/2012. Technical review 1 was completed of the permit review.	Terry Twp	41.681056	-76.310997	NI	CHESAPEAKE APPALACHIA LLC
POTTER 5H	015-20402	3	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.684227	-76.291191	04/10/10	CHESAPEAKE APPALACHIA LLC
POTTER BRA 1H	015-22498	0	NA	NA	NA	12/18/2012. The permit application package is complete, has been accepted, and is undergoing technical review.	Terry Twp	41.684278	-76.291214	NI	CHESAPEAKE APPALACHIA LLC
POTTER 3H	015-20449	2	NA	No Violations Noted	NA	Operator reported not drilled.	Terry Twp	41.684214	-76.291244	NA	CHESAPEAKE APPALACHIA LLC
POTTER 4H	015-20691	2	NA	No Violations Noted	NA	2/18/2010. Technical review 1 completed of permit review.	Terry Twp	41.684200	-76.291294	NI	CHESAPEAKE APPALACHIA LLC
POTTER 6H	015-20692	5	NA	No Violations Noted	NA	Vertical Well	Terry Twp	41.684213	-76.291244	04/10/10	CHESAPEAKE APPALACHIA LLC
ACLA 2H	015-20640	7	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.681744	-76.343977	04/11/10	CHESAPEAKE APPALACHIA LLC
ACLA 6H	015-20641	6	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.681766	-76.344025	05/25/10	CHESAPEAKE APPALACHIA LLC
ACLA BRA 3H	015-22287	0	NA	NA	NA	9/16/2013. The technical review and decision review are complete and either the permit decision and/or permit issuance are forthcoming.	Terry Twp	41.681786	-76.344072	NI	CHESAPEAKE APPALACHIA LLC

Table C-37 Notice of Violations Summary, Bradford County, Pennsylvania

Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
STALFORD 5H	015-20771	7	11/17/10	Failure to properly install the permit number, issued by the department, on a completed well.	Yes	Vertical Well	Wyalusing Twp	41.711966	-76.320275	07/01/10	CHESAPEAKE APPALACHIA LLC
			06/17/11	1) Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Compliance record indicates: 3 string design. Venting off of 13 3/8 - 60% combustable gas. 9 5/8 venting 90-100% combustible gas.	Resolution not listed						
PAULINY BRA 6H	015-22527	0	NA	NA	NA	1/1/2013. The permit application package is complete, has been accepted, and is undergoing technical review.	Terry Twp	41.686275	-76.302283	NI	CHESAPEAKE APPALACHIA LLC
PAULINY 2H	015-21150	0	NA	NA	NA	8/6/2010. Technical review 1 is complete of permit review.	Terry Twp	41.686311	-76.302233	NI	CHESAPEAKE APPALACHIA LLC
PAULINY 5H	015-20646	5	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.686247	-76.302247	07/28/10	CHESAPEAKE APPALACHIA LLC
BALDUZZI 2H	015-20720	9	03/11/11	Failure to properly install the permit number, issued by the department, on a completed well.	Yes	Horizontal Well	Wyalusing Twp	41.714730	-76.290683	09/20/10	CHESAPEAKE APPALACHIA LLC
			05/18/11	1) Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Compliance record indicates: 100% LEL spike off of 13 3/8 vent port. 90% LEL combustible gas constant off of 13 3/8 port. A subsequent inspection (6/17/11) noted 80% combustible gas vented off of 13 3/8.	Resolution not listed						
BALDUZZI 5H	015-20719	9	03/11/11	Failure to properly install the permit number, issued by the department, on a completed well.	Yes	Horizontal Well	Wyalusing Twp	41.714688	-76.290680	09/20/10	CHESAPEAKE APPALACHIA LLC
			06/17/11	1) Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Compliance records indicate: 10% combustible gas coming off of the 13 3/8.	Resolution not listed						
BALDUZZI BRA 3H	015-22331	0	NA	NA	NA	10/26/2012. Technical review 1 was completed of the permit review.	Wyalusing Twp	41.714772	-76.290683	NI	CHESAPEAKE APPALACHIA LLC
BURLEIGH 4H	015-21316	5	01/04/11	1) Failure to install, in a permanent manner, the permit number on a completed well. Compliance record indicates: Rig off location. No well tag or ID on well.	Yes	Horizontal Well	Wyalusing Twp	41.720186	-76.283863	12/01/10	CHESAPEAKE APPALACHIA LLC
BURLEIGH 3H	015-21420	6	NA	No Violations Noted	NA	Horizontal Well	Wyalusing Twp	41.720225	-76.283886	02/09/11	CHESAPEAKE APPALACHIA LLC

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Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
BURLEIGH 2H	015-21446	0	NA	NA	NA	Operator reported not drilled. 3/18/2011. Technical review 1 was completed of the permit review.	Wyalusing Twp	41.720264	-76.283906	NA	CHESAPEAKE APPALACHIA LLC
BURLEIGH 5H	015-21421	0	NA	NA	NA	12/20/2010. Technical review 1 was completed of the permit review.	Wyalusing Twp	41.720283	-76.283842	NI	CHESAPEAKE APPALACHIA LLC
BURLEIGH BRA 2H	015-22393	0	NA	NA	NA	Operator reported not drilled. 12/6/2012. Technical review 1 was completed of the permit review.	Wyalusing Twp	41.720264	-76.283906	NA	CHESAPEAKE APPALACHIA LLC
ROEBER 5H	015-21463	8	01/04/11	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Horizontal Well	Wyalusing Twp	41.716072	-76.312202	03/23/11	CHESAPEAKE APPALACHIA LLC
BLANNARD 1H	015-20817	2	NA	No Violations Noted	NA	Horizontal Well	Standing Stone Twp	41.784080	-76.311083	05/08/10	CHESAPEAKE APPALACHIA LLC
BLANNARD 2H	015-20717	0	NA	NA	NA	Operator reported not drilled. 3/3/2010. Technical review 1 was completed of the permit review.	Standing Stone Twp	41.784100	-76.311033	NA	CHESAPEAKE APPALACHIA LLC
BLANNARD 5H	015-20716	2	06/08/10	De minimis violations noted	NI	Horizontal Well	Standing Stone Twp	41.784100	-76.311033	05/08/10	CHESAPEAKE APPALACHIA LLC
BLANNARD BRA 3H	015-20818	0	NA	NA	NA	Operator reported not drilled.	Standing Stone Twp	41.784061	-76.311131	NA	CHESAPEAKE APPALACHIA LLC
LUNDY 5H	015-20557	2	NA	No Violations Noted	NA	Horizontal Well	Standing Stone Twp	41.782600	-76.320944	05/08/10	CHESAPEAKE APPALACHIA LLC
LUNDY BRA 3H	015-22397	0	NA	NA	NA	Proposed but never materialized. 1/3/2013. Technical review 1 completed of permit review.	Standing Stone Twp	41.782561	-76.320928	NA	CHESAPEAKE APPALACHIA LLC
LUNDY 2H	015-20556	3	NA	No Violations Noted	NA	Horizontal Well	Standing Stone Twp	41.782641	-76.320958	05/13/10	CHESAPEAKE APPALACHIA LLC
COATES 1H	015-21070	0	NA	NA	NA	Operator reported not drilled. 7/21/2010. Technical review 1 was completed of the permit review.	Standing Stone Twp	41.782875	-76.330883	NA	CHESAPEAKE APPALACHIA LLC
COATES 2H	015-20732	3	08/18/11	1) Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Compliance records indicate: 60% combustible gas off of vent.	Resolution not listed	Horizontal Well	Standing Stone Twp	41.782902	-76.330941	07/06/10	CHESAPEAKE APPALACHIA LLC

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Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
COATES 3H	015-21071	0	NA	NA	NA	Operator reported not drilled. 7/21/2010. Technical review 1 was completed of the permit review.	Standing Stone Twp	41.782972	-76.330881	NA	CHESAPEAKE APPALACHIA LLC
COATES 4H	015-21072	0	NA	NA	NA	Operator reported not drilled. 7/21/2010. Technical review 1 was completed of the permit review.	Standing Stone Twp	41.782908	-76.330853	NA	CHESAPEAKE APPALACHIA LLC
COATES 6H	015-21073	0	NA	NA	NA	Operator reported not drilled. 7/21/2010. Technical review 1 was completed of the permit review.	Standing Stone Twp	41.782944	-76.330822	NA	CHESAPEAKE APPALACHIA LLC
COATES BRA 3H	015-22307	0	NA	NA	NA	9/18/2013. The technical review and decision review are complete and either the permit decision and/or permit issuance are forthcoming.	Standing Stone Twp	41.782972	-76.330881	NI	CHESAPEAKE APPALACHIA LLC
COATES 5H	015-20946	2	NA	No Violations Noted	NA	Horizontal Well	Standing Stone Twp	41.782938	-76.330911	07/21/10	CHESAPEAKE APPALACHIA LLC
PRIMROSE 1H	015-21573	0	NA	NA	NA	2/28/2011. Technical review 1 completed of permit review	Standing Stone Twp	41.784942	-76.342919	NI	CHESAPEAKE APPALACHIA LLC
PRIMROSE 3H	015-21575	1	NA	No Violations Noted	NA	2/28/2011. Technical review 1 completed of permit review	Standing Stone Twp	41.784864	-76.343000	NI	CHESAPEAKE APPALACHIA LLC
PRIMROSE 4H	015-21576	0	NA	NA	NA	2/28/2011. Technical review 1 completed of permit review	Standing Stone Twp	41.784928	-76.342972	NI	CHESAPEAKE APPALACHIA LLC
PRIMROSE 6H	015-21577	0	NA	NA	NA	2/28/2011. Technical review 1 completed of permit review	Standing Stone Twp	41.784914	-76.343025	NI	CHESAPEAKE APPALACHIA LLC
PRIMROSE BRA 2H	015-22341	0	NA	NA	NA	Operator reported not drilled. 11/8/2012. Technical review 1 completed of permit review	Standing Stone Twp	41.784878	-76.342950	NA	CHESAPEAKE APPALACHIA LLC
PRIMROSE 5H	015-21447	1	NA	No Violations Noted	NA	Horizontal Well	Standing Stone Twp	41.784891	-76.342897	02/15/11	CHESAPEAKE APPALACHIA LLC
JONES BRA 5H	015-21760	2	NA	No Violations Noted	NA	Horizontal Well	Standing Stone Twp	41.754055	-76.306769	07/25/11	CHESAPEAKE APPALACHIA LLC
JONES BRA 2H	015-21794	2	NA	No Violations Noted	NA	Horizontal Well	Standing Stone Twp	41.754016	-76.306791	07/29/11	CHESAPEAKE APPALACHIA LLC
HAROLD W LUNDY 1	015-20002	4	NA	No Violations Noted	NA	Plugged well.	Standing Stone Twp	41.783701	-76.325586	NI	FAIRMAN DRILLING CO

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Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
HILLIS N BRA 3H	015-21994	2	01/30/12	O&G Act 223-General. Used only when a specific O&G Act code cannot be used.	Yes ($500)	Horizontal Well	Herrick Twp	41.748286	-76.289955	12/08/11	CHESAPEAKE APPALACHIA LLC
HILLIS S BRA 3H	015-22398	1	01/30/12	O&G Act 223-General. Used only when a specific O&G Act code cannot be used.	Yes ($500)	Proposed but never materialized.	Herrick Twp	41.748253	-76.289900	NA	CHESAPEAKE APPALACHIA LLC
HILLIS N BRA 2H	015-21984	1	01/30/12	O&G Act 223-General. Used only when a specific O&G Act code cannot be used.	O&G Act 223-General. Used only when a specific O&G Act code cannot be used	10/12/11. Technical review 1 completed of permit review	Herrick Twp	41.748219	-76.290022	NI	CHESAPEAKE APPALACHIA LLC
HILLIS S BRA 2H	015-21985	2	01/30/12	O&G Act 223-General. Used only when a specific O&G Act code cannot be used.	Yes	Horizontal Well	Herrick Twp	41.748252	-76.289988	12/11/11	CHESAPEAKE APPALACHIA LLC
STROM 627236 2H	015-20148	5	NA	No Violations Noted	NA	Horizontal Well	Monroe Twp	41.702438	-76.455175	06/04/09	CHESAPEAKE APPALACHIA LLC
DAN ELLIS 1H	015-20652	11	NA	No Violations Noted	NA	Horizontal Well	Monroe Twp	41.691897	-76.466025	04/12/10	CHESAPEAKE APPALACHIA LLC
DAN ELLIS 2H	015-20480	14	NA	No Violations Noted	NA	Horizontal Well	Monroe Twp	41.691936	-76.466036	04/13/10	CHESAPEAKE APPALACHIA LLC
DAN ELLIS 3H	015-20653	12	NA	No Violations Noted	NA	Horizontal Well	Monroe Twp	41.691858	-76.466011	04/13/10	CHESAPEAKE APPALACHIA LLC
DAN ELLIS BRA 4H	015-22548	0	NA	NA	NA	1/29/2013. The permit application package is complete, has been accepted, and is undergoing technical review.	Monroe Twp	41.691925	-76.466103	NI	CHESAPEAKE APPALACHIA LLC
STROM BRA 3H	015-21990	6	NA	No Violations Noted	NA	Horizontal Well	Monroe Twp	41.702438	-76.455277	11/04/11	CHESAPEAKE APPALACHIA LLC
STROM 627237 3H	015-20147	1	NA	No Violations Noted	NA	Horizontal Well	Monroe Twp	41.702491	-76.455141	11/23/11	CHESAPEAKE APPALACHIA LLC
STROM BRA 5H	015-22303	0	NA	NA	NA	9/21/2012. Technical review 1 completed of permit review.	Monroe Twp	41.702467	-76.455158	NI	CHESAPEAKE APPALACHIA LLC
STROM 627235 1H	015-20149	4	08/21/09	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Horizontal Well	Monroe Twp	41.702433	-76.455222	06/20/09	CHESAPEAKE APPALACHIA LLC
JONES BRA 4H	015-21795	0	NA	NA	NA	Operator reported not drilled. 7/13/2011. Technical review 1 completed of permit review.	Standing Stone Twp	41.754036	-76.306856	NA	CHESAPEAKE APPALACHIA LLC
JONES BRA 6H	015-21796	0	NA	NA	NA	Operator reported not drilled. 7/13/2011. Technical review 1 completed of permit review.	Standing Stone Twp	41.753997	-76.306875	NA	CHESAPEAKE APPALACHIA LLC
LLOYD JONES 1	015-20013	4	NA	No Violations Noted	NA	Plugged well.	Granville Twp	41.703044	-76.704950	NI	GOODWIN IND INC

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Well Name	API Permit	Number of Inspections	Date of Violation	Violations Identified by PADEP Inspector	Corrected	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
RHEPPARD 1H	015-20247	0	NA	NA	NA	4/10/2009. Technical review 1 completed of permit review	Granville Twp	41.716633	-76.681453	NI	CHESAPEAKE APPALACHIA LLC
SIMPLEX BRA 1H	015-22242	1	NA	No Violations Noted	NA	8/14/2012. Technical review 2 completed for permit review.	Standing Stone Twp	41.746947	-76.323408	NI	CHESAPEAKE APPALACHIA LLC
SIMPLEX BRA 2H	015-22262	0	NA	NA	NA	8/10/2012. Technical review 1 completed for permit review.	Standing Stone Twp	41.746883	-76.323250	NI	CHESAPEAKE APPALACHIA LLC
BENNETT 3H	015-21225	NI	NI	NI	NI	Horizontal Well	Tuscarora Twp	41.719150	-76.127669		CHESAPEAKE APPALACHIA LLC
BENNETT 2H	015-21213	4	NA	No Violations Noted	NA	Horizontal Well	Tuscarora Twp	41.719147	-76.127738	11/03/10	CHESAPEAKE APPALACHIA LLC
BENNETT 4H	015-21224	7	NA	No Violations Noted	NA	Horizontal Well	Tuscarora Twp	41.719105	-76.127736	10/27/10	CHESAPEAKE APPALACHIA LLC
BENNETT BRA 1H	015-23026	11	NA	No Violations Noted	NA	Horizontal Well	Tuscarora Twp	41.719108	-76.127666		CHESAPEAKE APPALACHIA LLC
BENNETT 1H	015-21226	NI	NI	NI	NI	Operator reported not drilled	Tuscarora Twp	41.719108	-76.127666		CHESAPEAKE APPALACHIA LLC
CRAWFORD 2H	015-20701	2	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.608355	-76.373486	04/17/10	CHESAPEAKE APPALACHIA LLC
SCHLAPFER S BRA 2H	015-22226	1	8/31/2012	78.86 - Failure to report defective, insufficient, or improperly cemented casing w/in 24 hrs or submit plan to correct w/in 30 days	Resolution not listed	Horizontal Well	Albany Twp	41.602150	-76.400763	06/11/12	CHESAPEAKE APPALACHIA LLC
SCHLAPFER N BRA 2H	015-22202	1	9/27/2012	78.81D1 - Failure to maintain control of anticipated gas storage reservoir pressures while drilling through reservoir or protective area	Corrected/ Abated	Horizontal Well	Albany Twp	41.602180	-76.400727	06/11/12	CHESAPEAKE APPALACHIA LLC
CRAWFORD BRA 3H	015-22304	NI	NI	NI	NI	Horizontal Well	Terry Twp	41.608333	-76.373591		CHESAPEAKE APPALACHIA LLC

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CRAWFORD 4H	015-20702	4	3/4/2011	78.86 - Failure to report defective, insufficient, or improperly cemented casing w/in 24 hrs or submit plan to correct w/in 30 days Compliance records indicate: Bubbling in cellar. 0% combustible gas coming off annuli. Needs further investigation and follow-up inspection.	Resolution not listed	Horizontal Well	Terry Twp	41.608344		05/30/10	CHESAPEAKE APPALACHIA LLC
			4/8/2011	78.86 - Failure to report defective, insufficient, or improperly cemented casing w/in 24 hrs or submit plan to correct w/in 30 days Compliance records indicate: 3 string design. Constant bubbling in cellar. Uncontrollable release of gas.	Resolution not listed	Horizontal Well					
DAVE 3H	015-21206	NI	NI	NI	NI	Horizontal Well	Albany Twp	41.608733	-76.389447		CHESAPEAKE APPALACHIA LLC
DAVE 1H	015-21207	NI	NI	NI	NI	NI	Albany Twp	41.608733	-76.389447		CHESAPEAKE APPALACHIA LLC
PLYMOUTH 2H	015-20644	1	NA	No Violations Noted	NA	Horizontal Well	Terry Twp	41.613275	-76.367180	05/10/10	CHESAPEAKE APPALACHIA LLC
DAVE 2H	015-21208	5	4/28/2011	1.) 401CSL - Discharge of pollultional material to waters of Commonwealth. 2.) 102.4 - Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d) 3.) CSL402POTPOL - There is a potential for polluting substance(s) reaching Waters of the Commonwealth and may require a permit	Corrected/Abated	Horizontal Well	Albany Twp	41.608741		12/30/10	CHESAPEAKE APPALACHIA LLC
			6/27/2011	1.) 691.1 - Clean Streams Law-General. Used only when a specific CLS code cannot be used 2.) 102.4 - Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d) 3.) 401CSL - Discharge of pollultional material to waters of Commonwealth.	Corrected/Abated	Horizontal Well					
			2/10/2012	78.86 - Failure to report defective, insufficient, or improperly cemented casing w/in 24 hrs or submit plan to correct w/in 30 days	Corrected/Abated	Horizontal Well					
SCHLAPFER N BRA 3H	015-22634	NI	NI	NI	NI	NI	Albany Twp	41.602122	-76.400802		CHESAPEAKE APPALACHIA LLC
PLYMOUTH 5H	015-20645	4	7/15/2010	1.) 78.56LINER - Improperly lined pit 2.) 301UNPMTIW - Industrial waste was discharged without permit.	Corrected/ Abated	Horizontal Well	Terry Twp	41.613261	-76.367230	05/11/10	CHESAPEAKE APPALACHIA LLC
FREED BRA 2H	015-22730	9	NA	No Violations Noted	NA	Horizontal Well	Albany Twp	41.596655	-76.381383		CHESAPEAKE APPALACHIA LLC
PLYMOUTH BRA 3H	015-22896	NI	NI	NI	NI	NI	Terry Twp	41.613247	-76.367280		CHESAPEAKE APPALACHIA LLC
DAVE BRA 5H	015-22892	NI	NI	NI	NI	NI	Albany Twp	41.608783	-76.389430		CHESAPEAKE APPALACHIA LLC

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CRAWFORD 5H	015-21030	NI	NI	NI	NI	Operator Reported Not Drilled	Terry Twp	41.608394	-76.373555		CHESAPEAKE APPALACHIA LLC
PLYMOUTH BRA 3H	015-22447	NI	NI	NI	NI	Operator Reported Not Drilled	Terry Twp	41.613247	-76.367280		CHESAPEAKE APPALACHIA LLC
CRAWFORD 3H	015-20723	NI	NI	NI	NI	Operator Reported Not Drilled	Terry Twp	41.608333	-76.373591		CHESAPEAKE APPALACHIA LLC
BURBAGE 1	015-00005	0	NA	NA		VERTICAL WELL	Albany Twp	41.606969	-76.398469		UNKNOWN OPR
DAVE BRA 5H	015-22388	NI	NI	NI	NI	Operator Reported Not Drilled	Albany Twp	41.608783	-76.389430		CHESAPEAKE APPALACHIA LLC
DAVE 5H	015-21209	3	5/4/2011	1.) 102.4 - Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d) 2.) CSL401CAUSPL - Polluting substance(s) allowed to discharge into Waters of the Commonwealth	Corrected/Abated	Failed E/S controls caused sediment pollution	Albany Twp	41.608791	-76.389486		CHESAPEAKE APPALACHIA LLC
PLYMOUTH 6H	015-20666	1	NA	No Violations Noted	NA	Operator Reported Not Drilled	Terry Twp	41.613294	-76.367308		CHESAPEAKE APPALACHIA LLC
FREED BRA 1H	015-22443	7	NA	No Violations Noted	NA	Regulatory Inactive Status	Albany Twp	41.596686	-76.381422	03/21/13	CHESAPEAKE APPALACHIA LLC

Sources: http://www.depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?%2fOil_Gas%2fOG_Compliance&rs:Command=Render - last accessed on December 2013
http://www.ahs.dep.pa.gov/eFACTSWeb/ - last accessed on December 2013

Key:
API = American Petroleum Industry.
bbl = Barrel.
DEP = Department of Environmental Protection.
ER = Emergency response.
E&S = Erosion and sedimentation.
ft. = Feet.
HCl = Hydrochloric acid.
ID = Identification number.
in. = Inch.
LEL = Lower explosive limit.
mg/kg = Milligram per killogram.
NI = No information available.
NA = Not applicable.
NOV = Notice of violation.
O&G = Oil and Gas.
PA = State of Pennsylvania.
Twp = Township.

Table C-38 Notice of Violations - Identified Potential Candidate Causes and Distances (less than 2 Miles) to EPA Sampling Points

Well	Latitude	Longitude	Search Area	EPA Sampling Point		EPA Sampling Point		EPA Sampling Point		EPA Sampling Point		EPA Sampling Point		EPA Sampling Point		EPA Sampling Point	
				ID	Distance (mi)	ID	Distance (mi)	ID	Distance (mi)	ID	Distance (mi)	ID	Distance (mi)	ID	Distance (mi)	ID	Distance (mi)
Bradford County, Pennsylvania																	
VANNOY 627108 2	41.709196	-76.682475	F	NEPAGW01 NEPAGW02	0.6 W	NEPAGW03 NEPASW03 NEPASW04	0.1 SE	NEPAGW07	3.3 SW	NEPAGW36	4.0 SW						
VANNOY 627108 3	41.709188	-76.682531	F	NEPAGW01 NEPAGW02	0.6 W	NEPAGW03 NEPASW03 NEPASW04	0.1 SE	NEPAGW07	3.3 SW	NEPAGW36	4.0 SW						
CRANRUN 2H	41.662872	-76.726075	F	NEPAGW36	0.3 NW	NEPAGW07	1.0 ENE										
ATGAS 2H	41.714105	-76.632633	F	NEPAGW01 NEPAGW02	3.1 NE	NEPAGW03 NEPASW03 NEPASW04	3.3 NE	NEPAGW07	0.1 SE	NEPAGW36	1.0 WSW						
ANDRUS UNIT 1H	41.649436	-76.307575	E	NEPAGW04 NEPASW05 NEPASW06	0.3 W												
WELLES 1 5H	41.649436	-76.307575	A	NEPAGW18 NEPAGW19	0.8 SE	NEPAGW20	0.9 SE	NEPAGW13	0.9 SE	NEPAGW31	2.1 NE						
WELLES 1 3H	41.649433	-76.307519	A	NEPAGW18 NEPAGW19	0.8 SE	NEPAGW20	0.9 SE	NEPAGW13	0.9 SE	NEPAGW31	2.1 NE						
WELLES 3 2H	41.653736	-76.295591	A	NEPAGW31	1.5 E	NEPAGW18 NEPAGW19	0.7 S	NEPAGW20	0.8 S	NEPAGW13	0.9S						
OTTEN 626935 1H	41.672523	-76.364501	B	NEPAGW06	0.7 ENE	NEPAGW05	0.9 ENE	NEPAGW27	1.5 NE	NEPAGW26	1.6 NE	NEPAGW25	1.6 NE				
CLAUDIA 2H	41.683183	-76.322275	A	NEPAGW10	1.0 ENE	NEPAGW14	1.1 NE	NEPAGW25	0.8 WNW	NEPAGW26	0.9 W	NEPAGW27	0.8 WSW	NEPAGW05	1.5 SW	NEPAGW06	1.6 SW
BALDUZZI 2H	41.714730	-76.290683	B	NEPAGW12	0.4 NW	NEPAGW11	0.7 W	NEPAGW09	0.6 SW	NEPAGW14	1.9 SW						
BALDUZZI 5H	41.714688	-76.290680	B	NEPAGW12	0.4 NW	NEPAGW11	0.7 W	NEPAGW09	0.6 SW	NEPAGW14	1.9 SW						
STALFORD 5H	41.711966	-76.320275	B	NEPAGW11	0.9 NE	NEPAGW09	1.1 SE	NEPAGW12	1.3 NE	NEPAGW14	1.9 SE	NEPAGW25	2.0 SW				
COATES 2H	41.789020	-76.330941	C	NEPAGW29	0.9 NW	NEPAGW28	1.1 NE										
BRACKMAN 2H	41.667355	-76.740830	F	NEPAGW36	0.6 SE	NEPAGW07	1.7 ESE										
HERSHBERGER 2H	41.684208	-76.336308	B	NEPAGW25	0.1 NW	NEPAGW26	0.2 SW	NEPAGW27	0.3 SW	NEPAGW05	0.9 SW	NEPAGW06	1.1 SW	NEPAGW10	1.8 E	NEPAGW14	1.8 ENE
HERSHBERGER 5H	41.684167	-76.336306	B	NEPAGW25	0.1 NW	NEPAGW26	0.2 SW	NEPAGW27	0.3 SW	NEPAGW05	0.9 SW	NEPAGW06	1.1 SW	NEPAGW10	1.8 E	NEPAGW14	1.8 ENE
SCHLAPFER S BRA 2H	41.602150	-76.400763	H	NEPAGW32	1.1 NE	NEPAGW33	0.97 NE										
SCHLAPFER N BRA 2H	41.602180	-76.400727	H	NEPAGW32	1.1 NE	NEPAGW33	0.97 NE										
CRAWFORD 4H	41.608344	-76.373538	H	NEPAGW32	0.38 SW	NEPAGW33	0.5 SW										
DAVE 2H	41.608741	-76.389500	H	NEPAGW32	0.49 SE	NEPAGW33	0.37 SE										
PLYMOUTH 5H	41.613261	-76.367230	H	NEPAGW32	0.83 SW	NEPAGW33	0.94 SW										
DAVE 5H	41.608791	-76.389486	H	NEPAGW32	0.49 SE	NEPAGW33	0.37 SE										

Key:

EPA = Environmental Protection Agency.
E = East.
ENE = East-northeast.
ESE = East-southeast.
ID = Identification.
mi = Mile.
NE = Northeast.
NW = Northwest.
SE = Southeast.
SW = Southwest.
W = West.
WNW = West-northwest.
WSW = West-southwest.

Table C-39 Environmental Database Review Summary, Susquehanna County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause Yes /No	Potential Candidate Cause Details/Justification	Groundwater Wells
US MINES	James M. Ely Jr.,	Longitude: -075 51 43 Latitude: 41 43 58	1.7 miles NNE from NEPAGW23	No	Intermittent, surface, stone quarry; 1 violation (104(g)(1)) (Orders of Withdrawal - Untrained Miners); Dimension stone mining. Surface stone quarry activities are not a likely source of contamination.	Search Area A: 16 Federal USGS Wells 1 Federal FRDS Public Water Supply System 77 State Wells
US MINES	Lenzinsky Portable, James Lezinsky, NW 1.194 mi.	Longitude: -075 52 52 Latitude: 41 44 26	1.0 miles WNW from NEPAGW23	No	Intermittent, surface, stone quarry; Multiple violations (104(a) (health or safety standards, rules, orders, or regulations) and 104(g)(1))(Orders of Withdrawal - Untrained Miners). Surface stone quarry activities are not a likely source of contamination.	
US MINES	Jackson Stone, N 2.445 mi.	Longitude: -075 51 39 Latitude: 41 45 47	1.8 miles NW from NEPAGW22	No	Abandoned, surface, stone quarry; Multiple violations (104(a) (health or safety standards, rules, orders, or regulations) and 107(a)) (imminent danger exists). Surface stone quarry activities not likely sources of contamination.	
US MINES	Braveheart Quarry, McLaud Flagstone, NW 2.473 mi.	Longitude: -075 54 10 Latitude: 41 45 01	~2.5 miles NW from NEPAGW23	No	Abandoned, surface, sandstone quarry; Multiple violations (104(a) and 104(g)(1))(Orders of Withdrawal - Untrained Miners). Stone quarry activities not likely sources of contamination, also far from sample points and no release violations found.	
US AIRS	CHIEF GATHERING LLC/KORBAN STA	CORBIN RD 1 Latitude: 41.72545 Longitude: -75.82037	~2 miles E from NEPAGW23	No	In national repository for information concerning airborne pollution in the US, compliance status: In compliance with procedural requirements. Listed only due to air concerns, facility is in compliance, not a likely source of contamination.	
US HIST AUTO STAT	Steve's Auto Body	375 Orchard Road, Great Bend, PA	0.56 miles NE of NEPAGW24	Yes	No details available	Search Area B: 5 Federal USGS Well 1 Federal FRDS Public Water Supply System Well 13 State Wells
US MINES	R Luce Flag and Field Stone	41 58 24 075 45 20	0.6 miles south of NEPAGW24	No	Non-coal mine. Violation issued 11/9/05. Violation unknown. Mine status: abandoned as of 9/16/10.	
UNREG LTANKS	Betty J Scalzo Residence	605 church Street, Great Bend, PA	0.79 miles SE of NEPAGW24	Yes	Fuel Oil No. 2	
AST	Hallstead Great Bend JT SEW AUTH WWTP	249 Spring Street, Great Bend, PA	0.85 miles SE of NEPAGW24	No	500 gal AST installed on 11/16/11containing hazardous substances; 2000 gal AST install 11/16/11 containing hazardous substances. No reported releases.	
US HIST AUTO STAT	Rich's Auto Service	524 Main Street, Forest City, PA	0.85 miles SE of NEPAGW24	Yes	No details available	
FINDS, US AIRS	Hornbeck Used Cars	402 Main Street, Forest City, PA	0.9 miles SE of NEPAGW24	No	POTENTIAL UNCONTROLLED EMISSIONS < 100 TONS/YE of Chlorofluorocarbons	
US HIST AUTO STAT	Rich's Auto Service	429 Main Street, Forest City, PA	0.9 miles SE of NEPAGW24	Yes	No details available	
ORPHAN: HIST LF	Springville TWP	Herb Button Road Springville, PA 18844	>2 miles SW from NEPAGW21 not exact location	No	Inactive solid waste landfill. Last inspected on 11/27/2002. Not a likely source of contamination due to distance from nearest sample point.	
ORPHAN: CERC-NFRAP, HIST LF	Montrose Dump	NI	NI	No	Based on a 1987 EPA Preliminary Assessment, the site was designated as No Future Remedial Action Planned (NFRAP). Although its location was not determined, the site is inactive and designated as NFRAP; thus, it was not retained as a potential source of contamination.	
ORPHAN: CERC-NFRAP, RCRA-SQG, FINDS, MANIFEST, AST	PA DOT Maint. Facility	Route 706 & Tiffany Cor , Montrose, PA 18801	6.6 miles N from NEPAGW23	No	Based on a 1986 EPA Preliminary Assessment the site was designated as No Future Remedial Action Planned (NFRAP); 3 - open AST's (1 Hazardous mixed with Petroleum, 1 diesel and 1 other), no violations; currently a small quantity generator of RCRA waste (D001, D007, D008, F003, and F005), however they were previously a large quantity generator. Not a likely source of contamination due to distance from sample points.	
ORPHAN: FINDS	PA DOT- E.D. 4-0-SUSQUEHANNA	ERIE BOULEVARD SUSQUEHNA SHOP LATITUDE: 41.93791 LONGITUDE: -75.59583	> 20 mi NE of any sampling point	No	Site shows up on envirofacts in RCRAINFO as Air traffic Control, the Facility Information data indicate No Violations. Not a likely source of contamination due to distance from nearest sample points.	
ORPHAN: VCP	Knapik Well Pad	Valley View Road Franklin Forks, PA 18801	Unknown, location could not be identified.	Yes	The database does not provide much detail on the voluntary cleanup of the site. It mentions soil and diesel fuel. No other information found. Approximate location for waste site could not be determined. Site included due to potential for contamination.	
ORPHAN: VCP	R Vandermark 3H Well	1129 Vandermark Road Montrose, PA 18801	1.9 miles N from NEPAGW23	No	The database does not provide much detail on the voluntary cleanup of the site. Violations found: 10/18/11: Code: 201G - Failure to post permit number, operator name, address, telephone number in a conspicuous manner at the site during drilling. 10/09/2012 Failure to post pit approval number. Due to distance and lack of significant violations other than administrative, this facility was not retained as a likely source of contamination.	
ORPHAN: VCP	Teel Prop	Herb Button Road Springville, PA 18844	Several TEEL entries in eFACTS. Not clear which one is this location, however one listed as TEEL 2 mi SW from NEPAGW21	Yes	The database does not provide much detail on the voluntary cleanup of the site. eFACTS listed violations for TEEL Property: 06/03/08: Polluting substance(s) allowed to discharge into Waters of the Commonwealth. 07/11/08 and 07/13/09 : There is a potential for polluting substance(s) reaching Waters of the Commonwealth and may require a permit. Site included due to potential for contamination.	
ORPHAN: VCP	R Hull 2H Well Site	Longitude: 75°53'35.81"W Latitude: 41°43'34.40"N Springville TWP, PA 18844	1.5 miles NW from NEPAGW21 and NEPAGW22	Yes	The database does not provide much detail on the voluntary cleanup of the site. It mentions soil, diesel fuel and inorganics. Violations listed in eFACTS: 10/12/11: There is a potential for polluting substance(s) reaching Waters of the Commonwealth and may require a permit; Pit and tanks not constructed with sufficient capacity to contain pollutional substances; Failure to properly store, transport, process or dispose of a residual waste. Site included due to potential for contamination.	

Table C-39 Environmental Database Review Summary, Susquehanna County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause: Yes /No	Potential Candidate Cause: Details/Justification	Groundwater Wells
ORPHAN: VCP	Heitsman 2V Well Site	Longitude: 75°54'2.56"W Latitude: 41°42'42.26"N Springville, PA 18844	1.2 miles NW from NEPAGW21 and NEPAGW22	Yes	The database does not provide much detail on the voluntary cleanup of the site. It mentions soil cleanup. Violations listed in eFACTS: 10/20/10: Impoundment not structurally sound, impermeable, third party protected; Failure to properly store, transport, process or dispose of a residual waste; There is a potential for polluting substance(s) reaching Waters of the Commonwealth and may require a permit 7/8/09: Failure to post permit number, operator name, address, telephone number in a conspicuous manner at the site during drilling 5/8/09: Discharge of pollutional material to waters of Commonwealth; Discharge of pollutional material to waters of Commonwealth. Site included due to potential for contamination.	
ORPHAN: VCP	Heitsman 4H Well Site	Longitude: 75°54'2.56"W Latitude: 41°42'42.26"N Springville, PA 18844	1.2 miles NW from NEPAGW21 and NEPAGW22	Yes	The database does not provide much detail on the voluntary cleanup of the site. It mentions soil cleanup. Violations listed in eFACTS: 10/20/10: *Failure to properly store, transport, process or dispose of a residual waste.*There is a potential for polluting substance(s) reaching Waters of the Commonwealth and may require a permit * Impoundment not structurally sound, impermeable, 3rd party protected. 9/22/09 & 9/17/09 & 9/16/09: *O&G Act 223-General. Used only when a specific O&G Act code cannot be used*Clean Streams Law-General. Used only when a specific CLS code cannot be used. 7/8/09: *Failure to post permit number, operator name, address, telephone number in a conspicuous manner at the site during drilling. Site included due to potential for contamination.	
ORPHAN: ARCHIVE UST	Mountain View High School	11748 Pennsylvania 106, Kingsley, PA 18826	6.8 miles E from NEPAGW23	No	The property has/had? a 12,000 gallon heating oil tank, no violations. Not a likely source of contamination due to distance from nearest sample point.	
ORPHAN: ARCHIVE UST	Masters Garage	Main St, Kingsley, PA 18826	≥5.7 miles ENE from NEPAGW23	No	2 - 2000 gallon tanks (diesel and gasoline) are/were? on the property. Current status is unknown, no violations. Not a likely source of contamination due to distance from study area.	
ORPHAN: UNREG LTANKS, UST, LUST	Checkered Express	Route 29 Springville, PA 18844	3.8 miles SW from NEPAGW21	No	1- closed LUST with a confirmed release on 10/20/1997. The UST contained Fuel Oil No. 2. Multiple violations. Not a likely source of contamination due to distance from study area.	
ORPHAN: UST	Lenox Texaco	Longitude: -75.673035 Latitude: 41.711652 Route 106 & 92 Kingsley, PA 18826	9.8 miles E from NEPAGW23	No	5 - open UST's (3 gasoline, 1 diesel and 1 kerosene), 1 violation in 2009 for Failure to meet performance standards for new/upgraded tanks (abated/corrected). Not a likely source of contamination due to distance from study area.	
ORPHAN: UST	Diaz Forrest Products LLC	7686 State Route 167 Kingsley, PA 18826	4.0 miles NE from NEPAGW23	No	2 - open UST's containing diesel violations: Failure to comply with underground storage tank system release detection requirements and Tank handling and inspection requirements (administrative). Not a likely source of contamination due to distance from study area.	
ORPHAN: UST	Dalton Air	RTE 29 N, SOUTH MONTROSE, PA 18843	approx. 6.7 miles N from NEPAGW23	No	1 - out-of-use UST containing ULGAS, 07/27/07 & 10/15/10: Tank handling and inspection requirements 12/02/10: Failure to comply with temporary closure requirements. Not a likely source of contamination due to distance from study area.	
ORPHAN: AST	Cayuga Concrete Pipe	Route 706 Montrose, PA 18801	> 6 mi - Exact location could not be identified.	No	1 - open AST containing diesel violations: Inspection activities without proper certification (administrative), AST registration violation(s), Closure or change-in-service violations. Not a likely source of contamination due to distance from study area.	
ORPHAN: AST	Williams Oil	Route 706 Montrose, PA 18801	> 6 mi - Exact location could not be identified.	No	1 - open AST containing diesel violations: Failure to meet performance and design standards, Operation and maintenance violation. Not a likely source of contamination due to distance from study area.	
ORPHAN: RCRA-CESQG, FINDS	Autotek Collision Center	Route 706 between PennDOT Bldg & RT 167	approx. 6.6 miles N from NEPAGW23	No	RCRA-CESQG (D001, D008, D018, D035, D039, D040, F003, F005), no violations. Not a likely source of contamination due to distance from study area.	
ORPHAN: RCRA-CESQG, FINDS, MANIFEST	Penelectric Montrose District Office	Route 706, 1.5 miles E of Route 29/7 Montrose, PA 18801	≥7.0 miles NE from NEPAGW23	No	RCRA-CESQG (D007 and D008), no violations. Not a likely source of contamination due to distance from study area.	
ORPHAN: RCRA-CESQG, FINDS	Tony's Auto Body	Valley View Road, 1/8 mile W of Route 29, Montrose, PA 18801	≥12.6 miles N from NEPAGW23	No	RCRA-CESQG (D001, D007, D035, F003 and F005), no violations. Not a likely source of contamination due to distance from study area.	
ORPHAN: FINDS	Susquehanna County Correctional Facility	137 Ellsworth Dr, Montrose, PA 18801	4.8 miles N from NEPAGW23	No	In FINDS database-Public Water Supply Permit Community Water System Operations, no violations. Not a likely source of contamination due to distance from study area.	
ORPHAN: ICIS	B.S. Quarries, Inc.	Montrose, PA 18801	NI	No	In LOCAL database, ICIS-03-2003-0114 FORMAL ENFORCEMENT ACTION no violations. Approximate location not determined. Facility is a stone quarry, so not a likely sources for study issues.	
ORPHAN: ICIS	Powers of Stone	STONE RD RR 5 BOX 124 MONTROSE, PA 18801	3 mi NW from NEPAGW23	No	FORMAL ENFORCEMENT ACTION (ICIS-03-2002-0238 and ICIS-03-2002-0239) NPDES Permit (CWA). Not a likely source of contamination due to distance from study area.	
ORPHAN: FINDS	PA DOT - E.D. 4-0 - SUSQUEHANNA	ERIE BLVD SUSQUEHANNA SHOP CTR SUSQUEHANNA, PA 18801	19 mi from NEPAGW23	No	Only information found is that the site has an air permit (NAICS CODE: AIR TRAFFIC CONTROL). Not a likely source of contamination due to distance from study area.	
ORPHAN: MANIFEST	Montrose Industrial Steel	Route 706 E & junction 167 S, Montrose, PA 18801	> 6 mi - Exact location could not be identified.	No	Waste manifest for F005, no violations. Not a likely source of contamination due to distance from sample locations.	
ORPHAN: FINDS, US AIRS	Williams Field SVC Co LLC/Springville	Herb Button Road Springville, PA 18844 Latitude: 41.68284 Longitude: -75.88446	~2.4 miles SSW from NEPAGW21	No	PAG-10 Permit for Discharge Resulting from Hydrostatic Testing of Tanks & Pipelines no violations. Not a likely source of contamination due to distance from sample locations and no record of releases.	
ORPHAN: NPDES, FINDS	Susquehanna Loop Pipeline	Tennessee Gas Pipeline Company Hop Bottom, PA Latitude: 41.739351 Longitude: -75.797313	~3.3 miles E from NEPAGW23 based on the coordinates, however the proposed pipeline location could not be verified.	No	NPDES permit (PCS-PAG102204) was valid from 02/05/2002 until 02/04/2007; no violations. Not a likely source of contamination due to distance from sample locations and no record of releases.	

Table C-39 Environmental Database Review Summary, Susquehanna County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause Yes /No	Potential Candidate Cause Details/Justification	Groundwater Wells
ORPHAN: NPDES; ARCHIVE UST	Herbert Kilmer & Sons Inc. Stone Quarry	RR 1 BOX 331 Kingsley, PA 18826 Latitude: 41.736189 Longitude: -75.717966	7.4 miles E from NEPAGW23	No	NPDES permit is valid from 09/01/2011 until 08/31/2016; no violations. Surface stone quarry activities are not a likely source of contamination.	
ORPHAN: NPDES	Masters RMC Inc. Kingsley Plant	PA SR 11 in Kingsley Kingsley, PA 18826	~5.8 miles E from NEPAGW23	No	NPDES permit is valid from 06/01/2010 until 05/10/2015; no violations. Not a likely source of contamination due to distance from sample points	
ORPHAN: NPDES, FINDS, MANIFEST	PA American Water - Montrose WTP	Route 29 Montrose, PA 18801 Latitude: 41.845633 Longitude: -75.858527	7.3 miles N from NEPAGW23	No	NPDES permit is valid from 07/01/2011 until 06/30/2016; no violations; Drinking Water Program (PWSID-2580023); waste disposal manifests (filters-waste code: D008 - lead in 2006 and in 2011 D001 Ignitable wastes); no violations; Not a likely source of contamination due to distance from study area.	
ORPHAN: NPDES	Williams Field SVC Co LLC (Vandermark Pipeline)	Pipeline located between PA-29 and PA-147.	approx. 2.5 mi - Exact location could not be identified.	No	NPDES permit PAG-10 for Discharge Resulting from Hydrostatic Testing of Tanks & Pipelines for Meshoppen Creek is valid from 05/01/2012 until 04/30/2017; no violations. Sample points area and no record of violations.	
ORPHAN NPDES	Lee Allard Trucking	RR1 Box 1484, Great Bend, PA	Within 1 mile of NEPAGW24	No	NPDES permit effective 6/1/05 - 5/9/10	
ORPHAN UNREG LTANKS	Thomas Franks Residence	RR1 Box 142 Spring Street, Great Bend, PA	Within 1 mile of NEPAGW24	Yes	Fuel Oil No. 2 spill	
ORPHAN UNREG LTANKS, VCP	Eugene Lecher Residence	RR1 Box 1312 Orchard Street, Great Bend, PA	Within 1 mile of NEPAGW24	Yes	BTEX spill, media soil, closed 2/27/01	
ORPHAN RCRA-CESQG	Mike Carns Ford	RR 1 Randolph Road, Great Bend, NY	Within 1 mile of NEPAGW24	No	Generates 100 and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste, or other debris resulting from the clean-up of a spill, into on any land or water, of acutely hazardous waste; or generates 100 kg or less of aany residue or contaminated soil, waste or other debris resulting from teh clean-up of a spill, into or on any land or water, of acutely hazardous waste during any claendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the clean-up of a spill into or on any land or water, of acutely hazardous waste. hazardous wastes include: lead, benzene, methyl ethyl keytone, tetrachloroethene, trichloroethene and several spent non-halogenated solvents. No viloations reported.	
ORPHAN MANIFEST	PA DOT	S.R. 1029 SEC 5508 Route 11 and 81, Great Bend, PA	Within 1 mile of NEPAGW24	No	Metal boxes, cartons, cases (including roll-offs) of D008 wastes. No violations reported.	
ORPHAN LUST, UST	Great Bend Travel Plaza	Route 11 and Route 81, Great Bend, PA	Within 1 mile of NEPAGW24	Yes	Facility contains a 12,000 gal diesel UST installed 3/15/95; two 12000 gal gasoline UST installed 3/15/95; 12,000 gallon gasoline UST installed 1/9/13. Stained poil/concrete around diesel dispenser on 11/5/09. Concrete is of poor integrity and soil had fuel odor. Clean-up completed 6/30/2010.	
ORPHAN LUST, UST	Exxon 2 0449	Route 11 and Route 81, Great Bend, PA	Within 1 mile of NEPAGW24	Yes	Unleaded gasoline spill on 8/5/89. Soil impacted. Clean-up completed 3/23/07.	
ORPHAN RCRA NonGen/NLR	Sunoco Service Station Great Bend	Box 258 RT 11 E I-81, Great Bend, PA	Within 1 mile of NEPAGW24	No	No violations reported.	
ORPHAN ARCHIVE UST	Kime Apartments	Main St, Great Bend, PA	Within 1 mile of NEPAGW24	No	250 gal diesel UST. No voilations reported.	
ORPHAN NPDES	Camp Iroquoina	RR 1 Box 1601, Hallstead, PA	>1.5 miles from NEPAGW24	No	NPDES permit valid 6/1/09 - 5/31/14. No violations reported.	
ORPHAN UNREGLTANKS	Lafler Residence	RR 1 Box 119, Hallstead, PA	>1.5 miles from NEPAGW24	No	Fuel Oil No. 2 spill. No other details available.	
ORPHAN UNREGLTANKS	Edward Rosenkrans Residence	RR 1 Box 253, Mount Valley Road, Hallstead, PA	>1.5 miles from NEPAGW24	No	Fuel Oil No. 2 spill. No other details available.	
ORPHAN VCP	A & E Auto	RT 11, Hallstead, PA	>1.5 miles from NEPAGW24	No	Unleaded gasoline spill VCP approved 3/21/07. No other details available.	
ORPHAN ARCHIVE AST	Mike Carns Ford Mercury	RT 11, Hallstead, PA	>1.5 miles from NEPAGW24	No	Facility contains a 550 gal AST of used motor oil. No violations reported.	
ORPHAN MANIFEST	Chenango Industries of PA	RT 81 and RT 68, Hallstead, PA	>1.5 miles from NEPAGW24	No	Dump trucks with D005 and D008 wastes. No violations recorded.	
ORPHAN ARCHIVE UST	US Assemblies Inc.	RT 81 and RT 68, Hallstead, PA	>1.5 miles from NEPAGW24	No	Facility contains an 8,000 gal and 10,000 gal USTs with heating oil. No voilations reported.	
ORPHAN RCRA NonGen/NLR, MANIFEST	Magnetic Lab, Inc.	Rt 81 Exit, Hallstead, PA	>1.5 miles from NEPAGW24	No	Violation 11/19/84: F001-unknown waste. Compliance date 12/10/84.	
ORPHAN ARCHIVE UST	Haworth Press Inc.	Franklin Ave, Hallstead, PA	>1.5 miles from NEPAGW24	No	Facility contains 5000 gal heating oil UST. No viloations reported.	
ORPHAN LUST, ARCHIVE UST	Hallstead Foundry	Main Street, Hallstead, PA	>1.5 miles from NEPAGW24	No	Facility contains UST with petroleum product (gasoline). Release occurred 8/5/89 which impacted soils. Another release occurred 4/18/08. A PREVIOUSLY UNKNOWN GASOLINE UST WAS FOUND AT THE SITE. PETROLEUM ODORS AND SOIL STAINING WERE OBSERVED. THE 3,000 GALLON TANK WILL BE REGISTERED FOR REMOVAL PURPOSES.	
ORPHAN MANIFEST	PA Game Commission SGL 035	State Game Land, Hallstead, PA	>1.5 miles from NEPAGW24	No	Facility contained 1 55-gal drum of D001- non-listed ignitable wastes in 1996.	

Table C-39 Environmental Database Review Summary, Susquehanna County, Pennsylvania

Database	Name of Facility	Site Location Address	Distance from Nearest Sample Point	Potential Candidate Cause		Groundwater Wells
				Yes /No	Details/Justification	

Primary Source: Environmental records search report by Environmental Data Resources, Inc. (EDR)
Other Sources: Pennsylvania eFacts website, EPA envirofacts website, and http://mines.findthedata.org/d/s/Pennsylvania. Last accessed in January 2014.

Notes:

EDR Inquiry Number: 3599152.2s

EDR Search Radius: 3 miles

EDR Center of Search :Latitude (North): 41.7278000 - 41° 43' 40.08'', Longitude (West): 75.8655000 - 75° 51' 55.80''

ORPHAN SITE: A site of potential environmental interest that appear in the records search but due to incomplete location information (i.e., address and coordinates) is unmappable and not included in the records provided by EDR Inc.

Key:

AST = Above ground storage tank.
FRDS = Federal Reporting Data System.
mi = Mile.
NI = No infromation.
NPDES = National Pollutant Discharge Elimination System.
PA = Pennsylvania.
USGS = United States Geological Survey.

Databases:
ARCHIVE UST: Local list of Archived Underground Storage Tank Sites
AST: Listing of Pennsylvania Regulated Aboveground Storage Tanks
CERC-NFRAP: Federal CERCLIS (Comprehensive Environmental Response, Compensation, and Liability Information System) NFRAP (No Further Remedial Action Planned) site list
FINDS: Facility Index System/Facility Registry System
HIST LF: Abandoned Landfill Inventory
ICIS: Integrated Compliance Information System
LUST: Storage Tank Release Sites
MANIFEST - Hazardous waste manifest information
NPDES: National Pollutant Discharge Elimination System Permit Listing
RCRA-CESQG - Federal RCRA (Resource Conservation and Recovery Act) Conditionally Exempt Small Quantity Generator List
UNREG LTANKS: Unregulated Tank Cases (State and tribal leaking storage tank list)
US AIRS: Aerometric Information Retrieval System Facility Subsystem
US MINES: Mines Master Index File. The source of this database is the Dept. of Labor, Mine Safety and Health Administration
UST: Listing of Pennsylvania Regulated Underground Storage Tanks
VCP: Voluntary Cleanup Program Listing

Waste Code F003 - The following spent non-halogenated solvents: Xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends cont use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and, a total of 10 percent or more (by volume) of one or more of those in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

Waste Code F005 - The following spent nonhalogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before u ten percent or more (by volume) of one or more of the above nonhalogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

Table C-40 Well Inventory Summary

Susquehanna County, Pennsylvania

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CABOT OIL & GAS CORP	COSTELLO 1 OG WELL	702443	703722	964485	115-20036	Active	4	YES	A	41.728214	-75.879091
CABOT OIL & GAS CORP	ELY 1H OG WELL	704346	705285	967055	115-20049	Active	4	YES	A	41.734197	-75.869117
CABOT OIL & GAS CORP	ELY 1 OG WELL	698055	700204	958146	115-20029	Proposed but never materialized	6	YES	A	41.718769	-75.872861
CABOT OIL & GAS CORP	ELY 4 OG WELL	698061	700211	958154	115-20016	Proposed but never materialized	401	YES	A	41.724333	-75.871429
CABOT OIL & GAS CORP	A & M HIBBARD 2H OG WELL	718474	717110	987284	115-20149	Active	4	YES	A	41.739731	-75.900197
CHIEF OIL & GAS LLC	TEEL UNIT 2H OG WELL	725510	723413	1000140	115-20228	Active	4	YES	A	41.714661	-75.884700
CABOT OIL & GAS CORP	BAKER 3 OG WELL	725522	723420	1000150	115-20226	Active	4	YES	A	41.744511	-75.879614
CABOT OIL & GAS CORP	D SIMPSON 1 OG WELL	730636	727487	1008130	115-20311	Active	4	YES	A	41.718656	-75.860656
CABOT OIL & GAS CORP	D SIMPSON 2 OG WELL	730638	727490	1008133	115-20312	Active	4	YES	A	41.718736	-75.860639
CABOT OIL & GAS CORP	W HERITAGE 1 OG WELL	732256	728911	1010665	115-20355	Active	4	YES	A	41.729667	-75.847303
CABOT OIL & GAS CORP	GREENWOOD 9 OG WELL	732776	729328	1011380	115-20370	Active	4	YES	A	41.751086	-75.867861
CABOT OIL & GAS CORP	T MAKOSKY 1 OG WELL	756202	748178	1063519	115-20827	Active	4	YES	A	41.752617	-75.835228
CABOT OIL & GAS CORP	COSNER 3 OG WELL	735789	731691	1015813	115-20405	Active	4	YES	A	41.697597	-75.855106
CABOT OIL & GAS CORP	RAYIAS 1 OG WELL	731959	728646	1010257	115-20352	Active	4	YES	A	41.722806	-75.847692
CABOT OIL & GAS CORP	C LARUE 7 OG WELL	732254	728905	1010656	115-20354	Active	4	YES	A	41.738986	-75.913889
CABOT OIL & GAS CORP	W BROOKS 7 OG WELL	732411	729019	1010834	115-20356	Active	4	YES	A	41.701058	-75.886900
CABOT OIL & GAS CORP	BAKER 1 OG WELL	700300	701932	961082	115-20026	Plugged well	361	YES	A	41.744566	-75.879518
CABOT OIL & GAS CORP	LEWIS 1 OG WELL	702211	703530	964161	115-20035	Active	4	YES	A	41.723280	-75.884552
CABOT OIL & GAS CORP	REVISED SEVERCOOL B P1	766829	758943	1092758	115-21126	Active	4	YES	A	41.730211	-75.908528

Table C-40 Well Inventory Summary

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
Susquehanna County, Pennsylvania											
CABOT OIL & GAS CORP	TEEL 1 OG WELL	673724	681598	923737	115-20007	Active	4	YES	A	41.713153	-75.877927
CABOT OIL & GAS CORP	C LARUE 2 OG WELL	713793	713017	980448	115-20082	Active	4	YES	A	41.731116	-75.921320
CABOT OIL & GAS CORP	W BROOKS 4H SE OG WELL	721126	719512	991863	115-20176	Active	4	YES	A	41.698472	-75.892689
CABOT OIL & GAS CORP	A & M HIBBARD 3 OG WELL	725461	723367	1000069	115-20221	Active	4	YES	A	41.741825	-75.910369
CHIEF OIL & GAS LLC	TEEL UNIT 3H OG WELL	725511	723414	1000141	115-20229	Active	4	YES	A	41.700828	-75.889817
CABOT OIL & GAS CORP	TEEL 7 OG WELL	697803	699989	957770	115-20023	Active	4	YES	A	41.708000	-75.871256
CABOT OIL & GAS CORP	TEEL 5 OG WELL	697880	700047	957911	115-20024	Active	4	YES	A	41.713119	-75.871074
CABOT OIL & GAS CORP	HEITSMAN 2 OG WELL	698294	700405	958444	115-20021	Proposed but never materialized	6	YES	A	41.726403	-75.893230
CABOT OIL & GAS CORP	W BROOKS 6 OG WELL	732413	729020	1010835	115-20357	Active	4	NO	A	41.701044	-75.886792
CABOT OIL & GAS CORP	T MAKOSKY 2 OG WELL	756248	748219	1063688	115-20828	Active	4	YES	A	41.752625	-75.835175
CABOT OIL & GAS CORP	BROOKS W 2 OG WELL	713787	713014	980440	115-20089	Active	4	YES	A	41.698392	-75.892772
CABOT OIL & GAS CORP	R VANDERMARK 1 OG WELL	748843	742260	1043815	115-20603	Active	4	NO	A	41.764153	-75.862317
CABOT OIL & GAS CORP	HEITSMAN 2 OG WELL	717433	716186	985644	115-20140	Active	4	YES	A	41.726403	-75.893230
CABOT OIL & GAS CORP	HEITSMAN 4H NW OG WELL	719971	718454	989706	115-20162	Active	4	YES	A	41.726392	-75.893311
CABOT OIL & GAS CORP	GESFORD 7H NW OG WELL	719973	718455	989712	115-20163	Active	4	YES	A	41.738692	-75.879050
CABOT OIL & GAS CORP	F LIPPINCOTT 1H OG WELL	753604	746122	1051940	115-20721	Active	4	YES	A	41.732936	-75.822119
CABOT OIL & GAS CORP	DEPAOLA 2 OG WELL	727466	724968	1003317	115-20240	Active	4	YES	A	41.752303	-75.903053
CHIEF OIL & GAS LLC	KERR UNIT 2H OG WELL	730003	726983	1007276	115-20276	Active	4	YES	A	41.697694	-75.840111
CABOT OIL & GAS CORP	GESFORD 2 OG WELL	698286	700396	958436	115-20033	Active	4	YES	A	41.738713	-75.878913
CABOT OIL & GAS CORP	J PLONSKI 1 OG WELL	731194	727964	1009037	115-20337	Active	4	NO	A	41.740167	-75.837883

Table C-40 Well Inventory Summary

Susquehanna County, Pennsylvania

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CABOT OIL & GAS CORP	COSNER 4 OG WELL	735792	731693	1015815	115-20406	Active	4	YES	A	41.697653	-75.854958
CABOT OIL & GAS CORP	A & M HIBBARD 4 OG WELL	725466	723369	1000078	115-20222	Active	4	YES	A	41.739669	-75.900319
CABOT OIL & GAS CORP	R HULL 4 OG WELL	729573	726652	1006618	115-20261	Active	4	YES	A	41.709664	-75.906542
CABOT OIL & GAS CORP	ELY 5H OG WELL	705193	705955	968114	115-20054	Active	4	YES	A	41.734333	-75.869335
CABOT OIL & GAS CORP	BROOKS W 1 OG WELL	713789	713015	980445	115-20090	Active	4	YES	A	41.700989	-75.887047
CABOT OIL & GAS CORP	HUBBARD 6H OG WELL	718481	717115	987302	115-20147	Active	4	YES	A	41.749638	-75.874510
CABOT OIL & GAS CORP	ELY 1H OG WELL	704346	705285	1059519	115-20049	Active	4	YES	A	41.734197	-75.869117
CABOT OIL & GAS CORP	ELY 2 OG WELL	698059	700209	958152	115-20015	Active	4	YES	A	41.729172	-75.871993
CABOT OIL & GAS CORP	W HERITAGE 2 OG WELL	732423	729030	1010852	115-20361	Active	4	YES	A	41.729586	-75.847283
CABOT OIL & GAS CORP	COSNER 5 OG WELL	735785	731687	1015809	115-20404	Active	4	YES	A	41.697633	-75.855006
CABOT OIL & GAS CORP	J PLONSKI 2 OG WELL	741095	735773	1023465	115-20476	Inactive/ plugged well	361	YES	A	41.740211	-75.837872
CABOT OIL & GAS CORP	HESS 3 OG WELL	743395	737755	1033560	115-20494	Active	4	YES	A	41.759514	-75.868847
CABOT OIL & GAS CORP	GESFORD 9 OG WELL	722151	720402	993666	115-20187	Active	4	YES	A	41.733816	-75.876477
CABOT OIL & GAS CORP	R HESS 5 OG WELL	753845	746346	1052303	115-20728	Active	4	YES	A	41.759453	-75.868772
CABOT OIL & GAS CORP	R HULL 2H OG WELL	716463	715311	984205	115-20121	Active	4	YES	A	41.711919	-75.900936
CABOT OIL & GAS CORP	R VANDERMARK 3 OG WELL	748845	742261	1043823	115-20604	Active	4	YES	A	41.764117	-75.862294
CABOT OIL & GAS CORP	C LARUE 3H SE OG WELL	720155	718629	989994	115-20172	Active	4	YES	A	41.731083	-75.921356
CABOT OIL & GAS CORP	TEEL 6 OG WELL	697802	699987	957767	115-20011	Active	4	YES	A	41.708530	-75.880083
CABOT OIL & GAS CORP	CARSON 3 OG WELL	731025	727814	1008751	115-20320	Active	4	YES	A	41.697367	-75.865619
CABOT OIL & GAS CORP	RAYIAS 2 OG WELL	731962	728651	1010262	115-20353	Active	4	YES	A	41.722797	-75.847581
CABOT OIL & GAS CORP	T MAKOSKY 4 OG WELL	756269	748243	1063719	115-20830	Active	4	YES	A	41.752642	-75.835067

Table C-40 Well Inventory Summary

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
Susquehanna County, Pennsylvania											
CABOT OIL & GAS CORP	ELY 6H OG WELL	704361	705298	967070	115-20041	Active	4	YES	A	41.724239	-75.871352
CABOT OIL & GAS CORP	BLACK 2H OG WELL	705602	706268	968561	115-20056	Active	4	YES	A	41.712103	-75.864579
CABOT OIL & GAS CORP	ROZANSKI 1 OG WELL	705895	706532	969022	115-20057	Active	4	YES	A	41.718364	-75.885966
CABOT OIL & GAS CORP	REVISED SEVERCOOL B P1	766829	758944	1092759	115-21127	Active	4	YES	A	41.730292	-75.908514
CABOT OIL & GAS CORP	R SMITH 1H OG WELL	713731	712964	980387	115-20078	Active	4	YES	A	41.702883	-75.907406
CABOT OIL & GAS CORP	GESFORD 5H NW OG WELL	723562	721614	996391	115-20201	Active	4	YES	A	41.738839	-75.885567
CABOT OIL & GAS CORP	RATZEL 3V OG WELL	716448	715295	984181	115-20117	Active	4	YES	A	41.736538	-75.862843
CABOT OIL & GAS CORP	BROOKS 3V OG WELL	719977	718460	989719	115-20161	Active	4	YES	A	41.705336	-75.866078
CABOT OIL & GAS CORP	POST 1 OG WELL	731197	727969	1009042	115-20338	Active	4	NO	A	41.732903	-75.840892
CABOT OIL & GAS CORP	J PLONSKI 6 OG WELL	759277	750797	1074137	115-20896	Active	4	YES	A	41.740372	-75.837828
CABOT OIL & GAS CORP	J PLONSKI 5 OG WELL	760083	751406	1075586	115-20914	Inactive/ plugged well	361	YES	A	41.740331	-75.837839
CABOT OIL & GAS CORP	REVISED SEVERCOOL B P1	766829	758946	1092763	115-21128	Active	4	YES	A	41.730250	-75.908519
CABOT OIL & GAS CORP	A & M HIBBARD 1H OG WELL	718469	717108	987281	115-20150	Active	4	YES	A	41.741908	-75.910381
CABOT OIL & GAS CORP	GREENWOOD 1 OG WELL	691948	695541	949405	115-20008	Active	4	NO	A	41.751108	-75.868132
CABOT OIL & GAS CORP	HUBBARD 1 OG WELL	698063	700214	958157	115-20039	Active	4	YES	A	41.749649	-75.874785
CABOT OIL & GAS CORP	LEWIS 2 OG WELL	700997	702511	962235	115-20030	Active	4	YES	A	41.723400	-75.878330
CABOT OIL & GAS CORP	P KELLEY 3 OG WELL	733007	729531	1011702	115-20374	Active	4	YES	A	41.718683	-75.899208
CABOT OIL & GAS CORP	B SEVERCOOL 1 OG WELL	713740	712971	980391	115-20080	Active	4	YES	A	41.729828	-75.908470
CABOT OIL & GAS CORP	GESFORD 4R OG WELL	714093	713268	980868	115-20091	Active	4	NO	A	41.733258	-75.886172
CABOT OIL & GAS CORP	HOOVER 1V OG WELL	723842	721861	996863	115-20207	Active	4	YES	A	41.725375	-75.909356
CHIEF OIL & GAS LLC	KERR UNIT 3 OG WELL	733183	729659	1011959	115-20377	Active	4	NO	A	41.697639	-75.840083

Table C-40 Well Inventory Summary

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
Susquehanna County, Pennsylvania											
CABOT OIL & GAS CORP	TEEL 8H OG WELL	704359	705296	967067	115-20045	Active	4	YES	A	41.703792	-75.881335
CABOT OIL & GAS CORP	P KELLEY 4 OG WELL	735640	731605	1015645	115-20402	Active	4	YES	A	41.718608	-75.899256
CABOT OIL & GAS CORP	R HESS 4 OG WELL	753843	746345	1052302	115-20727	Active	4	YES	A	41.759483	-75.868811
CABOT OIL & GAS CORP	T MAKOSKY 3 OG WELL	756258	748226	1063694	115-20829	Active	4	YES	A	41.752633	-75.835119
CABOT OIL & GAS CORP	F LIPPINCOTT 3H OG WELL	753611	746131	1051950	115-20723	Active	4	YES	A	41.732861	-75.822164
CABOT OIL & GAS CORP	ELY 4H OG WELL	701331	702795	962733	115-20034	Active	4	YES	A	41.724333	-75.871429
CABOT OIL & GAS CORP	RATZEL 2H OG WELL	707043	707401	970658	115-20152	Active	4	YES	A	41.736600	-75.862887
CABOT OIL & GAS CORP	R HULL 1H OG WELL	716461	715310	984203	115-20122	Active	4	NO	A	41.711822	-75.900864
CABOT OIL & GAS CORP	R HULL 6 OG WELL	759272	750793	1074134	115-20894	Active	4	YES	A	41.709558	-75.906400
CABOT OIL & GAS CORP	J PLONSKI 7 OG WELL	759280	750800	1074140	115-20897	Active	4	YES	A	41.740411	-75.837817
CABOT OIL & GAS CORP	J PLONSKI 3 OG WELL	759908	751274	1075217	115-20904	Active	4	YES	A	41.740250	-75.837861
CABOT OIL & GAS CORP	CARSON 1 OG WELL	731024	727813	1008749	115-20319	Active	4	YES	A	41.697211	-75.865544
CABOT OIL & GAS CORP	POST 2 OG WELL	731027	727819	1008759	115-20321	Active	4	YES	A	41.732822	-75.840875
CHIEF OIL & GAS LLC	TEEL UNIT 4 OG WELL	731449	728201	1009445	115-20342	Active	4	YES	A	41.714717	-75.884697
CABOT OIL & GAS CORP	J GRIMSLEY 1 OG WELL	714550	713642	981565	115-20095	Active	4	YES	A	41.726314	-75.903103
CABOT OIL & GAS CORP	TEEL 13V OG WELL	716443	715292	984177	115-20116	Active	4	YES	A	41.703833	-75.881405
CABOT OIL & GAS CORP	HUBBARD 3 OG WELL	716894	715677	984809	115-20131	Active	4	YES	A	41.748939	-75.889175
CABOT OIL & GAS CORP	HUBBARD 5H OG WELL	718477	717112	987289	115-20148	Active	4	YES	A	41.749513	-75.874432
CABOT OIL & GAS CORP	ELY 7H SE OG WELL	719681	718200	989174	115-20160	Active	4	YES	A	41.734100	-75.869010
CABOT OIL & GAS CORP	J GRIMSLEY 2H SE OG WELL	720153	718628	989993	115-20171	Active	4	YES	A	41.726375	-75.902975
CHIEF OIL & GAS LLC	KERR UNIT 1H OG WELL	724053	722058	997372	115-20212	Active	4	YES	A	41.697739	-75.840136

Table C-40 Well Inventory Summary

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
Susquehanna County, Pennsylvania											
CABOT OIL & GAS CORP	R HULL 5 OG WELL	729572	726651	1006616	115-20260	Active	4	YES	A	41.709681	-75.906433
CABOT OIL & GAS CORP	D SIMPSON 4 OG WELL	730644	727496	1008139	115-20314	Active	4	YES	A	41.721358	-75.854581
CABOT OIL & GAS CORP	B SEVERCOOL 2H NW OG WELL	719975	718459	989718	115-20164	Active	4	YES	A	41.729919	-75.908628
CABOT OIL & GAS CORP	GESFORD 3 OG WELL	698291	700403	958441	115-20019	Plugged well	361	YES	A	41.733889	-75.876964
CABOT OIL & GAS CORP	BROOKS 1H OG WELL	704357	705294	967064	115-20051	Active	4	NO	A	41.705442	-75.866018
CABOT OIL & GAS CORP	TEEL 10H OG WELL	704712	705569	967473	115-20055	Active	4	YES	A	41.703372	-75.874872
CHIEF OIL & GAS LLC	NOBLE UNIT 1H OG WELL	748441	741917	1043142	115-20596	Active	4	YES	A	41.717086	-75.835858
CABOT OIL & GAS CORP	P KELLEY 1 OG WELL	723473	721548	996251	115-20196	Active	4	YES	A	41.718689	-75.899219
CABOT OIL & GAS CORP	C LARUE 6 OG WELL	725457	723365	1000064	115-20220	Active	4	YES	A	41.731203	-75.921703
CABOT OIL & GAS CORP	GREENWOOD 8 OG WELL	730331	727239	1007786	115-20284	Active	4	NO	A	41.751081	-75.867808
CABOT OIL & GAS CORP	T MAKOSKY 5 OG WELL	756290	748265	1063762	115-20831	Active	4	YES	A	41.752650	-75.835014
CABOT OIL & GAS CORP	W BROOKS 5 OG WELL	725474	723374	1000088	115-20225	Active	4	YES	A	41.701047	-75.886847
CABOT OIL & GAS CORP	GESFORD 1 OG WELL	698282	700393	958434	115-20040	Active	4	NO	A	41.738858	-75.885416
CABOT OIL & GAS CORP	D SIMPSON 3 OG WELL	730640	727493	1008136	115-20313	Active	4	YES	A	41.721350	-75.854692
CABOT OIL & GAS CORP	R HULL 7 OG WELL	759276	750795	1074135	115-20895	Active	4	YES	A	41.709567	-75.906347
CABOT OIL & GAS CORP	RATZEL 1H OG WELL	704351	705288	967058	115-20047	Active	4	NO	A	41.736480	-75.862799
CABOT OIL & GAS CORP	GREENWOOD 3V OG WELL	717504	716251	985764	115-20142	Active	4	YES	A	41.748228	-75.863906
CABOT OIL & GAS CORP	HOOVER 2H SE OG WELL	721464	719807	992454	115-20177	Active	4	NO	A	41.725275	-75.908914
CABOT OIL & GAS CORP	GESFORD 8H NW OG WELL	721693	720011	992889	115-20183	Active	4	YES	A	41.733261	-75.886272
CABOT OIL & GAS CORP	COSTELLO 2 OG WELL	703945	704963	966630	115-20043	Active	4	YES	A	41.728308	-75.885294
CABOT OIL & GAS CORP	BLACK 1H OG WELL	704343	705282	967052	115-20048	Active	4	YES	A	41.712033	-75.864524

Table C-40 Well Inventory Summary

Susquehanna County, Pennsylvania

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
CABOT OIL & GAS CORP	GREENWOOD 6 OG WELL	725469	723371	1000084	115-20223	Active	4	YES	A	41.751094	-75.868028
CABOT OIL & GAS CORP	TEEL 2 OG WELL	697799	699986	957766	115-20010	Active	4	YES	A	41.717291	-75.879041
CABOT OIL & GAS CORP	T MAKOSKY 6 OG WELL	756312	748284	1063796	115-20832	Active	4	YES	A	41.752661	-75.834958
CABOT OIL & GAS CORP	TEEL 12H NW OG WELL	719990	718473	989733	115-20167	Active	4	YES	A	41.717397	-75.879167
CABOT OIL & GAS CORP	F LIPPINCOTT 2H OG WELL	753607	746125	1051943	115-20722	Active	4	YES	A	41.732897	-75.822142
CABOT OIL & GAS CORP	GREENWOOD 7 OG WELL	725471	723373	1000085	115-20224	Active	4	YES	A	41.751089	-75.867917
CHIEF OIL & GAS LLC	TEEL UNIT 1H OG WELL	725505	723412	1000139	115-20227	Active	4	YES	A	41.711647	-75.886864
CABOT OIL & GAS CORP	DEPAOLA 3 OG WELL	727468	724971	1003320	115-20241	Active	4	YES	A	41.752383	-75.903053
CABOT OIL & GAS CORP	COSNER 2 OG WELL	732769	729319	1011359	115-20366	Active	4	YES	A	41.697617	-75.855056
CABOT OIL & GAS CORP	HEITSMAN 1H OG WELL	704349	705287	967057	115-20050	Active	4	YES	A	41.731194	-75.891402
CABOT OIL & GAS CORP	HESS 2 OG WELL	742479	736951	1025573	115-20492	Active	4	YES	A	41.759544	-75.868886
CABOT OIL & GAS CORP	R SMITH 2H OG WELL	713729	712962	980386	115-20077	Active	4	YES	A	41.702978	-75.907478
CHIEF OIL & GAS LLC	NOBLE WELL PAD	748769	761847	1099789	115-21228	Active	4	YES	A	41.717128	-75.835858
CHIEF OIL & GAS LLC	NOBLE WELL PAD	748769	761846	1099788	115-21227	Active	4	YES	A	41.717044	-75.835856
WPX ENERGY APPALACHIA LLC	COYLE SOUTH 1 4H OG WELL	761321	752561	1077764	115-20934	Active	4	YES	NA[1]	41.983089	-75.773300
WPX ENERGY APPALACHIA LLC	COYLE SOUTH 1 2H OG WELL	761315	752556	1077761	115-20932	Active	4	YES	NA[1]	41.983114	-75.773342
WPX ENERGY APPALACHIA LLC	COYLE NORTH 1 1H	759608	752555	1077760	115-20931	Active	4	YES	B	41.983136	-75.773319

Table C-40 Well Inventory Summary

Susquehanna County, Pennsylvania

Organization	Site Name	Site ID	Primary ID	Sub Facility ID	API Number	Site Status	Sub Facility #	Compliance	Search Area	Latitude	Longitude
WPX ENERGY APPALACHIA LLC	COYLE SOUTH 1 2H	759608	752556	1077761	115-20932	Active	4	YES	B	41.983113	-75.773341
WPX ENERGY APPALACHIA LLC	COYLE NORTH 1 3H	759608	752560	1077763	115-20933	Active	4	YES	B	41.983111	-75.773277
WPX ENERGY APPALACHIA LLC	COYLE SOUTH 1 4H	759608	752561	1077764	115-20934	Active	4	YES	B	41.983088	-75.773300

Source: http://www.pasda.psu.edu/uci/MetadataDisplay.aspx?entry=PASDA&file=OilGasLocations2013_01.xml&dataset=283 (Accessed April 2013)

Key:

API = American Petroleum Industry.
NA = Not applicable.
ID = Identification.

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
TEEL UNIT 2H	115-20228	6	06/30/10	1. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. 2. Failure to maintain 2 ft. freeboard in an impoundment.	Yes	Active Horizontal Well	Springville Twp	41.714661	-75.884700	4/10/10	CHIEF OIL & GAS LLC
			07/21/10	1. Failure to properly install the permit number, issued by the department, on a completed well. 2. Pit and tanks not constructed with sufficient capacity to contain pollutional substances. 3. Discharge of pollutional material to waters of Commonwealth. 4. Failure to maintain 2 ft. of freeboard in an impoundment.	Yes						
			01/10/11	1. There is a potential for polluting substance(s) reaching Waters of the Commonwealth and may require a permit. 2. Failure to properly store, transport, process or dispose of a residual waste. 3. Pit and tanks not constructed with sufficient capacity to contain pollutional substances. Compliance records indicate: self reported spill of approximately 150 bbls treated & untreated flowback from partially open valve on blender, partially on containment, response recovering unfrozen material, contaminated material to be removed and Act 2 characterization to be performed.	Yes						
			01/31/11	1. Failure to properly store, transport, process or dispose of a residual waste. 2. Failure to design, implement or maintain BMPs to minimize the potential for accelerated erosion and sedimentation. 3. Discharge of industrial waste to waters of Commonwealth without a permit. 4. Failure to design, implement or maintain BMPs to minimize the potential for accelerated erosion and sedimentation. Compliance records indicate: contractor discharging flowback onto ground surface while the department on site. Less than 5 gallons observed. No containment in area of discharge.	Yes						
			09/19/11	Rat hole not filled.	Yes						

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
TEEL UNIT 1H	115-20227	11	03/20/10	O&G Act 223-General. Used only when a specific O&G Act code cannot be used. (Administrative Violation)	Yes	Active Horizontal Well	Springville Twp	41.711647	-75.886863	12/10/09	CHIEF OIL & GAS LLC
			03/23/10	1. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. (Administrative Violation) 2. Clean Streams Law-General. Used only when a specific Clean Stream Law code cannot be used. (Administrative Violation) 3. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. (Administrative Violation)	Yes						
			04/30/10	1. Failure to maintain 2 ft. freeboard in an impoundment. 2. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. (Administrative Violation) Compliance records indicate: previously cited for cutting blown beyond reserve pit. Cuttings have not been cleaned up which is continuing violation of 25 PA Section 78.54. Observed tear in reserve pit liner approx. 8 in. above fluid level. This is violation of 78.56 a(2). No company man on site at time of inspection.	Yes						
TEEL 7	115-20023	24	06/03/08	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Active Vertical Well	Springville Twp	41.708000	-75.871256	5/6/08	CABOT OIL & GAS CORP
			09/03/08	1. E&S Plan not adequate. 2. Failure to post permit number, operator name, address, telephone number in a conspicuous manner at the site during drilling.	Yes						
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
TEEL 6	115-20011	7	12/10/08	Drillers Log not on site.	Not resolvable	Active Vertical Well	Springville Twp	41.708530	-75.880082	12/3/08	CABOT OIL & GAS CORP
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
TEEL 5	115-20024	24	06/03/08	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Active Vertical Well	Springville Twp	41.713119	-75.871073	5/17/08	CABOT OIL & GAS CORP
			09/03/08	1. Failure to maintain 2 ft. freeboard in an impoundment. 2. Failure to post permit number, operator name, address, telephone number in a conspicuous manner at the site during drilling.	Yes						
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
TEEL UNIT 4	115-20342	3	01/31/11	1. Failure to design, implement or maintain BMPs to minimize the potential for accelerated erosion and sedimentation. 2. Failure to obtain pit approval/permit. 3. Discharge of industrial waste to waters of Commonwealth without a permit. 4. Failure to properly control or dispose of industrial or residual waste to prevent pollution of the waters of the Commonwealth. Compliance records indicate: operator discharging flowback to site. Less than 5 gallon observed being discharged to ground. No containment in place.	Yes	Active Vertical Well	Springville Twp	41.714716	-75.884697	4/20/10	CHIEF OIL & GAS LLC
TEEL 2	115-20010	22	01/07/08	No E&S plan developed, plan not on site.	Yes	Active Vertical Well	Dimock Twp	41.717291	-75.879040	2/26/08	CABOT OIL & GAS CORP
			04/07/08	Failure to maintain 2 ft. freeboard in an impoundment.	Yes						
			05/06/08	1. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. (Administrative Violation) 2. Failure to maintain 2 ft. freeboard in an impoundment.	Yes ($4,700 - possibly from many facilities)						
			09/10/08	1. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. (Administrative Violation)	Yes						
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
TEEL 1	115-20007	19	01/16/07	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Active Vertical Well	Springville Twp	41.713152	-75.877926	9/25/06	CABOT OIL & GAS CORP
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
ROZANSKI 1	115-20057	11	04/27/11	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Active Vertical Well	Dimock Twp	41.718363	-75.885966	12/17/08	CABOT OIL & GAS CORP
RATZEL 3V	115-20117	3	NA	No Violations Noted	NA	Active Vertical Well	Dimock Twp	41.736538	-75.862842	11/3/09	CABOT OIL & GAS CORP
RATZEL 2H	115-20152	12	NA	No Violations Noted	NA	Active Horizontal Well	Dimock Twp	41.736599	-75.862887	5/17/09	CABOT OIL & GAS CORP

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
RATZEL 1H	115-20047	11	09/03/08	1. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. (Administrative Violation) 2. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Active Horizontal Well	Dimock Twp	41.736480	-75.862798	10/31/08	CABOT OIL & GAS CORP
			04/13/10	1. Failure to maintain 2 ft. freeboard in an impoundment. Compliance records indicate: Inspected the well head for evidence of leakage. No standing water was present in the cellar and no visible bubbling observed. The area around the base of the well has been filled to grade with P-gravel. The well is online. Gas readings were collected around the well head using a Model 60 gas meter. No readings were detected. There was no activity on site. The site has not been restored. Inspection revealed a failure to properly maintain the liner, and to maintain at least 2 feet of freeboard in the reserve pit. This is a violation of Section 78.56(a) (2) of the Department's regulations, 25 PA Code 78.56(a) (2). On the back of the well pad is a small poly-lined reserve pit. A portion of the liner has sloughed into the fluid within the reserve pit. Based on inspection, the liner in the reserve pit has not been properly maintained, and the reserve pit is currently in violation of freeboard requirements.	Yes						
			05/13/11	1. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2. Failure to implement and maintain BMPs in accordance with Chapter 102.	Resolution not listed - no other inspections						
LEWIS 2	115-20030	14	06/03/08	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Active Vertical Well	Dimock Twp	41.723399	-75.878329	5/28/08	CABOT OIL & GAS CORP
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
			01/06/10	O&G Act 223-General. Used only when a specific O&G Act code cannot be used. (Administrative Violation)	Yes						

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
LEWIS 1	115-20035	20	06/03/08	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Active Vertical Well	Dimock Twp	41.723280	-75.884552	6/16/08	CABOT OIL & GAS CORP
			07/08/08	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes						
			07/16/08	1. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. (Administrative Violation) 2.Failure to maintain 2 ft. freeboard in an impoundment.	Yes						
			08/20/08	Discharge of pollutional material to waters of Commonwealth.	Yes						
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
			04/14/11	1. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2. Failure to implement and maintain BMPs in accordance with Chapter 102.	Yes						
GESFORD 3	115-20019	43	06/03/08	No E&S plan developed, plan not on site.	Yes	Plugged Well/ Vertical Well	Dimock Twp	41.733888	-75.876963	5/28/08	CABOT OIL & GAS CORP
			12/08/08	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes						
			02/18/09	1. Failure to submit plugging certificate 30 days after well plugged. 2. Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
			05/05/09	1. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. 2. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. 3. Failure to report defective, insufficient, or improperly cemented casing within 24 hours or submit plan to correct within 30 days. Compliance records indicate: 78.86 defective casing or cementing, 78.81(a)(2) failure to prevent migration of gas or other fluids into sources of fresh groundwater, O&G Act 601.201(f) failure to submit written notice of intent to plug well or amend plat.	Yes (Compliance Schedule Agreed To $120,000 - possibly from many facilities)						
			03/22/11	1. Failure to implement and maintain BMPs in accordance with Chapter 102. 2. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes						

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
GESFORD 2	115-20033	15	06/03/08	No E&S plan developed, plan not on site.	Yes	Active Vertical Well	Dimock Twp	41.738713	-75.878912	9/23/08	CABOT OIL & GAS CORP
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
GESFORD 9	115-20187	24	08/21/09	1. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. 2. Clean Streams Law-General. Used only when a specific Clean Streams Lasw code cannot be used. Compliance records indicate: Spill of approximately100 gallons of diesel on pad. Day tank on air pak unit overflowed. Spill occurred on 8/19/09 at approximately 9:00 am. Soaked up fuel with pads and scraped up soil. Resource Environmental is overseeing sampling and reporting.	Yes	Active	Dimock Twp	41.733816	-75.876477	9/25/08	CABOT OIL & GAS CORP
			08/27/09	O&G Act 223-General. Used only when a specific O&G Act code cannot be used.							
ELY 7H SE	115-20160	8	08/06/09	1. No Control and Disposal/Pollution Prevention Control plan or failure to implement Pollution Prevention Control plan. Compliance records indicate: an un-permitted discharge of diesel fuel has occurred an the site. Such a discharge is a violation of Chapter 78.54 of the Rules and Regulations of the Environmental Quality Board, 25 PA Code, § 78.54 General Requirements.	Yes	Active Horizontal Well	Dimock Twp	41.734099	-75.869009	7/28/09	CABOT OIL & GAS CORP
ELY 6H	115-20041	23	04/23/08	1. No E&S plan developed, plan not on site. 2. Failure to post permit number, operator name, address, telephone number in a conspicuous manner at the site during drilling.	Yes	Active Horizontal Well	Dimock Twp	41.724238	-75.871351	4/18/08	CABOT OIL & GAS CORP
			06/03/08	1. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2. O&G Act 223-General. Used only when a specific O&G Act code cannot be used.	Yes						
			09/03/08	E&S Plan not adequate.	Yes						
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
ELY 5H	115-20054	16	09/03/08	E&S Plan not adequate.	Yes	Active Horizontal Well	Dimock Twp	41.734332	-75.869334	12/17/08	CABOT OIL & GAS CORP

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
ELY 4H	115-20034	24	04/07/08	Failure to maintain 2 ft. freeboard in an impoundment.	Yes	Active Vertical Well	Dimock Twp	41.724333	-75.871429	3/27/08	CABOT OIL & GAS CORP
			06/03/08	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes						
			09/03/08	E&S Plan not adequate.	Yes						
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
ELY 2	115-20015	27	06/03/08	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Active Vertical Well	Dimock Twp	41.729171	-75.871993	7/24/08	CABOT OIL & GAS CORP
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
ELY 1H	115-20049	22	09/03/08	E&S Plan not adequate.	Yes	Active Vertical Well	Dimock Twp	41.734197	-75.869116	10/23/08	CABOT OIL & GAS CORP
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
			08/20/01	1. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. Compliance records indicate: On August 20, 2009 at approximately 10:00 am, a call was received from Paul Harten of GDS reporting a spill of approximately 25 gallons of drilling mud on location. The spill occurred due to a leaking mud hose on the rig. It was reported that the drilling mud was immediately contained and cleaned up and the leaking hose was replaced. Mr. Harten indicated that the area where the drilling mud spilled was scraped with a backhoe, and the soil and mud was disposed of in the reserve pit on site. At the time of inspection, the area appeared to be clean and free of drilling mud. Some of the spilled drilling was contained in the cellar of the well. This mud was being pumped out and into the reserve pit. The investigation revealed that an un-permitted discharge of drilling mud has occurred at the site. Such a discharge is a violation of Chapter 78.54. Violation was immediately corrected.	Yes						

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
ELY 1	115-20029	3	06/03/08	O&G Act 223-General. Used only when a specific O&G Act code cannot be used.	Yes	Proposed But Never Materialized	Dimock Twp	41.718769	-75.872861	NA	BOT OIL & GAS C(
			09/03/08	E&S Plan not adequate.	Yes						
ELY 4	115-20016	2	02/02/09	1. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. Compliance records indicate: This was a violation of Solid Waste Management Act Section 301 for disposing diesel fuel to the ground. They spilled approximately100 gallons.	Yes ($120,000 - possibly from many facilities)	Proposed But Never Materialized	Dimock Twp	41.724333	-75.871429	NA	CABOT OIL & GAS CORP
COYLE SOUTH 1 4H	115-20934	2	NA	No Violations Noted	NA	Active Horizontal Well	Liberty Twp	41.983088	-75.773300	6/28/12	WPX ENERGY APPALACHIA LLC
COYLE SOUTH 1 2H	115-20932	3	NA	No Violations Noted	NA	Active Horizontal Well	Liberty Twp	41.983113	-75.773341	6/28/12	WPX ENERGY APPALACHIA LLC
COSTELLO 2	115-20043	19	07/30/08	1. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2. O&G Act 223-General. Used only when a specific O&G Act code cannot be used.	Yes	Active Vertical Well	Dimock Twp	41.728308	-75.885293	8/16/08	CABOT OIL & GAS CORP
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
			03/22/11	1. Failure to implement and maintain BMPs in accordance with Chapter 102. 2. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes						

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
COSTELLO 1	115-20036	35	06/03/08	Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes	Active Vertical Well	Dimock Twp	41.728213	-75.879090	7/16/08	CABOT OIL & GAS CORP
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
			03/22/11	1. Clean Streams Law-General. Used only when a specific Clean Streams Law code cannot be used. (Administrative Violation) 2. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 3. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. 4. Failure to implement and maintain BMPs in accordance with Chapter 102. 5. Pit and tanks not constructed with sufficient capacity to contain pollutional substances. Compliance records indicate: Solid Waste Management Act 6018.401 violation for discharge of hazardous waste.	Yes						
BROOKS 1H	115-20051	11	02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)	Active Horizontal Well	Springville Twp	41.705441	-75.866018	11/18/08	CABOT OIL & GAS CORP
			06/18/09	1. Discharge of pollutional material to waters of Commonwealth. 2. Stream discharge of industrial waste, includes drill cuttings, oil, brine, and/or silt. 3. Improperly lined pit.	Yes						
			04/11/11	1. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2. Failure to implement and maintain BMPs in accordance with Chapter 102.	Resolution not listed						

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
BLACK 2H	115-20056	13	07/30/08	1. No E&S plan developed, plan not on site. 2. Failure to maintain 2 ft. freeboard in an impoundment. 3. Failure to post permit number, operator name, address, telephone number in a conspicuous manner at the site during drilling.	Yes	Active Horizontal Well	Springville Twp	41.712102	-75.864579	7/10/08	CABOT OIL & GAS CORP
			09/10/08	1. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d). 2. O&G Act 223-General. Used only when a specific O&G Act code cannot be used.	Yes						
			09/24/08	1. Discharge of pollutional material to waters of Commonwealth. 2. Improperly lined pit. 3. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. Compliance record indicates: 6018.301 Solid waste to ground.	Yes ($120,000 - possibly from many facilities)						
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
BLACK 1H	115-20048	18	07/30/08	1. No E&S plan developed, plan not on site. 2. Failure to maintain 2 ft. freeboard in an impoundment.	Yes	Active Horizontal Well	Springville Twp	41.712033	-75.864523	6/16/08	CABOT OIL & GAS CORP
			09/10/08	1. O&G Act 223-General. Used only when a specific O&G Act code cannot be used. (Administrative Violation) 2. Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under O&G Act Section 206(c)(d).	Yes						
			02/18/09	Failure to submit well record within 30 days of completion of drilling.	Yes ($120,000 - possibly from many facilities)						
			03/15/11	1. Failure to properly store, transport, process or dispose of a residual waste. 2. Clean Streams Law-General. Used only when a specific Clean Streams Law code cannot be used. (Administrative Violation)	Yes						
COYLE SOUTH 1 2H	115-20932	3	NA	No Violations Noted	NA	Active Horizontal Well	Liberty Twp	41.983113	-75.773341	NA	WPX ENERGY APPALACHIA LLC
COYLE NORTH 1 3H	115-20933	2	NA	No Violations Noted	NA	Active Horizontal Well	Liberty Twp	41.983111	-75.773277	NA	WPX ENERGY APPALACHIA LLC
COYLE SOUTH 1 4H	115-20934	2	NA	No Violations Noted	NA	Active Horizontal Well	Liberty Twp	41.983088	-75.773300	NA	WPX ENERGY APPALACHIA LLC

Table C-41 Violations Summary, Susquehanna County, Pennsylvania

Well Name	API Permit	Number of Inspections[a]	Date of Violation	Violations Identified by PADEP Inspector	Corrected[b]	Comment	Municipality	Latitude	Longitude	Spud Date	Operator
COYLE NORTH 1 1H	115-20931	2	NA	No Violations Noted	NA	Active Horizontal Well	Liberty Twp	41.983136	-75.773319	NA	WPX ENERGY APPALACHIA LLC

Sources: http://www.depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?%2fOil_Gas%2fOG_Compliance&rs:Command=Render - Accessed December 2013.

http://www.ahs.dep.pa.gov/eFACTSWeb/ - Accessed December 2013.

KEY:

bbl = Barrel.
BMPs = Best management practices.
DEP = Department of Environmental Protection.
E&S = Erosion and sedimentation.
ft. = Feet.
in. = Inch.
NA = Not applicable.
NI = No information available.
O&G = Oil and Gas.
PA = Sate of Pennsylvania.
Twp = Township.

Table C-42 Notice of Violations - Identified Potential Candidate Causes and Distances (less than 2 Miles) to EPA

Northeast Pennsylvania - Susquehanna County

Well	Latitude	Longitude	Search Area	EPA Sample Point ID	EPA Sample Point Distance (mi)	EPA Sample Point ID	EPA Sample Point Distance (mi)	EPA Sample Point ID	EPA Sample Point Distance (mi)
GESFORD 3	41.7338880	-75.8769630	A	NEPAGW23	0.9 ENE	NEPAGW22	1.1 SSE	NEPAGW21	1.1 SSE
GESFORD 9	41.7338278	-75.8765139	A	NEPAGW23	0.9 ENE	NEPAGW22	1.1 SSE	NEPAGW21	1.1 SSE
TEEL UNIT 1H	41.7116470	-75.8868630	A	NEPAGW23	1.8 NE	NEPAGW22	0.5 NE	NEPAGW21	0.4 NE
TEEL UNIT 2H	41.7146610	-75.8847000	A	NEPAGW23	1.6 NE	NEPAGW22	0.3 NE	NEPAGW21	0.3 NE
TEEL 5	41.713119	-75.871073	A	NEPAGW23	1.7 NE	NEPAGW22	0.4 NW	NEPAGW21	0.4 NW
TEEL UNIT 4	41.7147160	-75.8846970	A	NEPAGW23	2.0 NE	NEPAGW22	0.7 NE	NEPAGW21	0.7 NE
TEEL 2	41.717291	-75.879040	A	NEPAGW23	1.6 NE	NEPAGW22	0.3 NE	NEPAGW21	0.3 NE
LEWIS 1	41.7232800	-75.8845520	A	NEPAGW23	1.6 NE	NEPAGW22	0.7 SE	NEPAGW21	0.7 SE
ELY 7H SE	41.7340990	-75.8690090	A	NEPAGW23	0.5 NE	NEPAGW22	1.1 SSW	NEPAGW21	1.1 SSW
ELY 4	41.7243330	-75.8714290	A	NEPAGW23	1.0 NE	NEPAGW22	0.4 SSW	NEPAGW21	0.4 SSW
ELY 4H	41.724333	-75.871429	A	NEPAGW23	1.0 NE	NEPAGW22	0.4 SW	NEPAGW21	0.3 SW
ELY 1H	41.7341970	-75.8691160	A	NEPAGW23	0.5 NE	NEPAGW22	1.1 SW	NEPAGW21	1.1 SW
COTSELLO 1	41.7282130	-75.8790900	A	NEPAGW23	1.1 NE	NEPAGW22	0.7 SE	NEPAGW21	0.8 SE
BLACK 1H	41.7120330	-75.8645230	A	NEPAGW23	1.7 NNE	NEPAGW22	0.6 NW	NEPAGW21	0.6 NW
BLACK 2H	41.7121020	-75.8645790	A	NEPAGW23	1.7 NNE	NEPAGW22	0.6 NW	NEPAGW21	0.6 NW
BROOKS 1H	41.7054410	-75.8660180	A	NEPAGW23	2.1 NNE	NEPAGW22	1.0 NW	NEPAGW21	0.9 NW
RATZEL 1H	41.736480	-75.862798	A	NEPAGW23	0.2 ESE	NEPAGW22	1.4 SW	NEPAGW21	1.3 SW

Key:

EPA = Environmental Protection Agency.
ENE = East-northeast.
ID = Identification.
mi = Mile.
NE = Northeast.
NNE = North-northeast.
NW = Northwest.
SE = Southeast.
SSE = South-southeast.
SSW = South-southwest.

Appendix C Figures

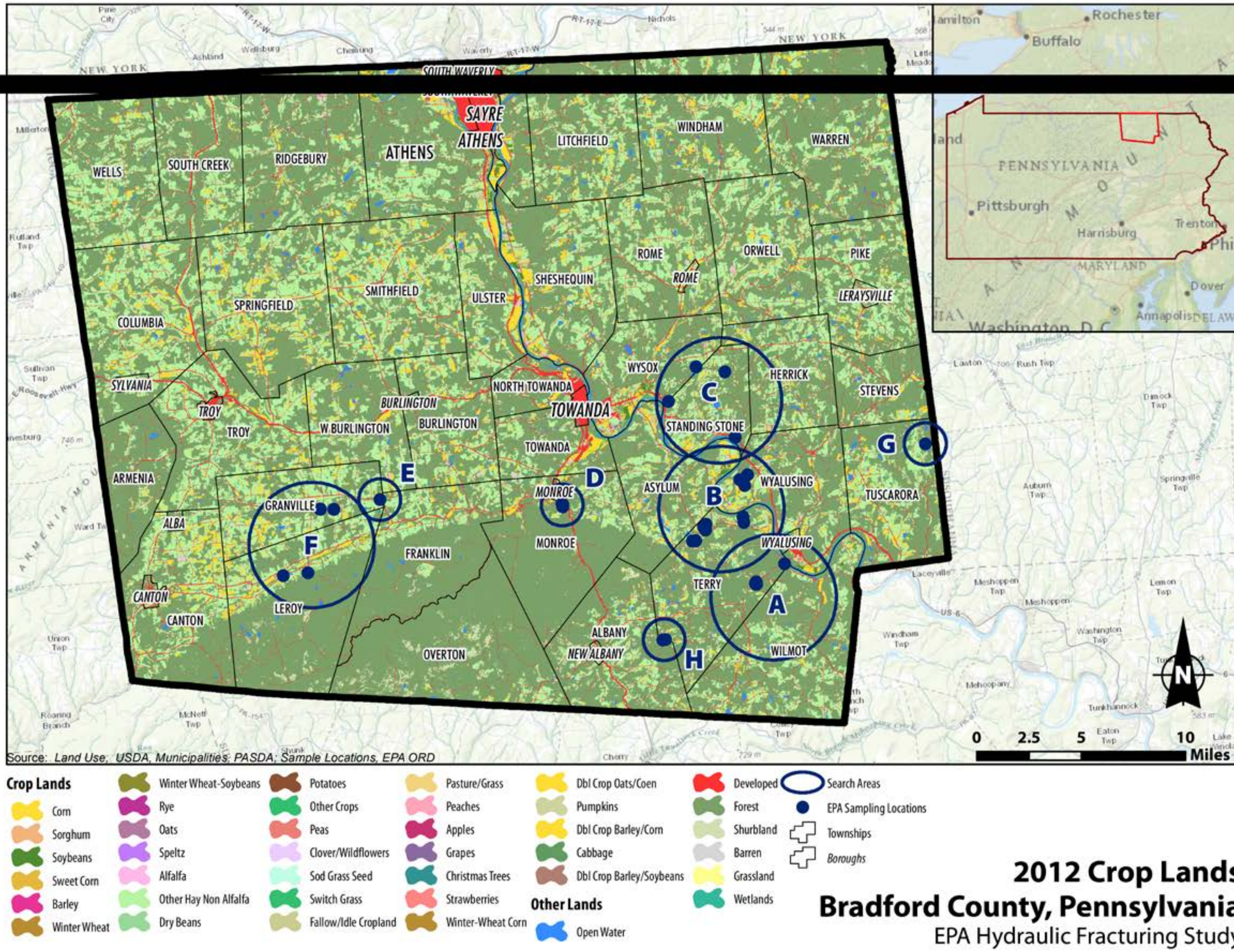


Figure C1a Crop Lands, Bradford County

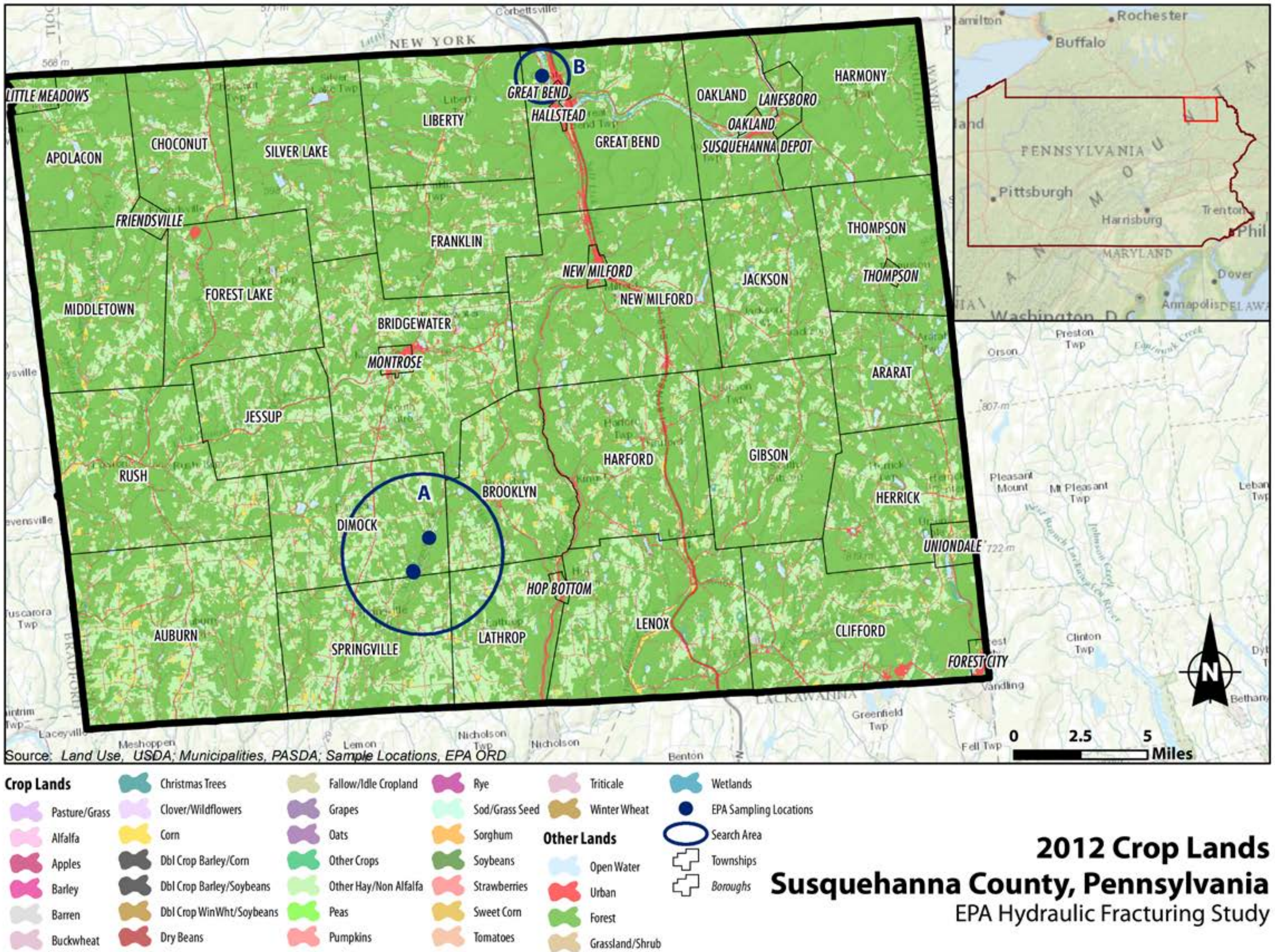


Figure C1b Crop Lands, Susquehanna County

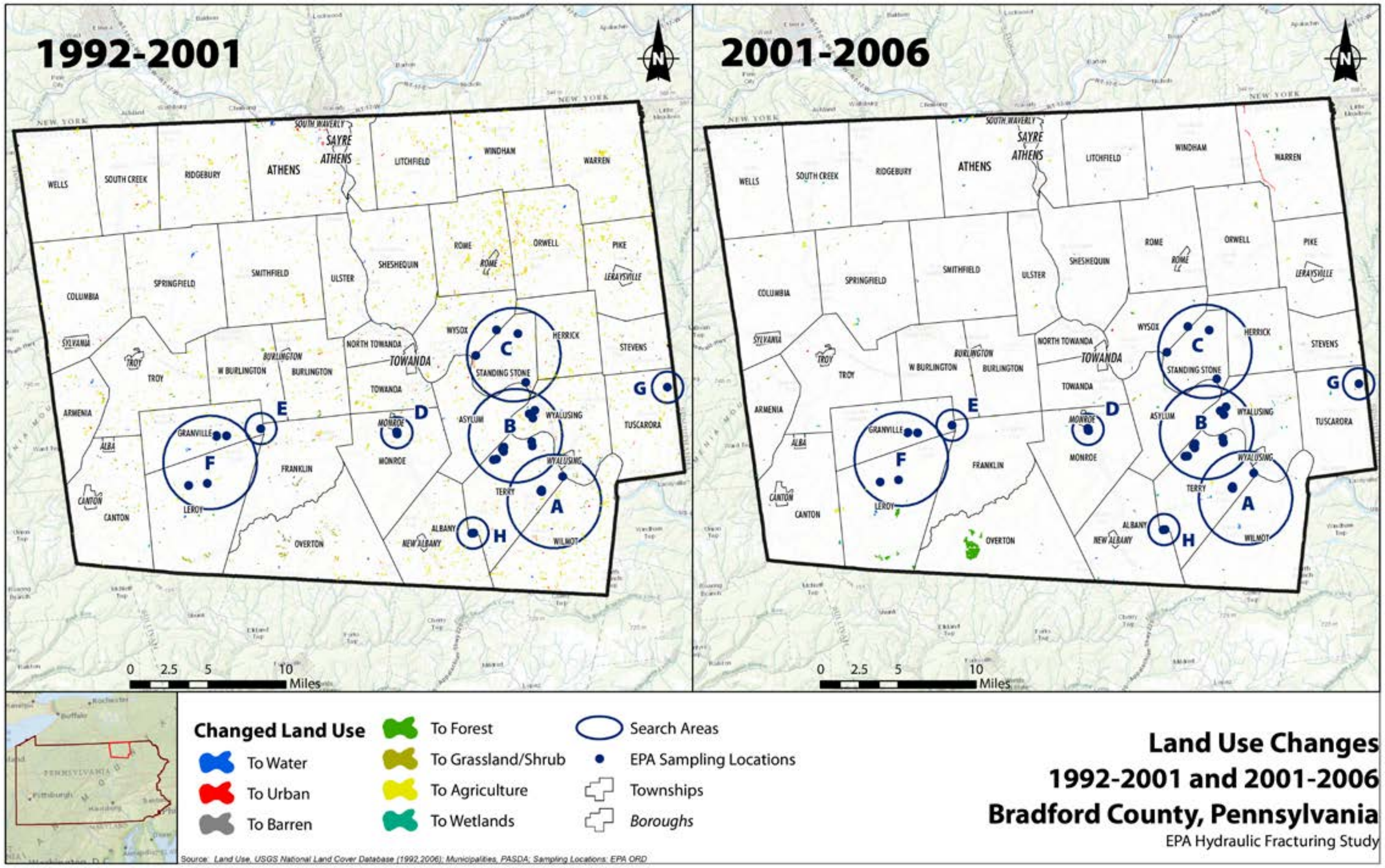


Figure C2a Land Use Changes 1992-2001 and 2001-2006, Bradford County

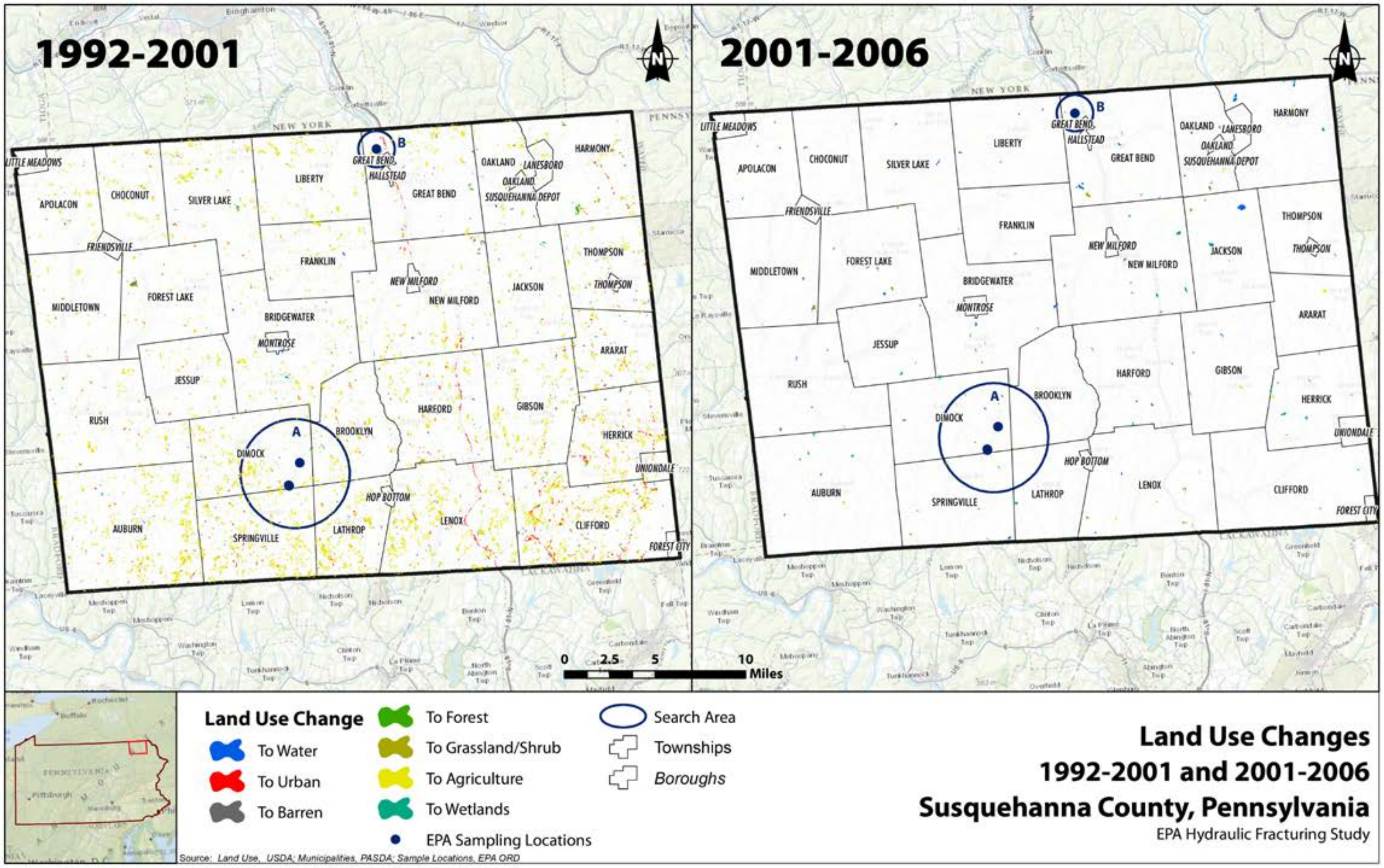


Figure C2b Land Use Changes 1992-2001 and 2001-2006, Susquehanna County

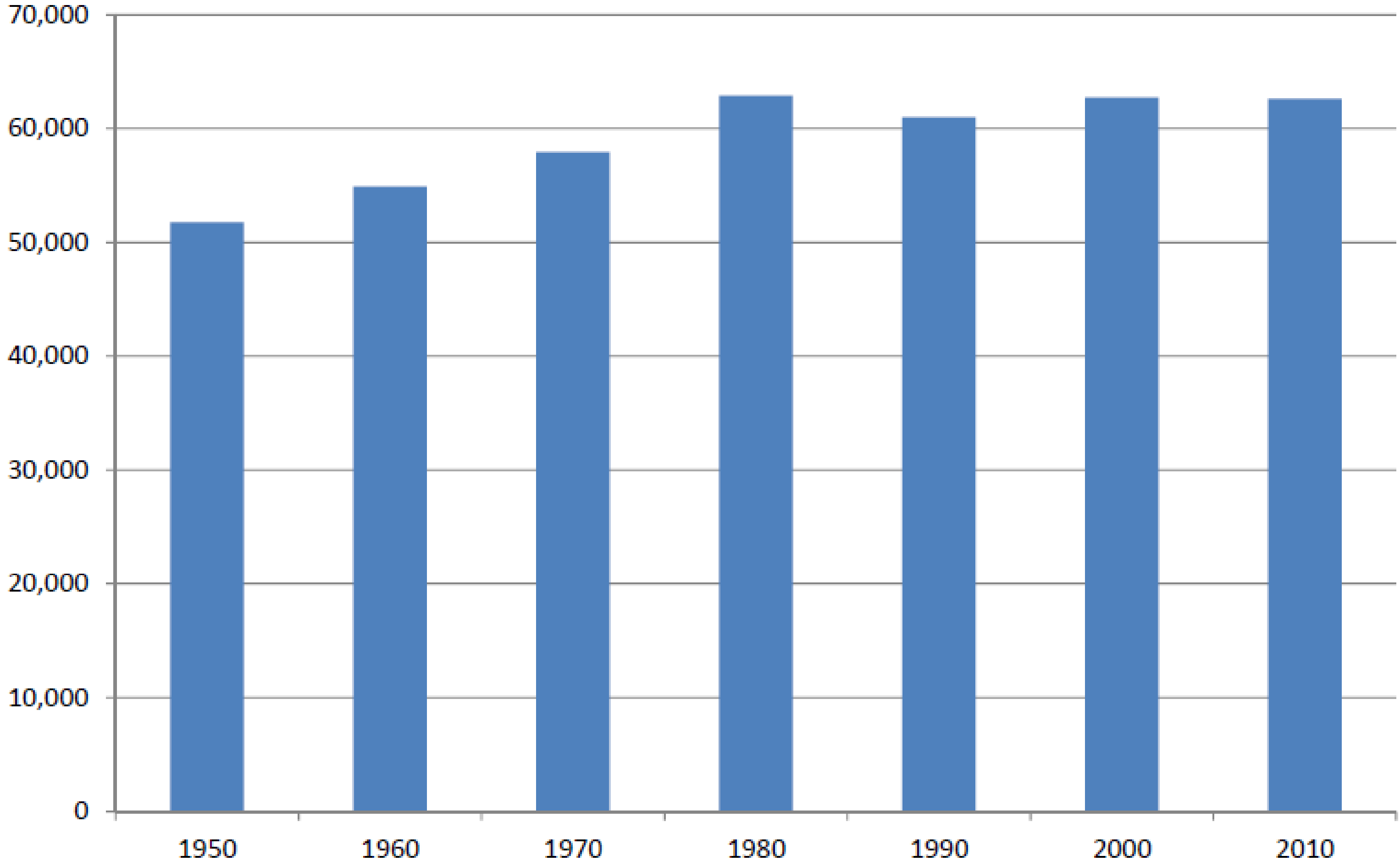


Figure C3a Population in Bradford County, Pennsylvania

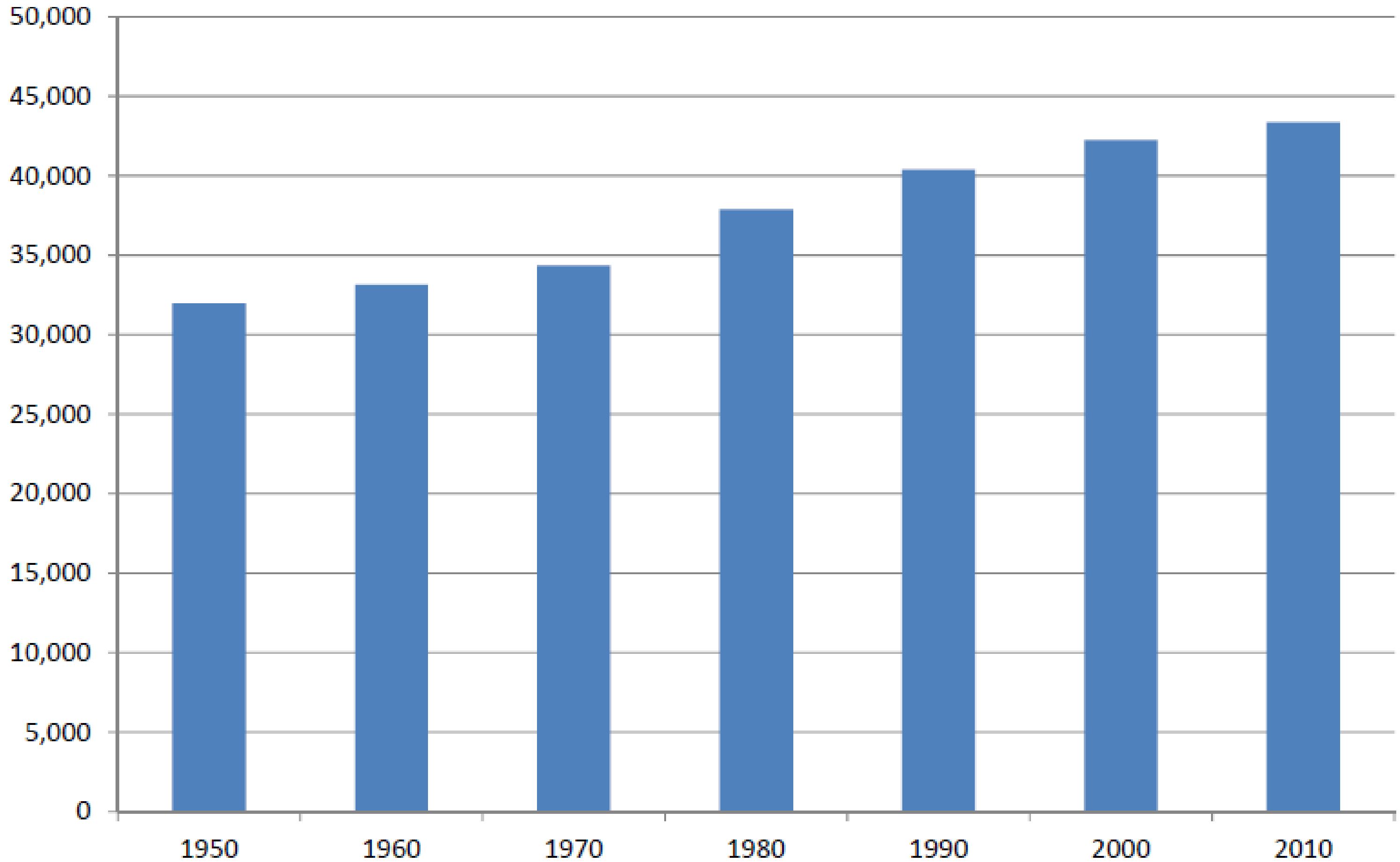


Figure C3b Population in Susquehanna County, Pennsylvania

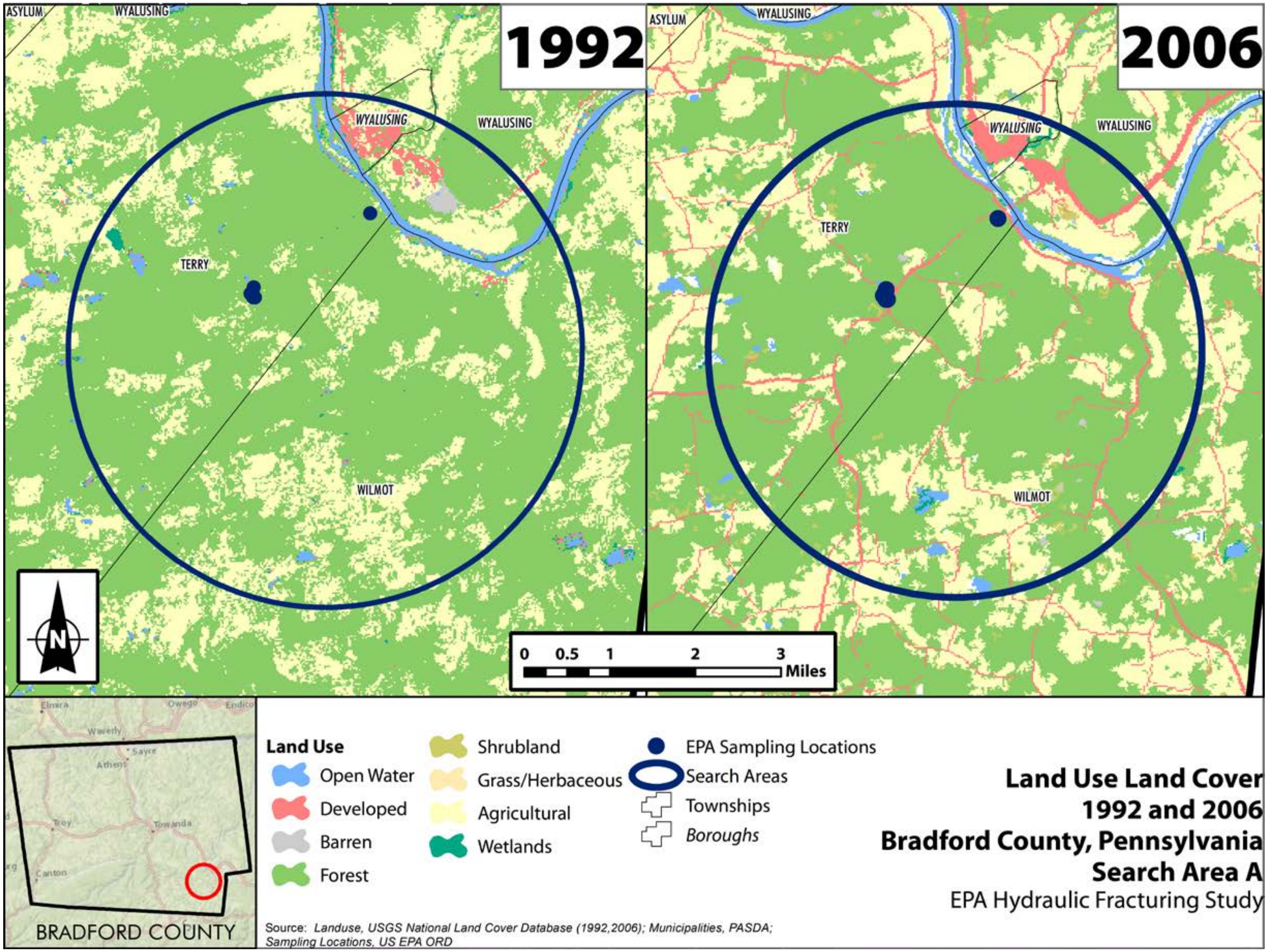


Figure C4 Land Use Land Cover in 1992 and 2006, Bradford County, Site A

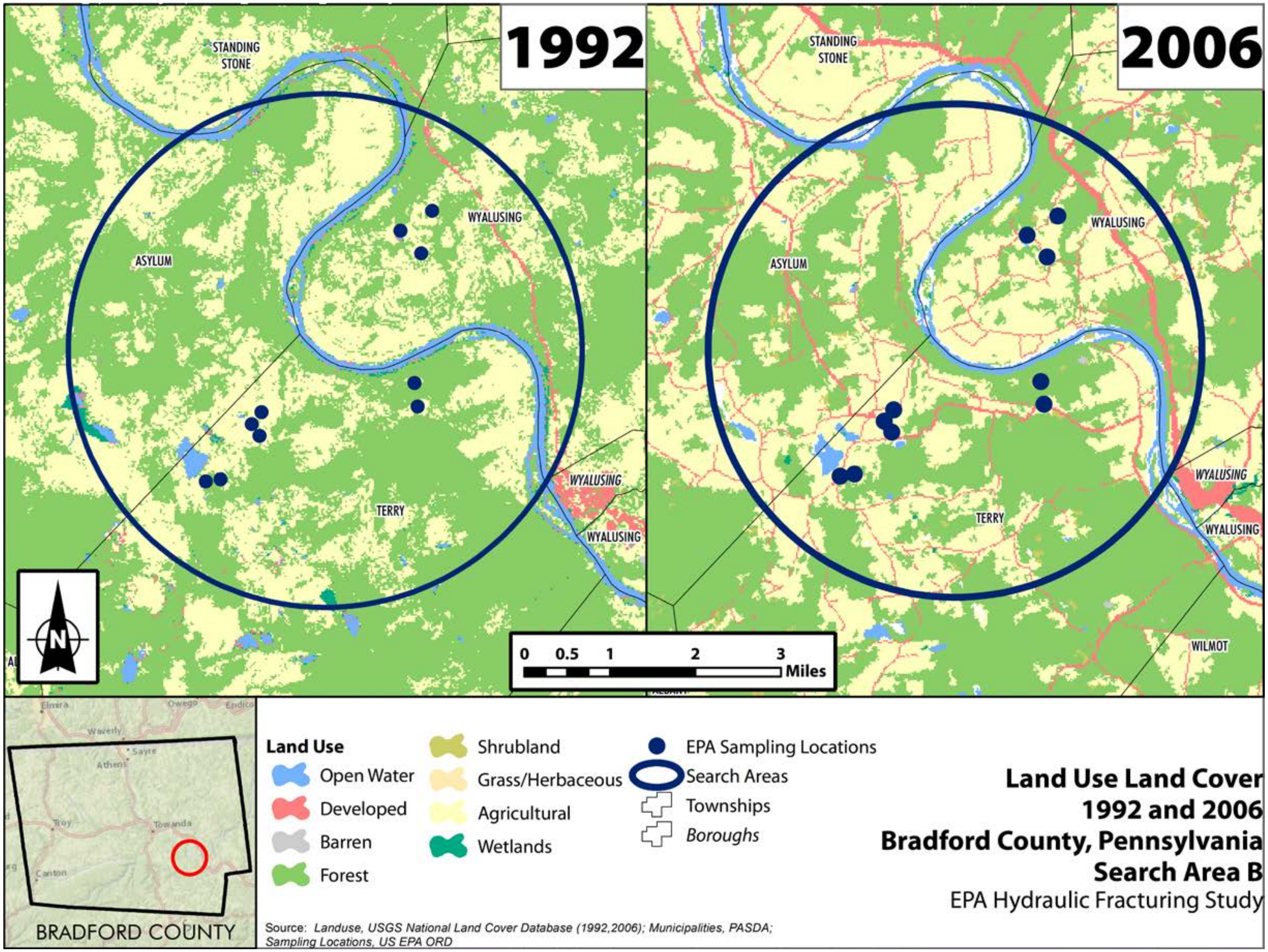


Figure C5 Land Use Land Cover in 1992 and 2006, Bradford County, Site B

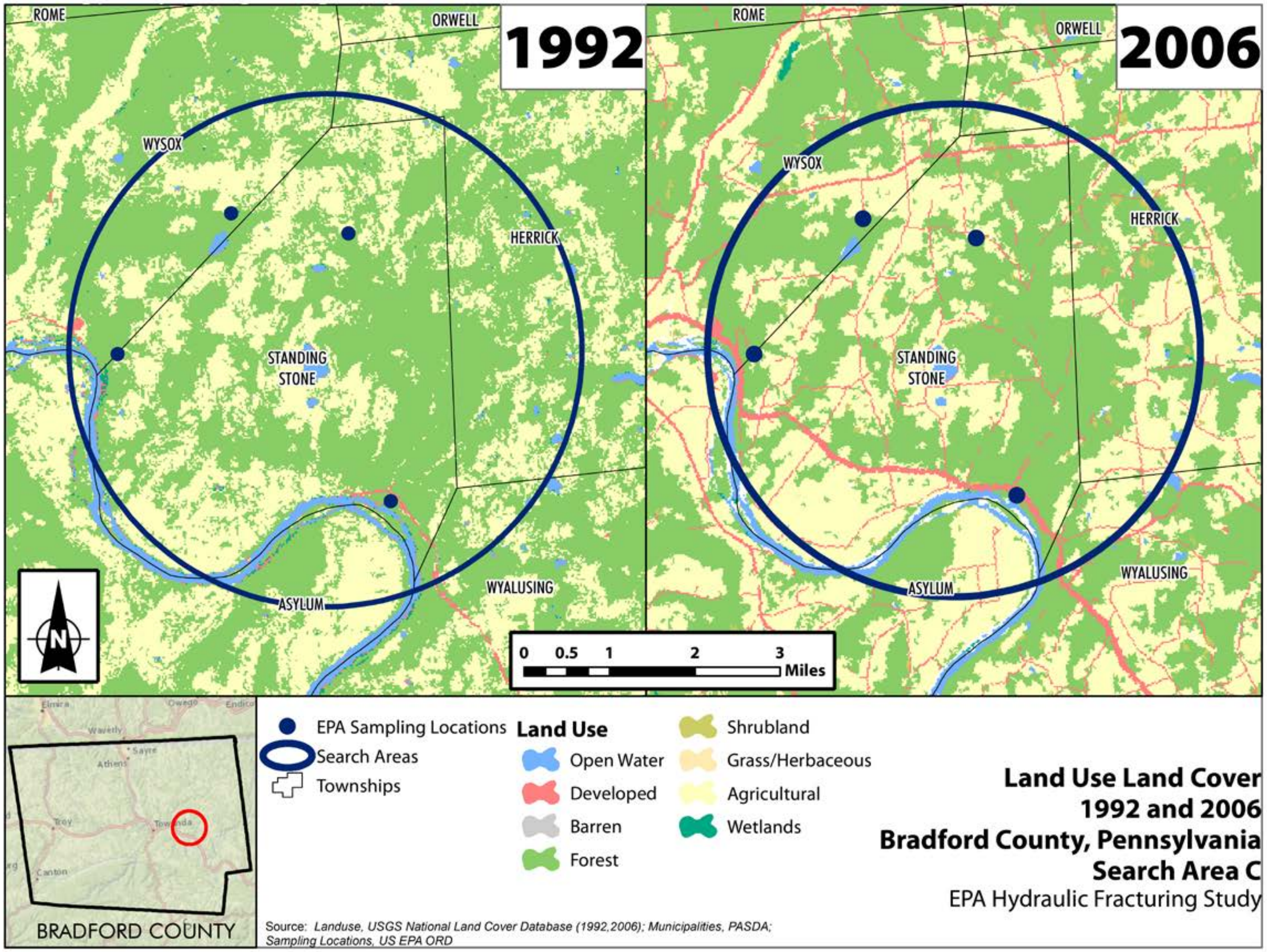


Figure C6 Land Use Land Cover in 1992 and 2006, Bradford County, Site C

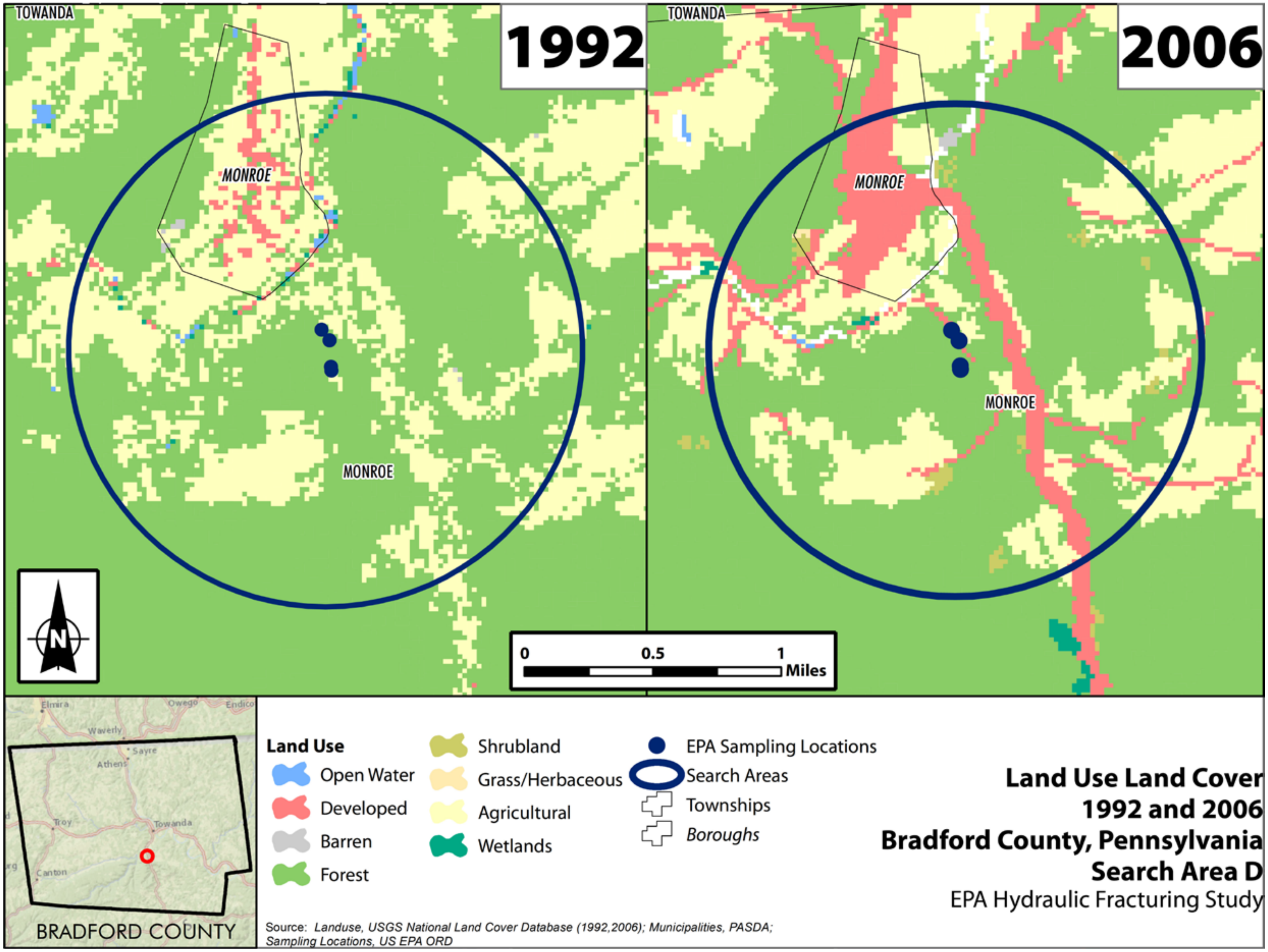


Figure C7 Land Use Land Cover in 1992 and 2006, Bradford County, Site D

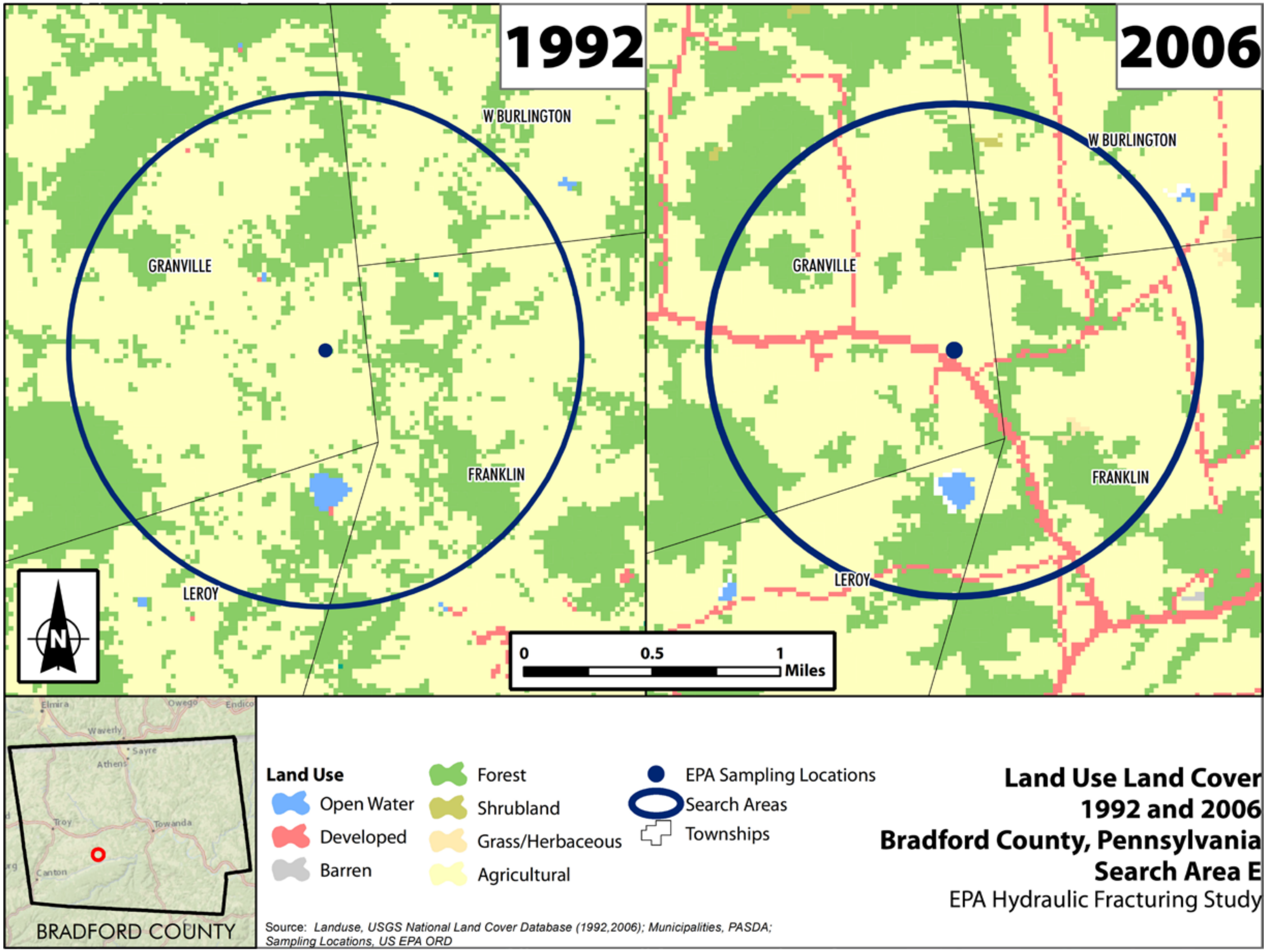


Figure C8 Land Use Land Cover in 1992 and 2006, Bradford County, Site E

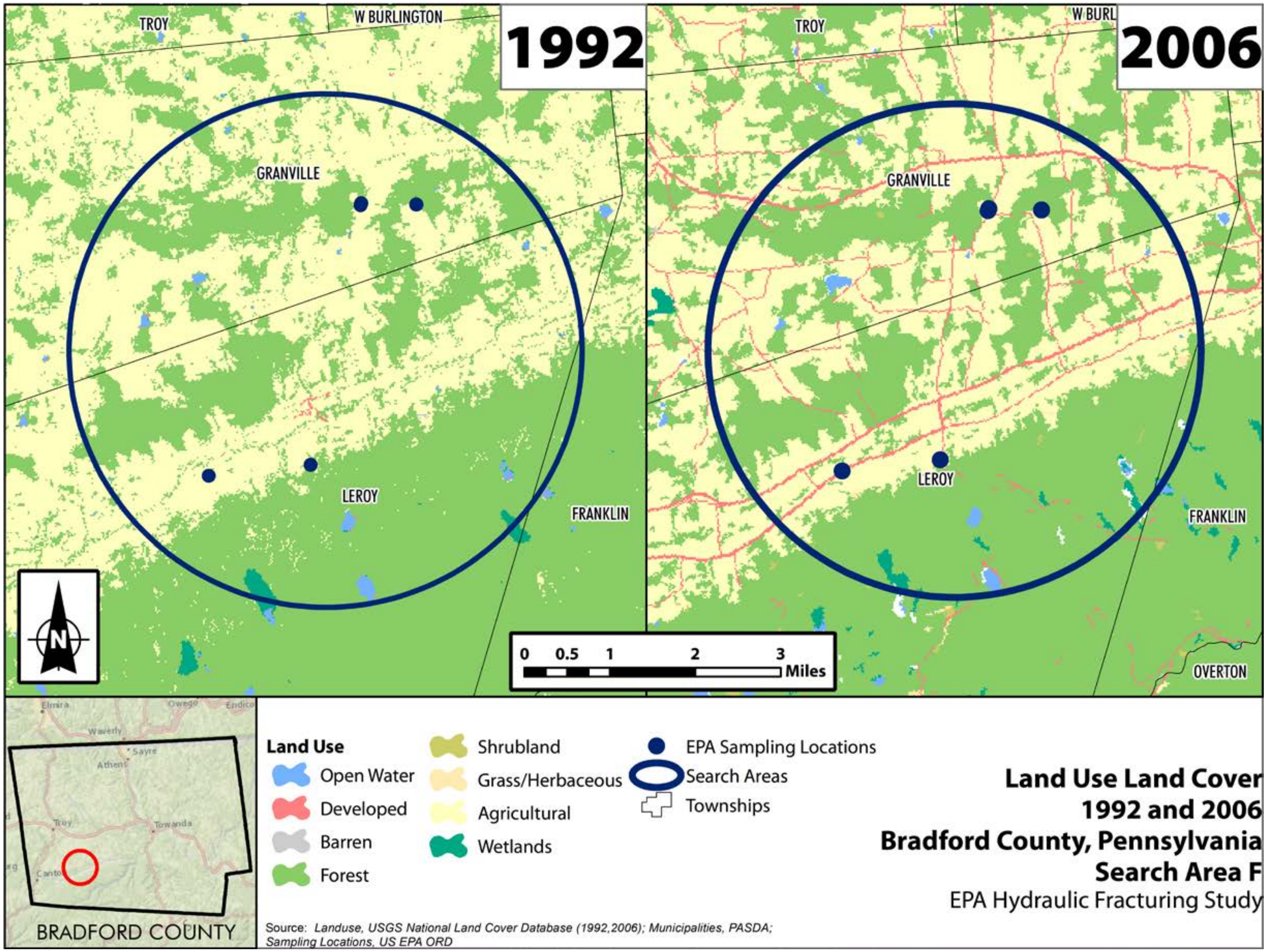


Figure C9 Land Use Land Cover in 1992 and 2006, Bradford County, Site F

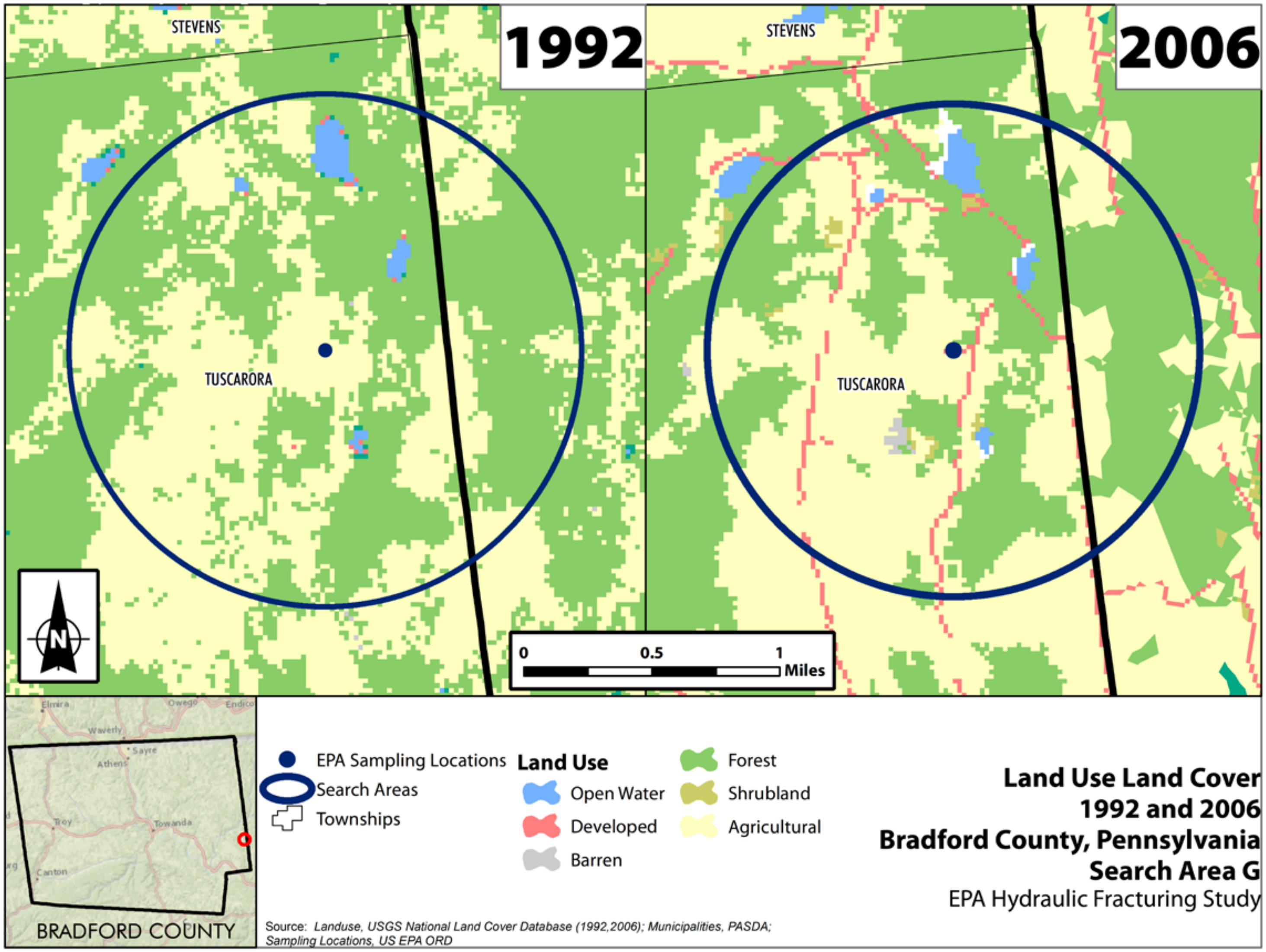


Figure C10 Land Use Land Cover in 1992 and 2006, Bradford County, Site G

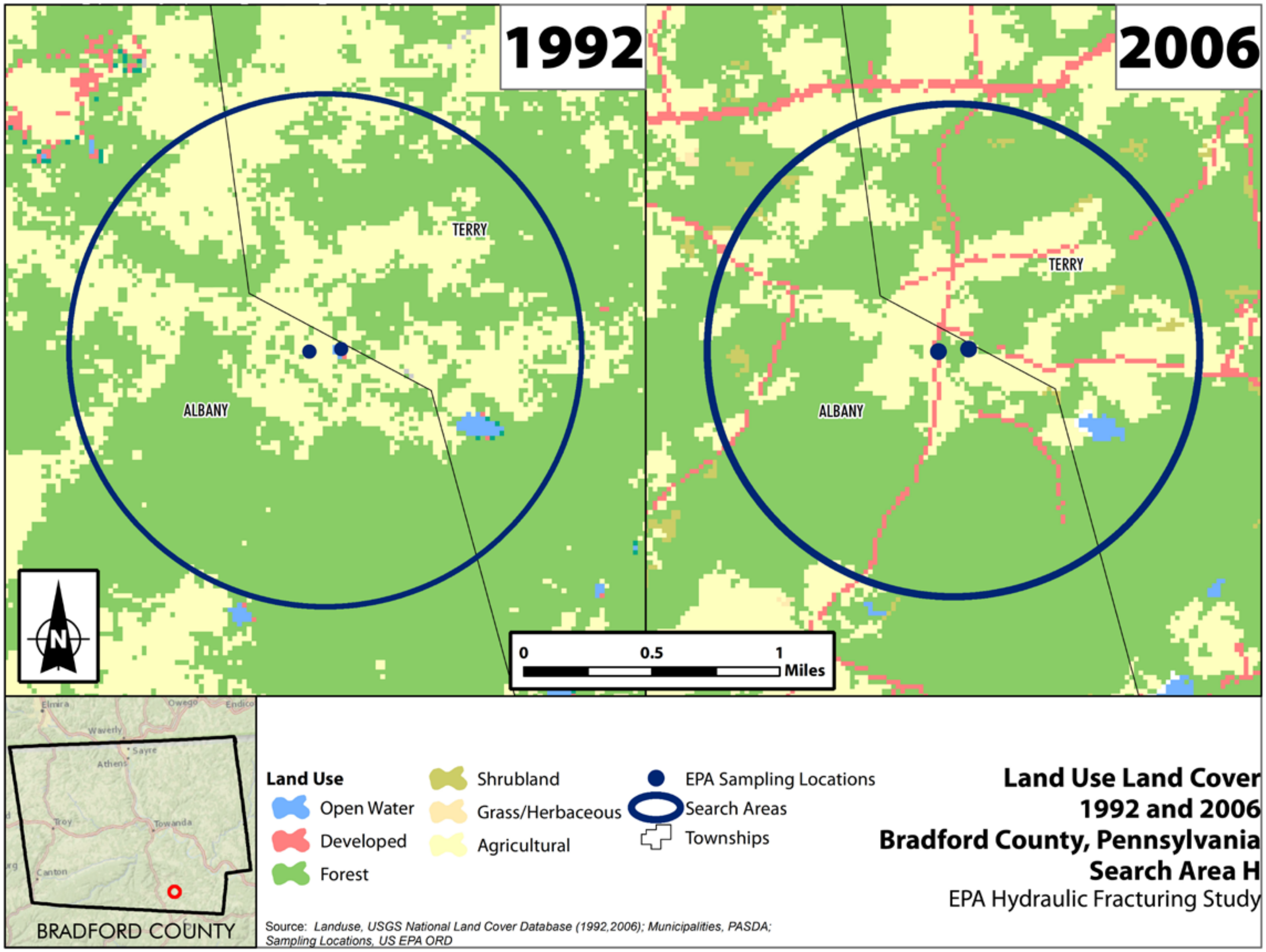


Figure C11 Land Use Land Cover in 1992 and 2006, Bradford County, Site H

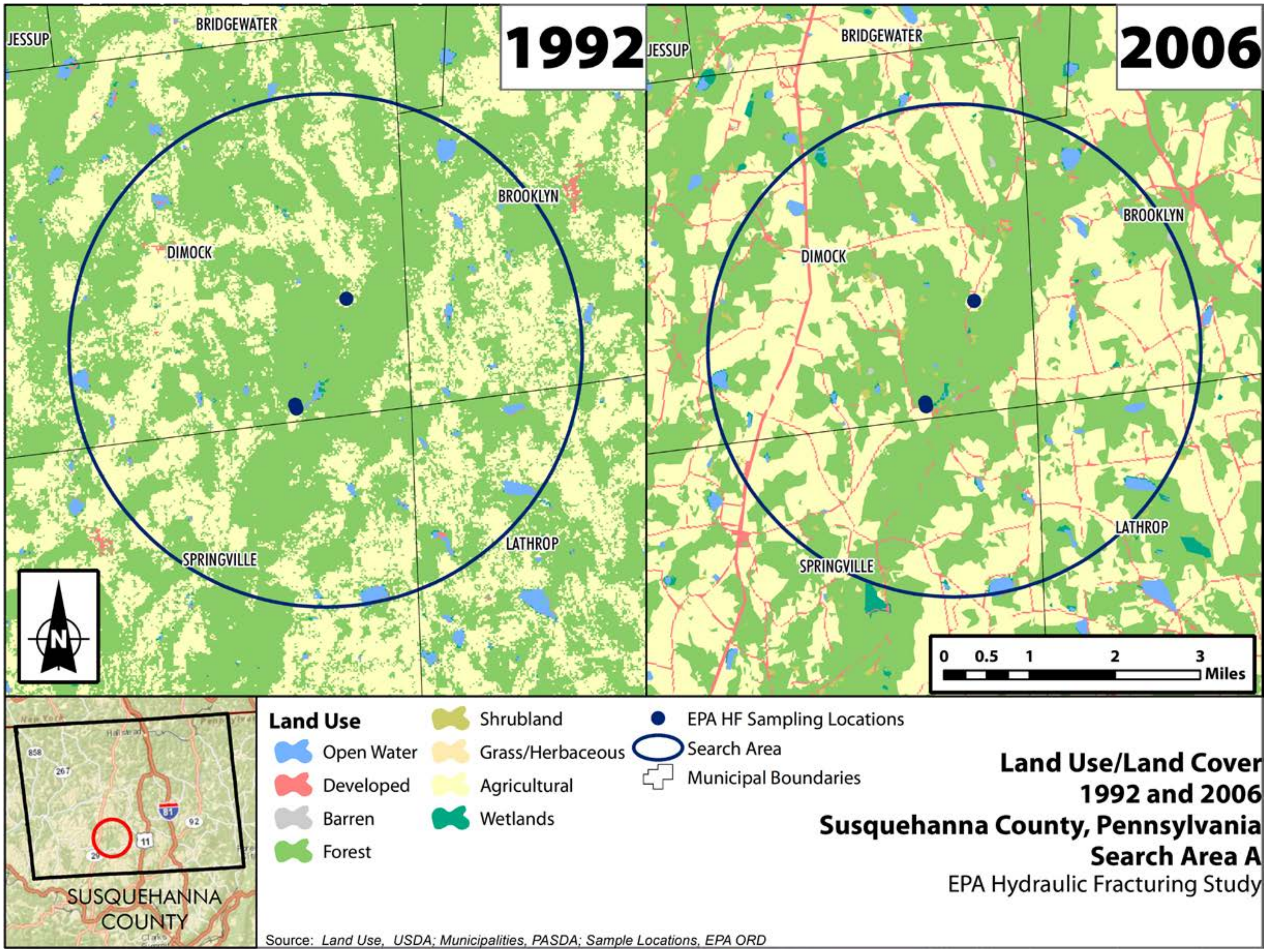


Figure C12 Land Use Land Cover in 1992 and 2006, Susquehanna County, Site A

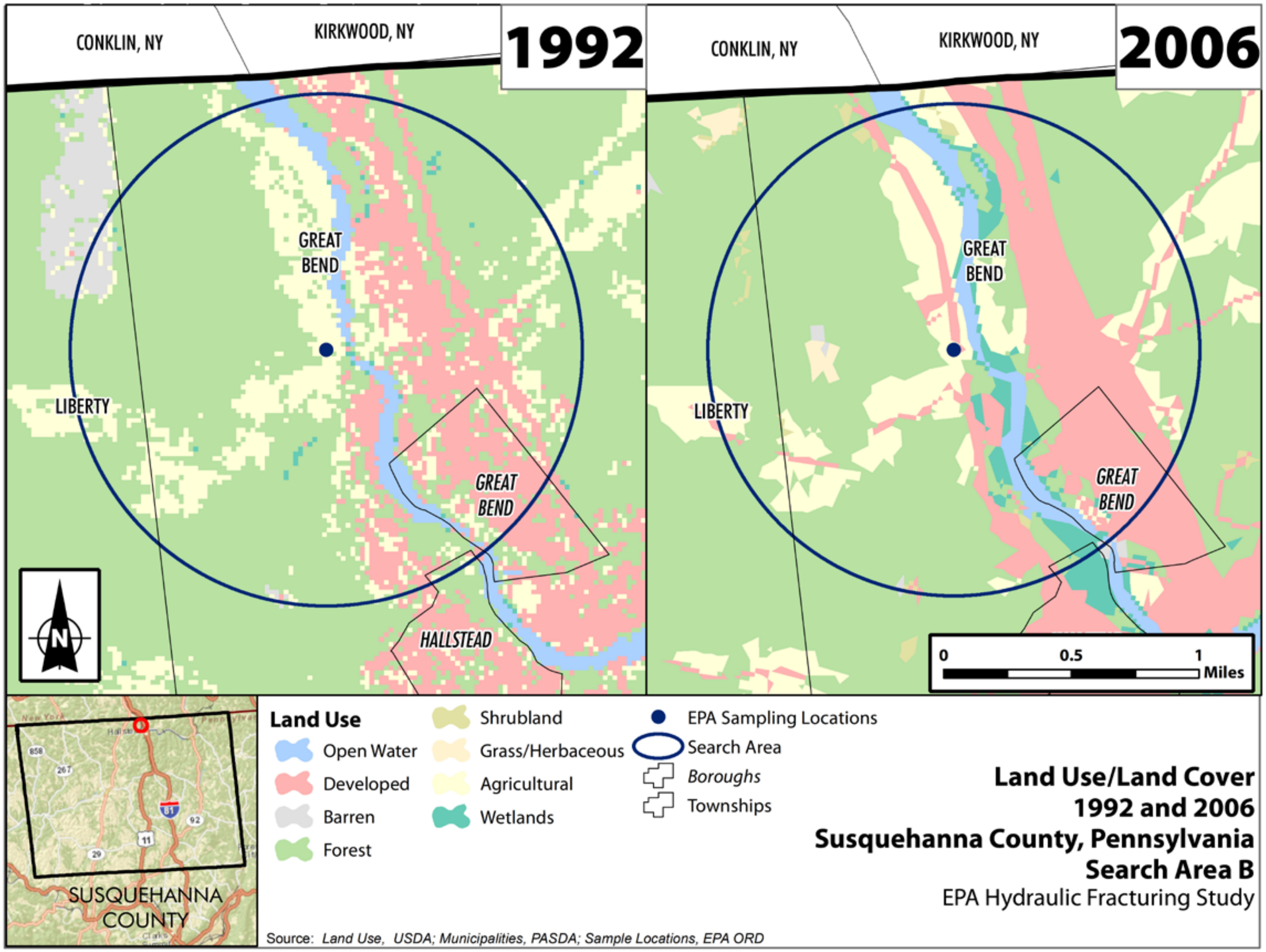


Figure C13 Land Use Land Cover in 1992 and 2006, Susquehanna County, Site B

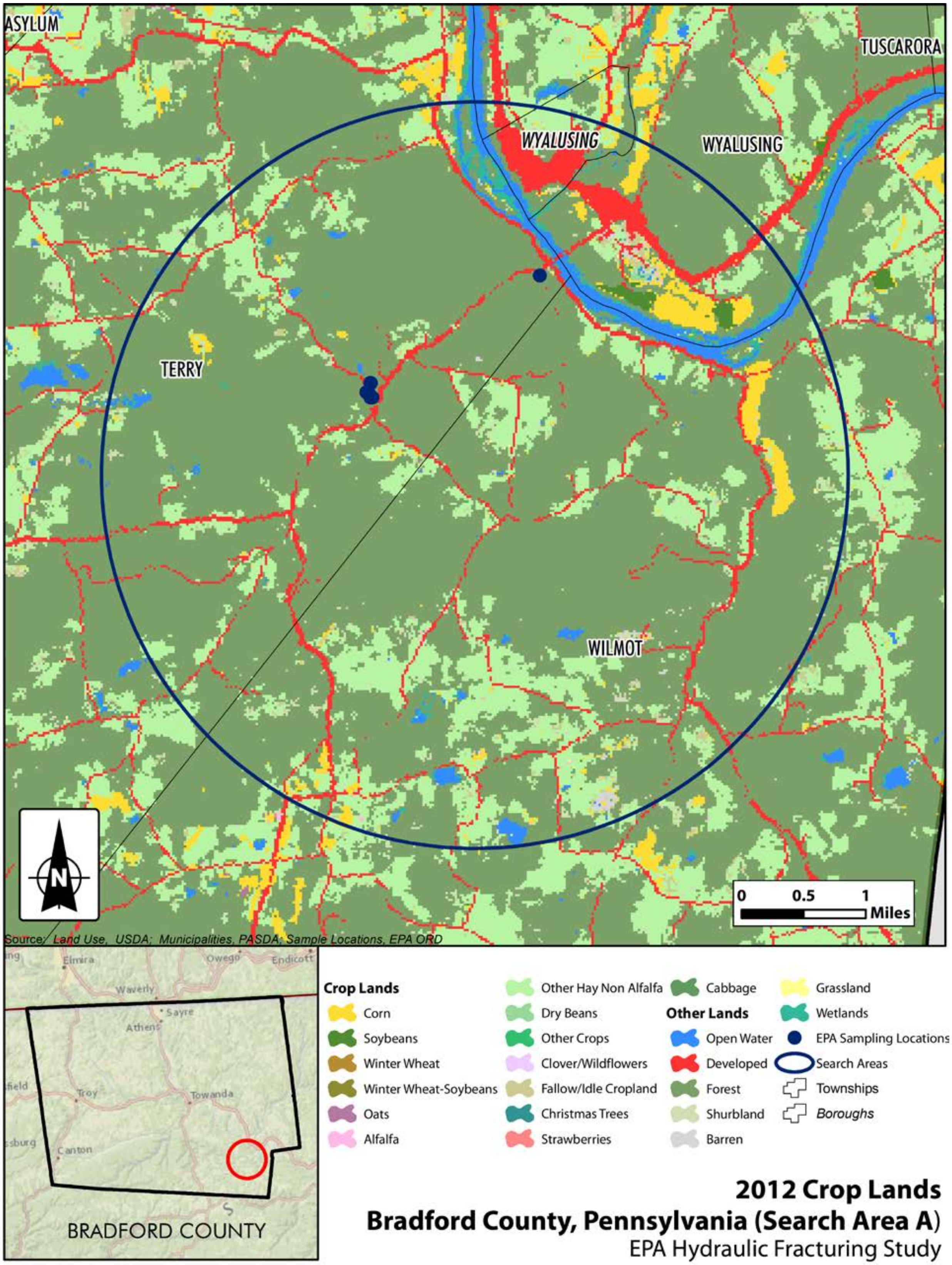


Figure C14 2012 Crop Lands, Bradford County, Site A

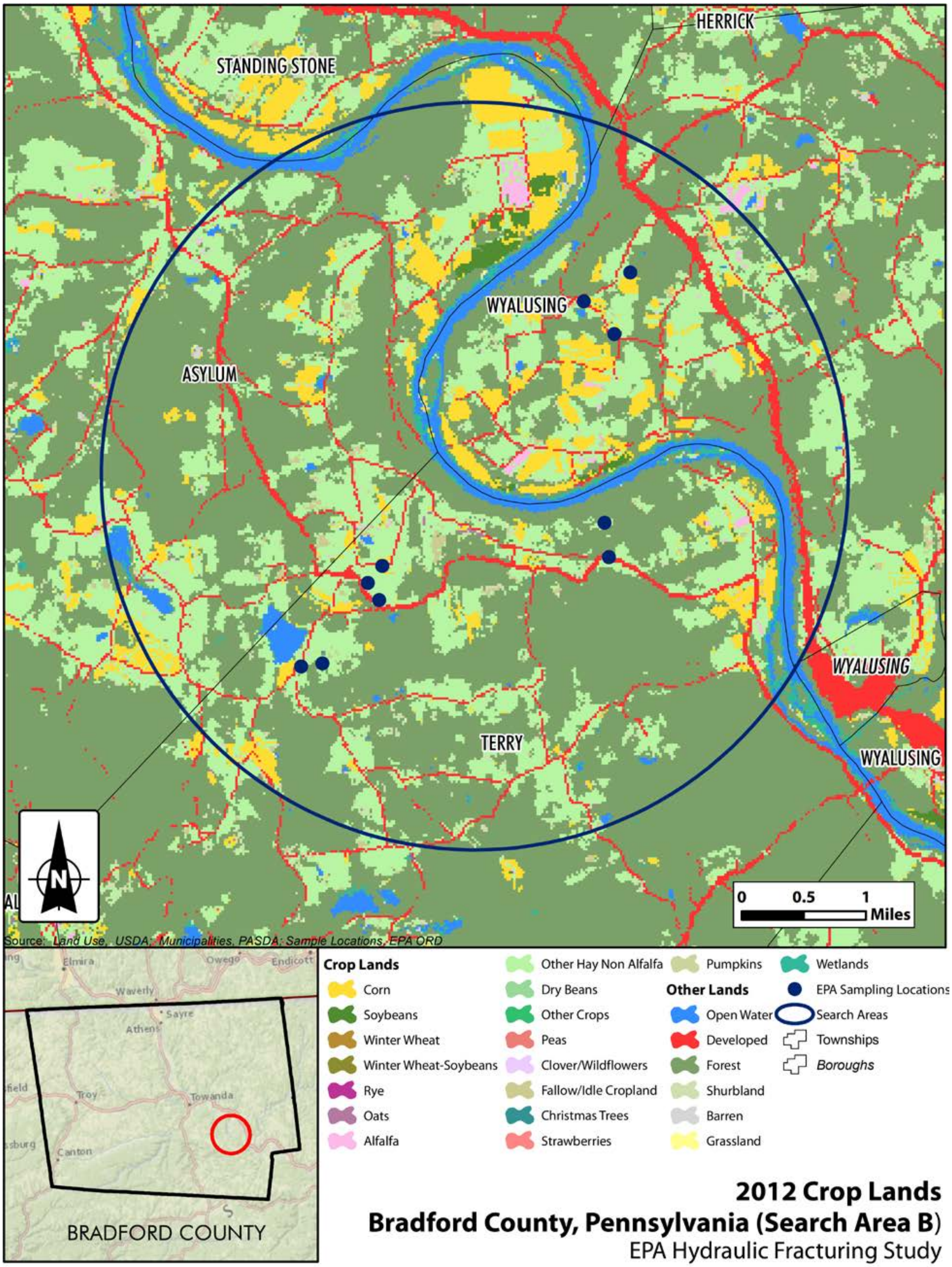


Figure C15 2012 Crop Lands, Bradford County, Site B

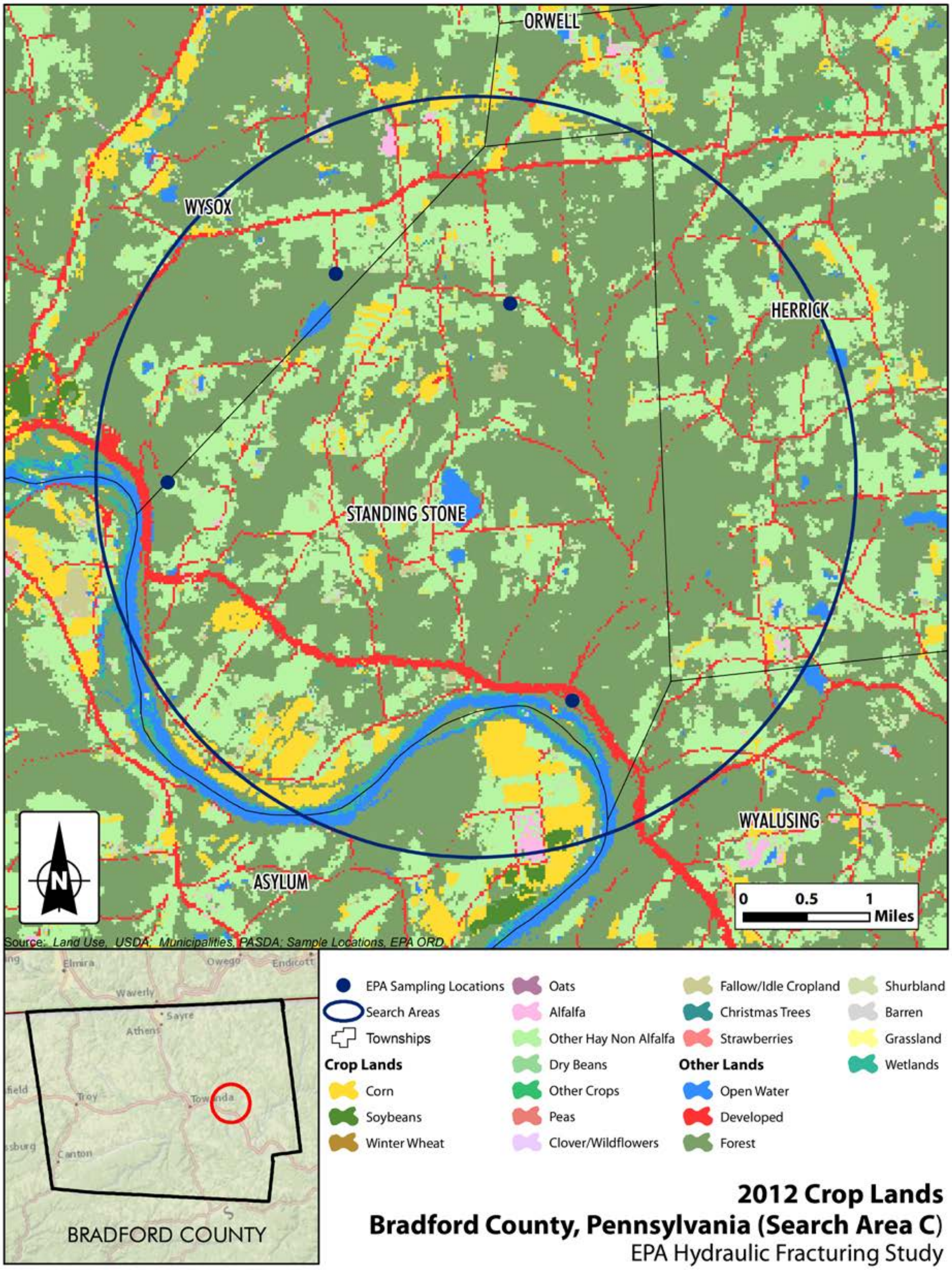


Figure C16 2012 Crop Lands, Bradford County, Site C

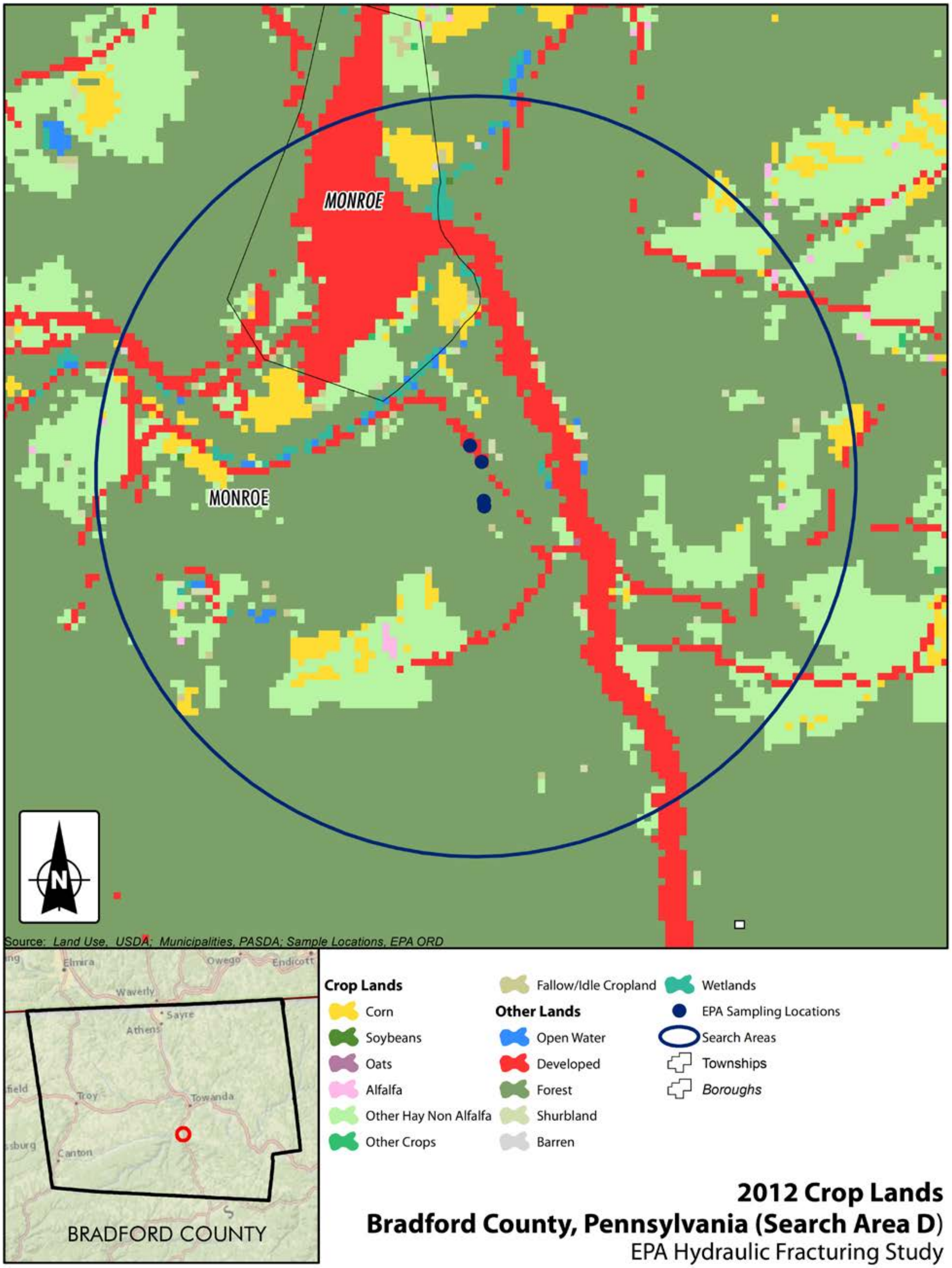


Figure C17 2012 Crop Lands, Bradford County, Site D

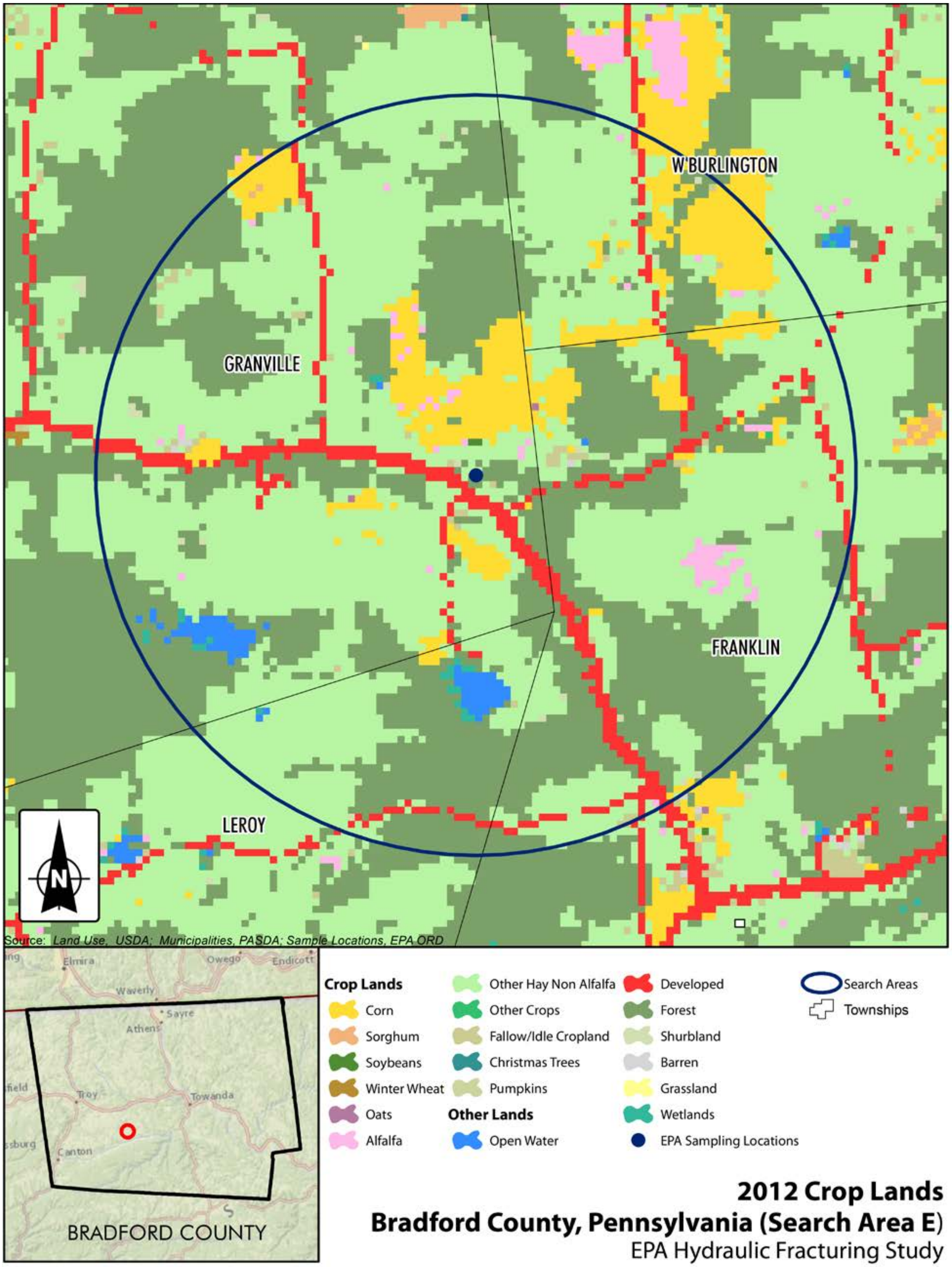


Figure C18 2012 Crop Lands, Bradford County, Site E

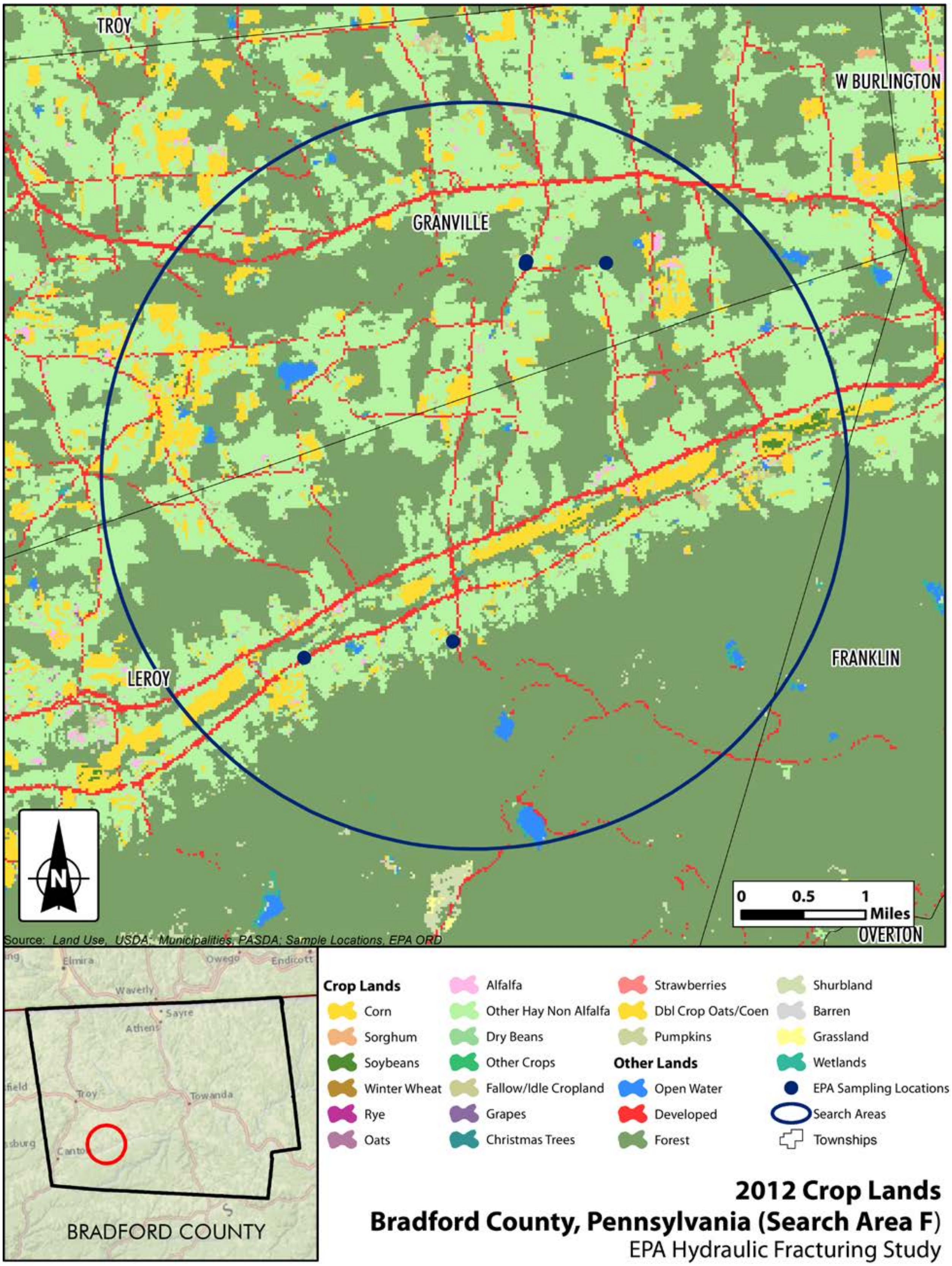


Figure C19 2012 Crop Lands, Bradford County, Site F

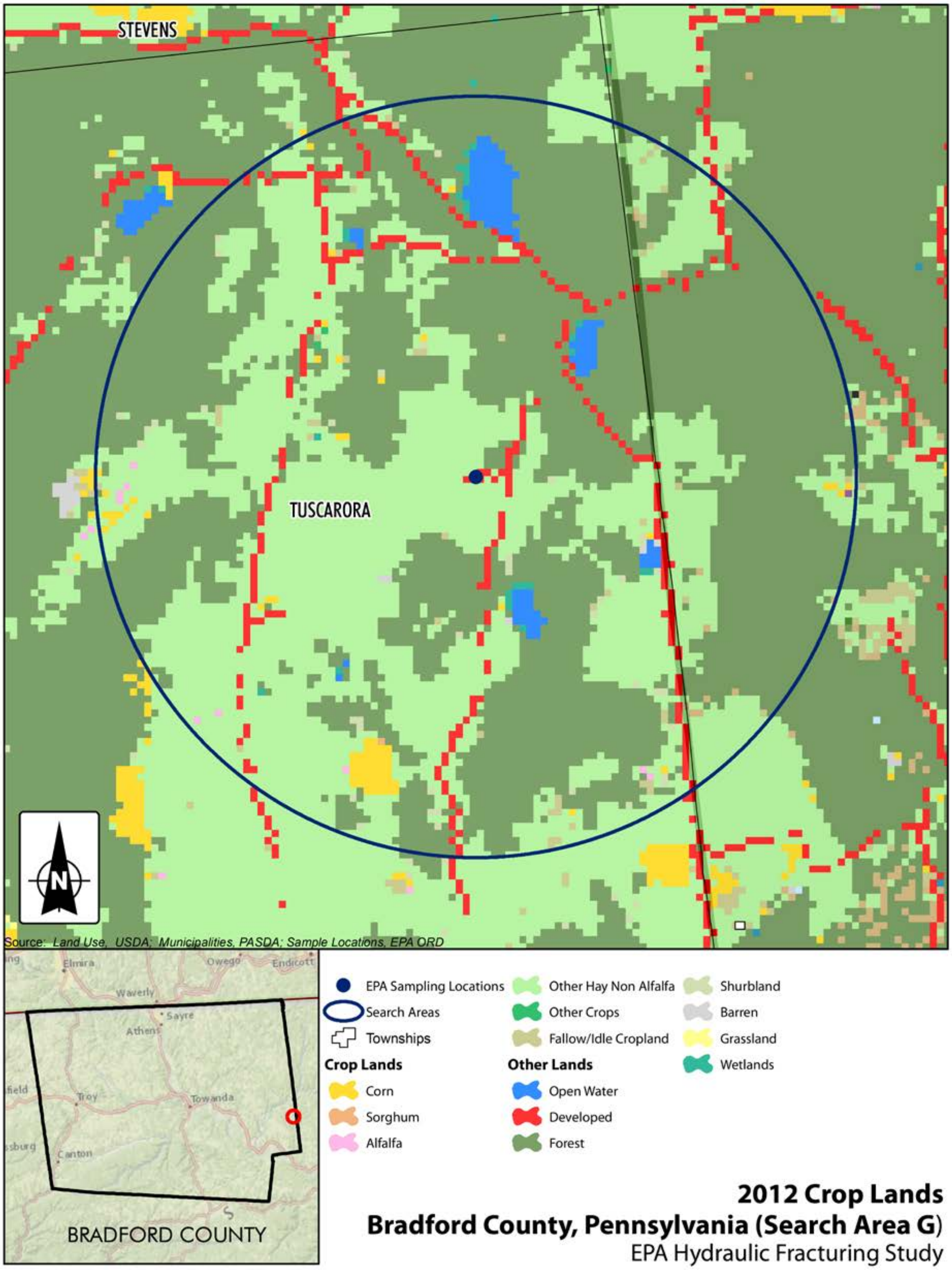


Figure C20 2012 Crop Lands, Bradford County, Site G

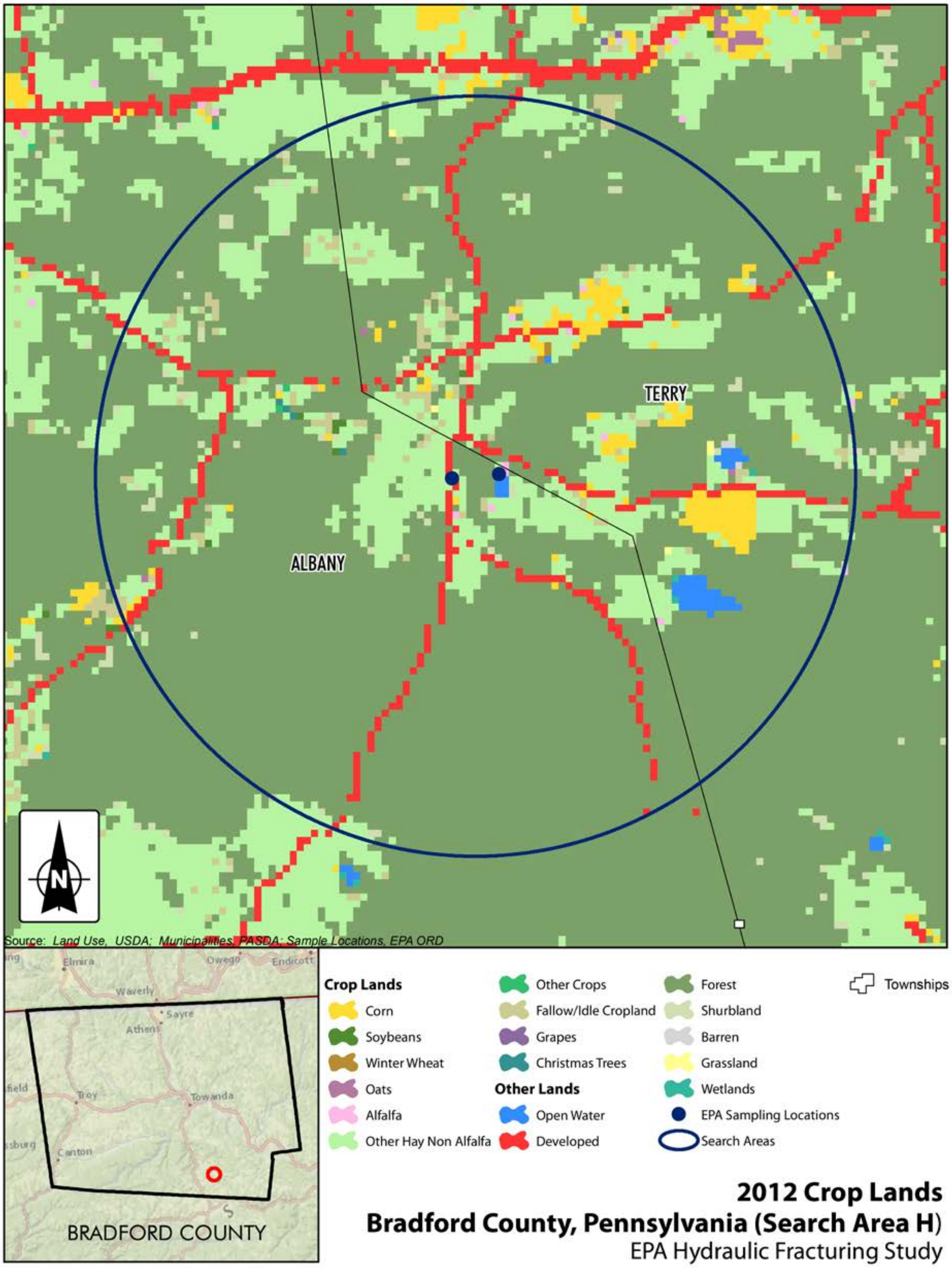


Figure C21 2012 Crop Lands, Bradford County, Site H

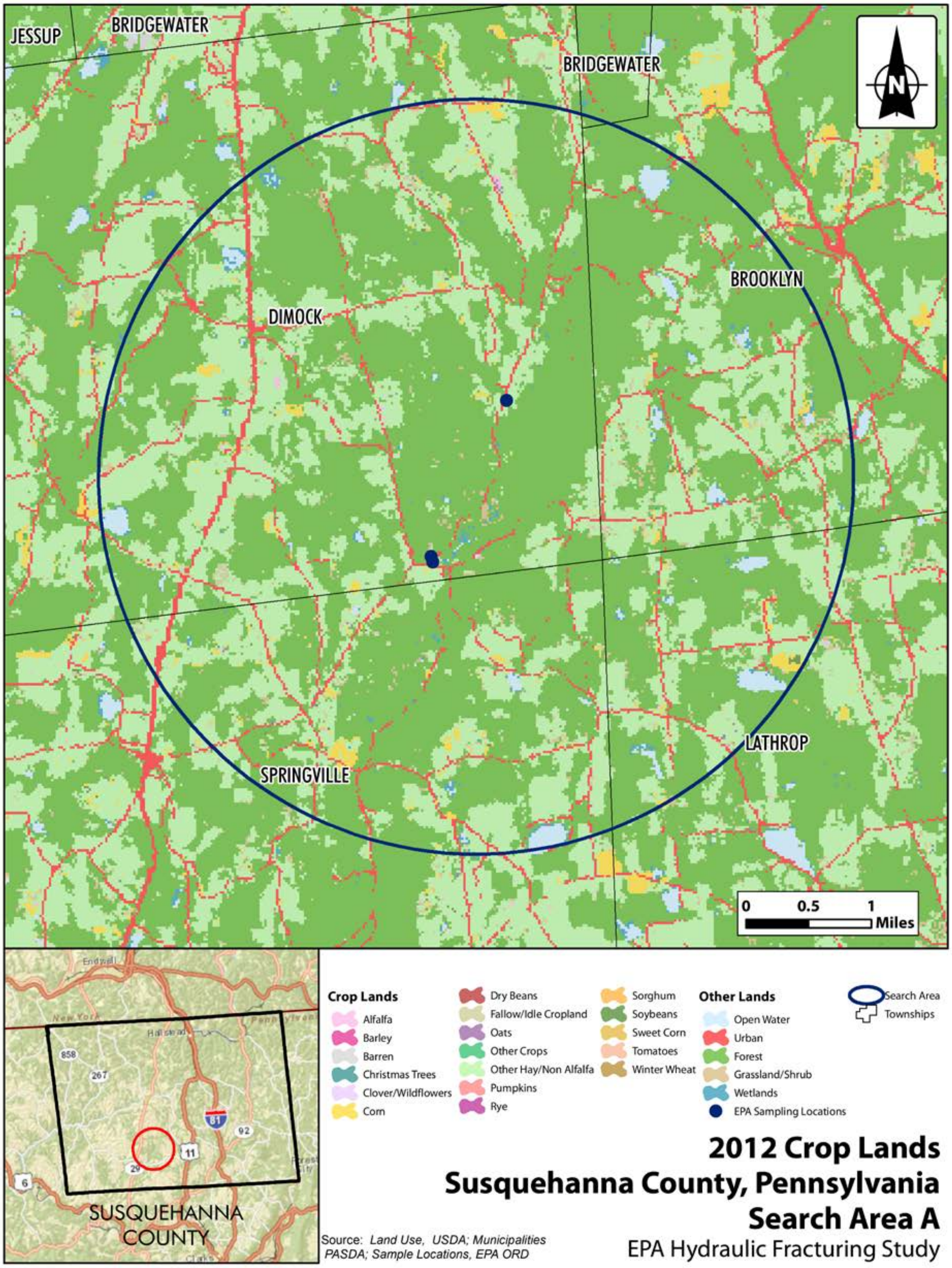


Figure C22 2012 Crop Lands, Susquehanna County, Site A

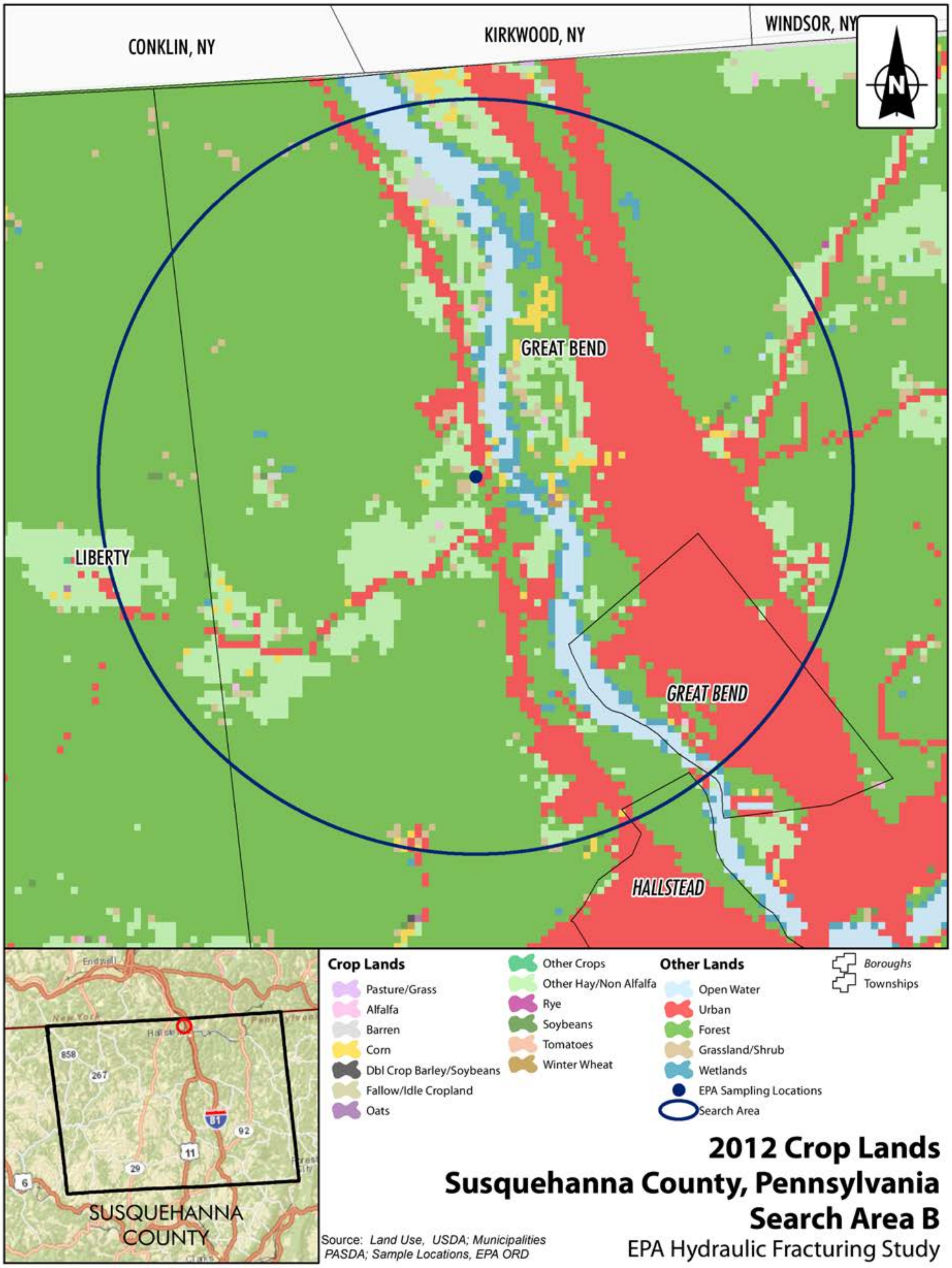


Figure C23 2012 Crop Lands, Susquehanna County, Site B

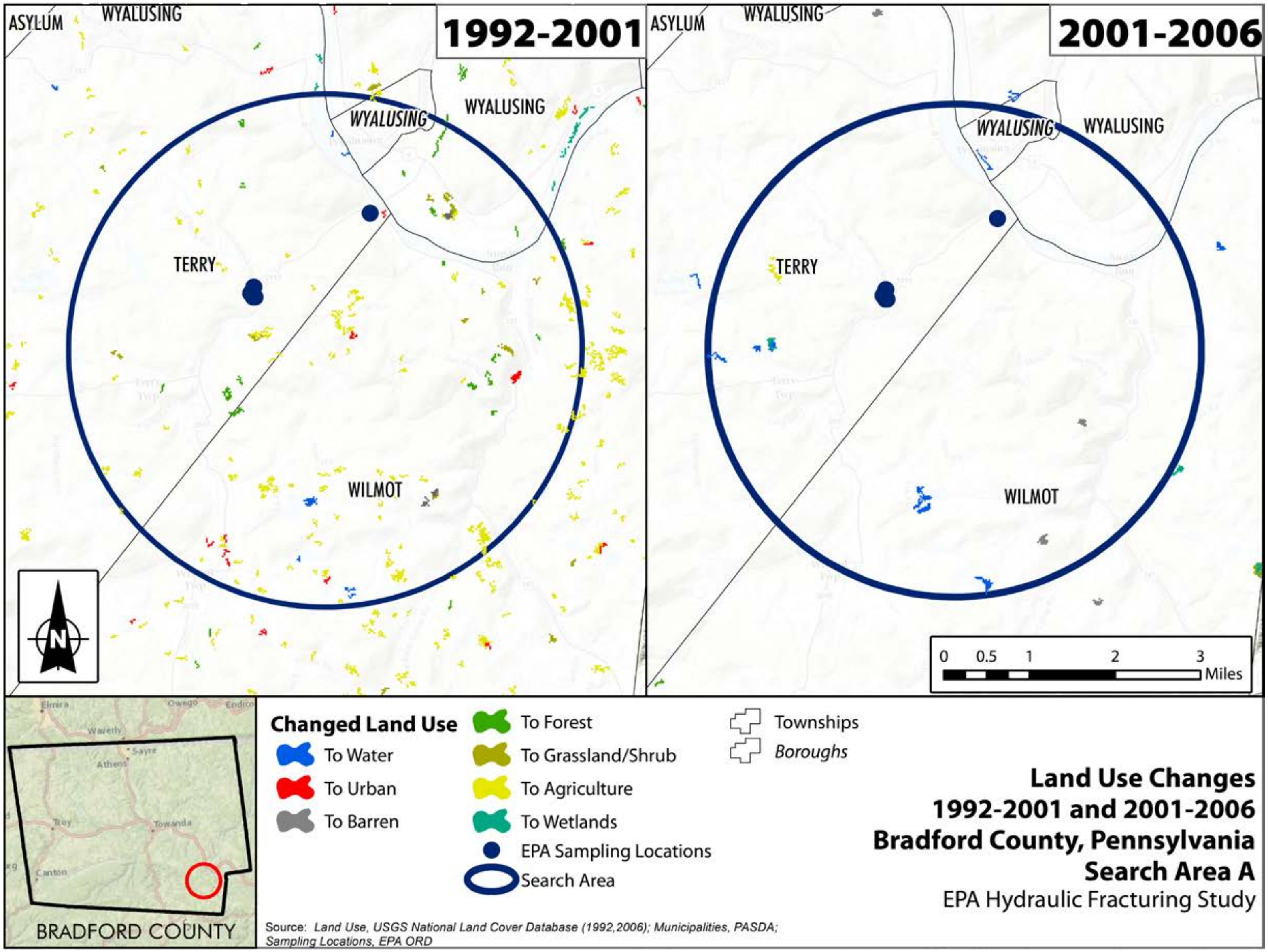


Figure C24 Land Use Changes 1992-2001 and 2001-2006, Bradford County, Site A

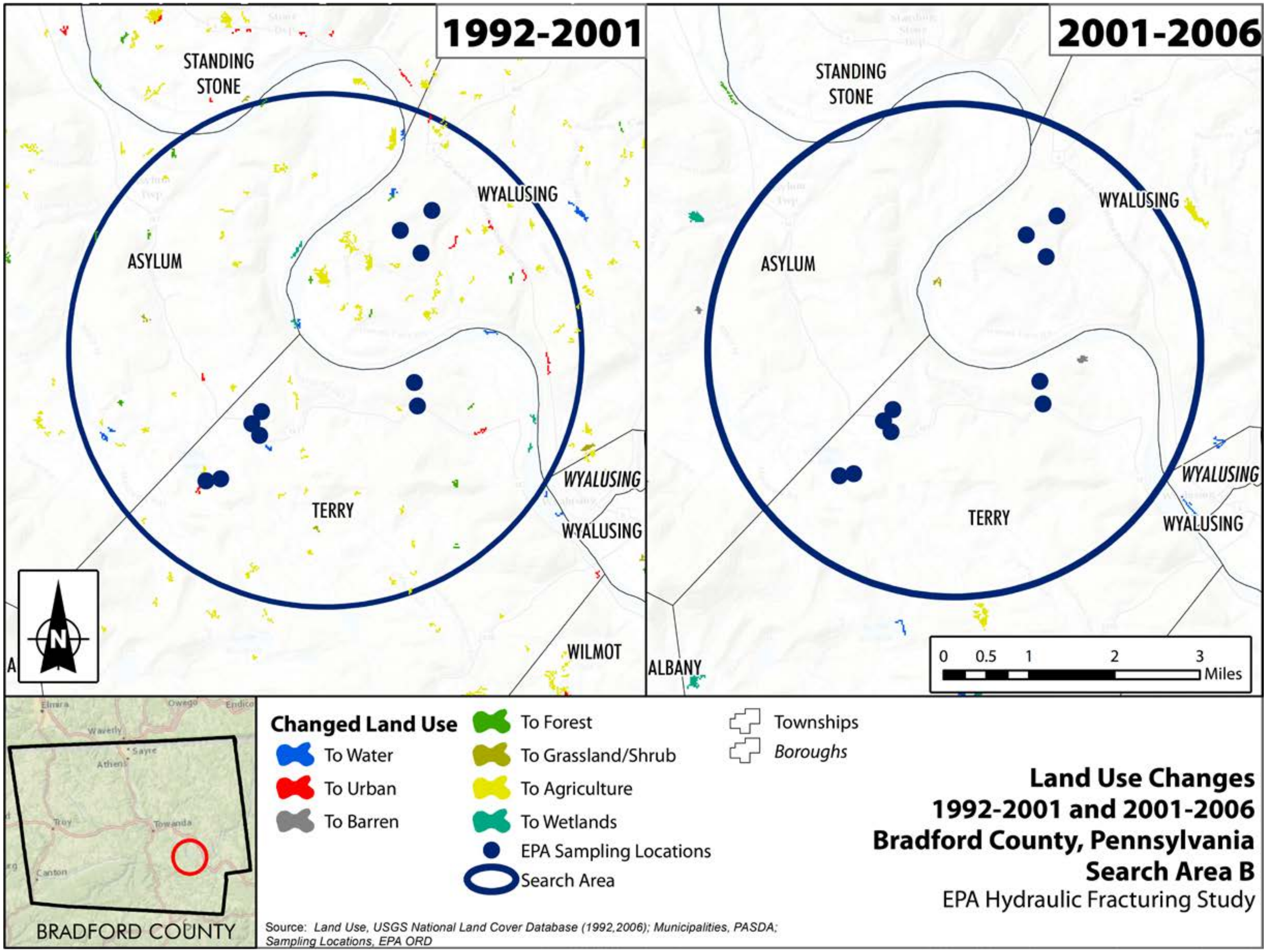


Figure C25 Land Use Changes 1992-2001 and 2001-2006, Bradford County, Site B

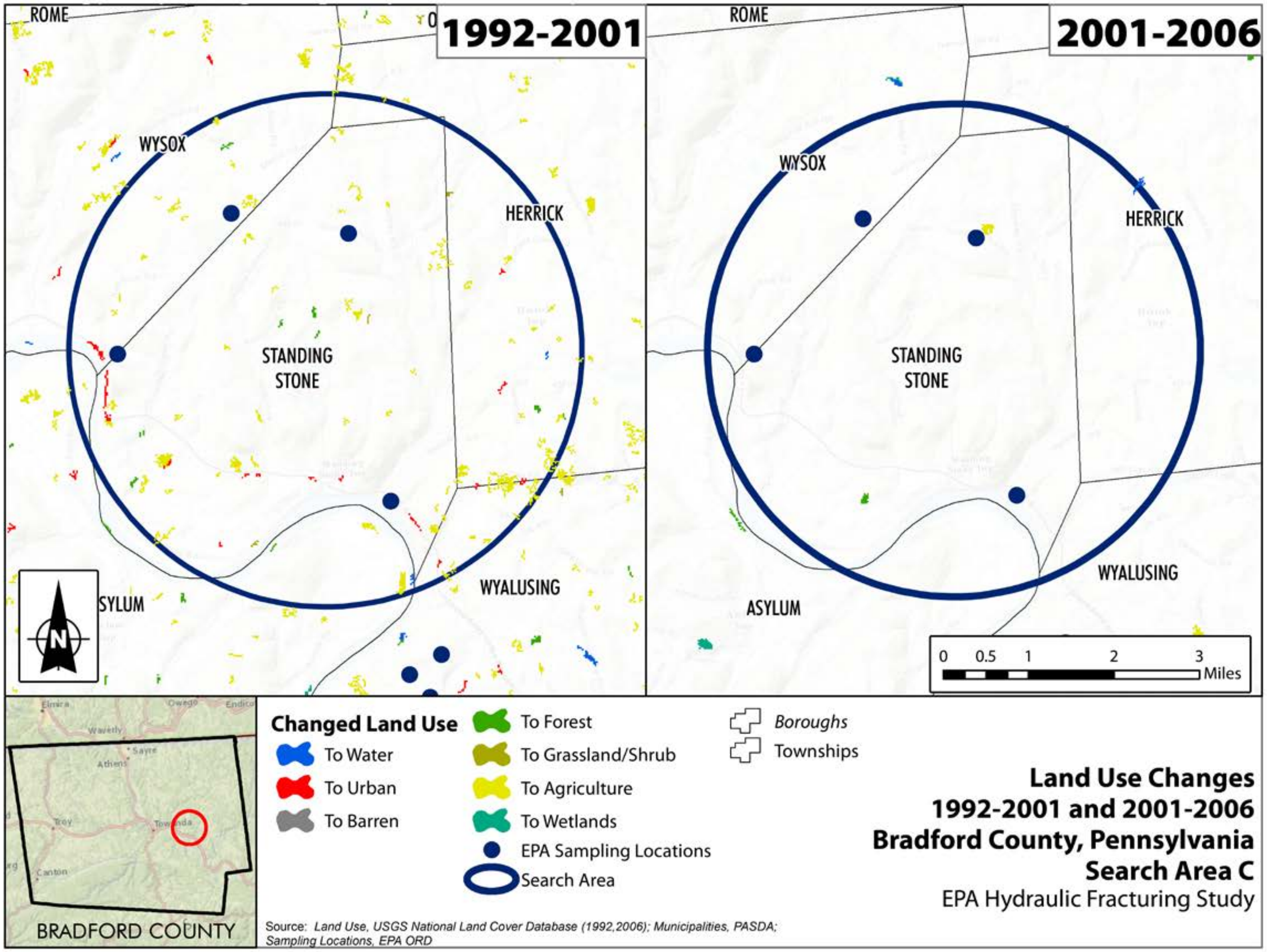


Figure C26 Land Use Changes 1992-2001 and 2001-2006, Bradford County, Site C

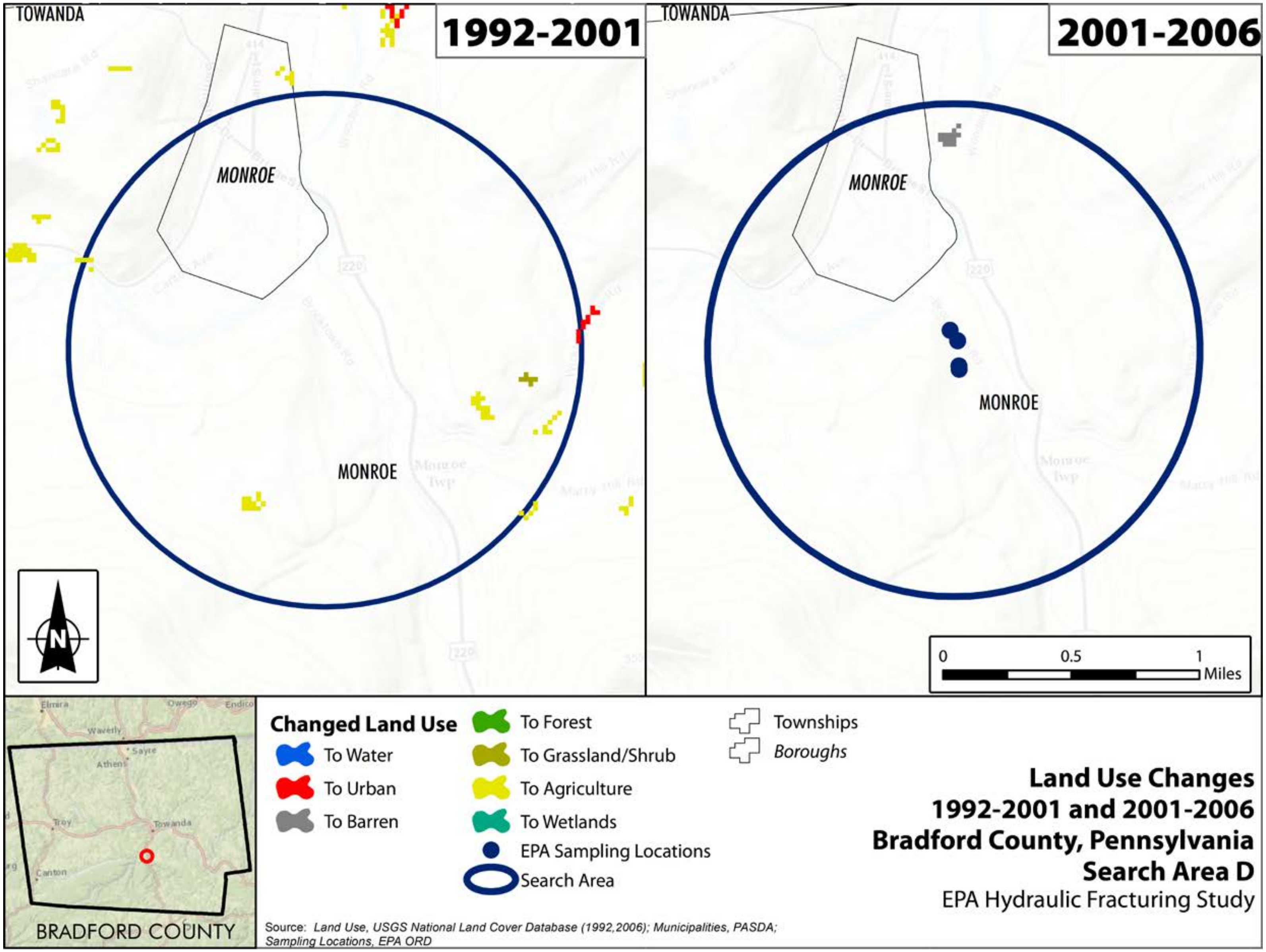


Figure C27 Land Use Changes 1992-2001 and 2001-2006, Bradford County, Site D

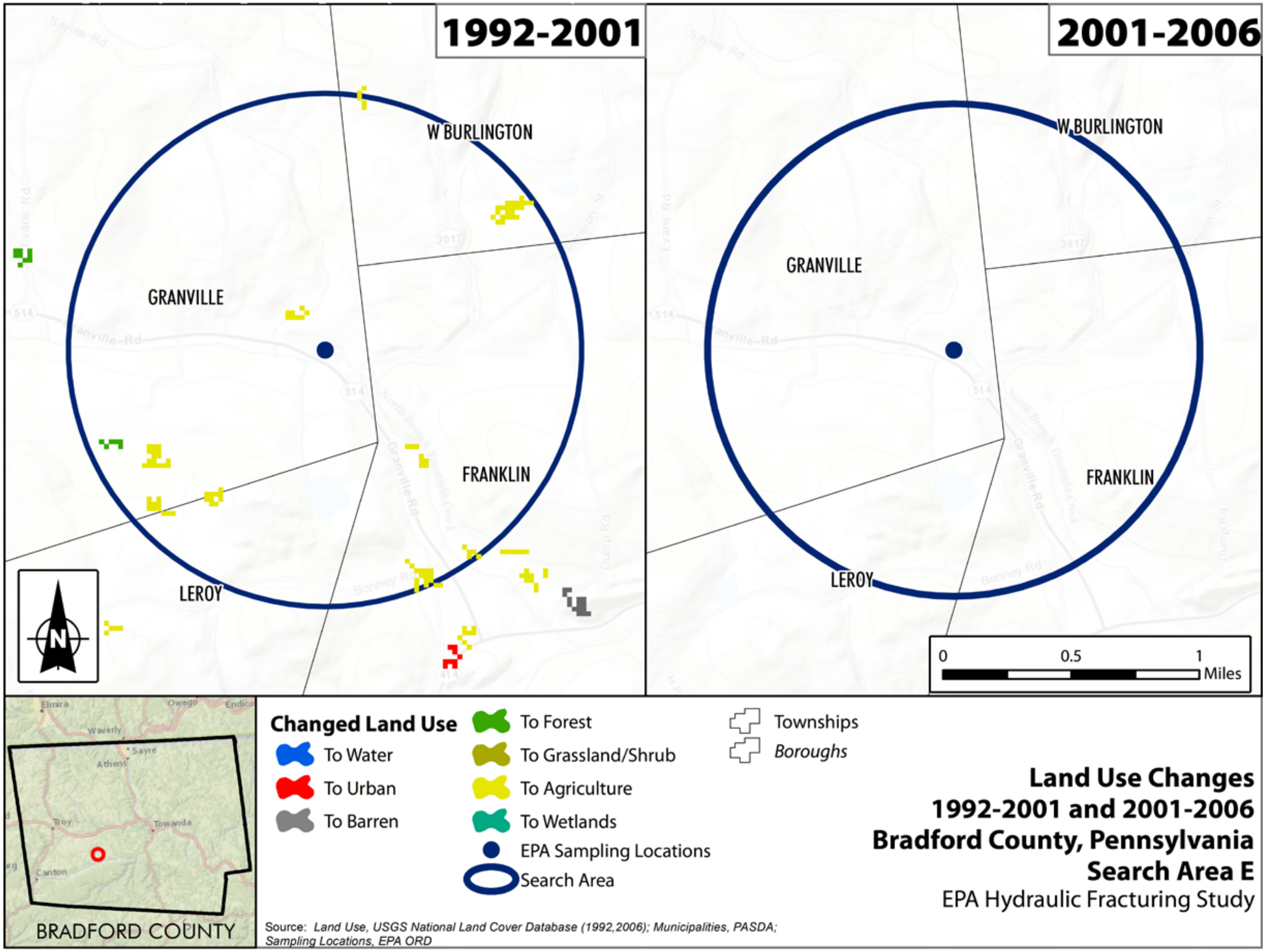


Figure C28 Land Use Changes 1992-2001 and 2001-2006, Bradford County, Site E

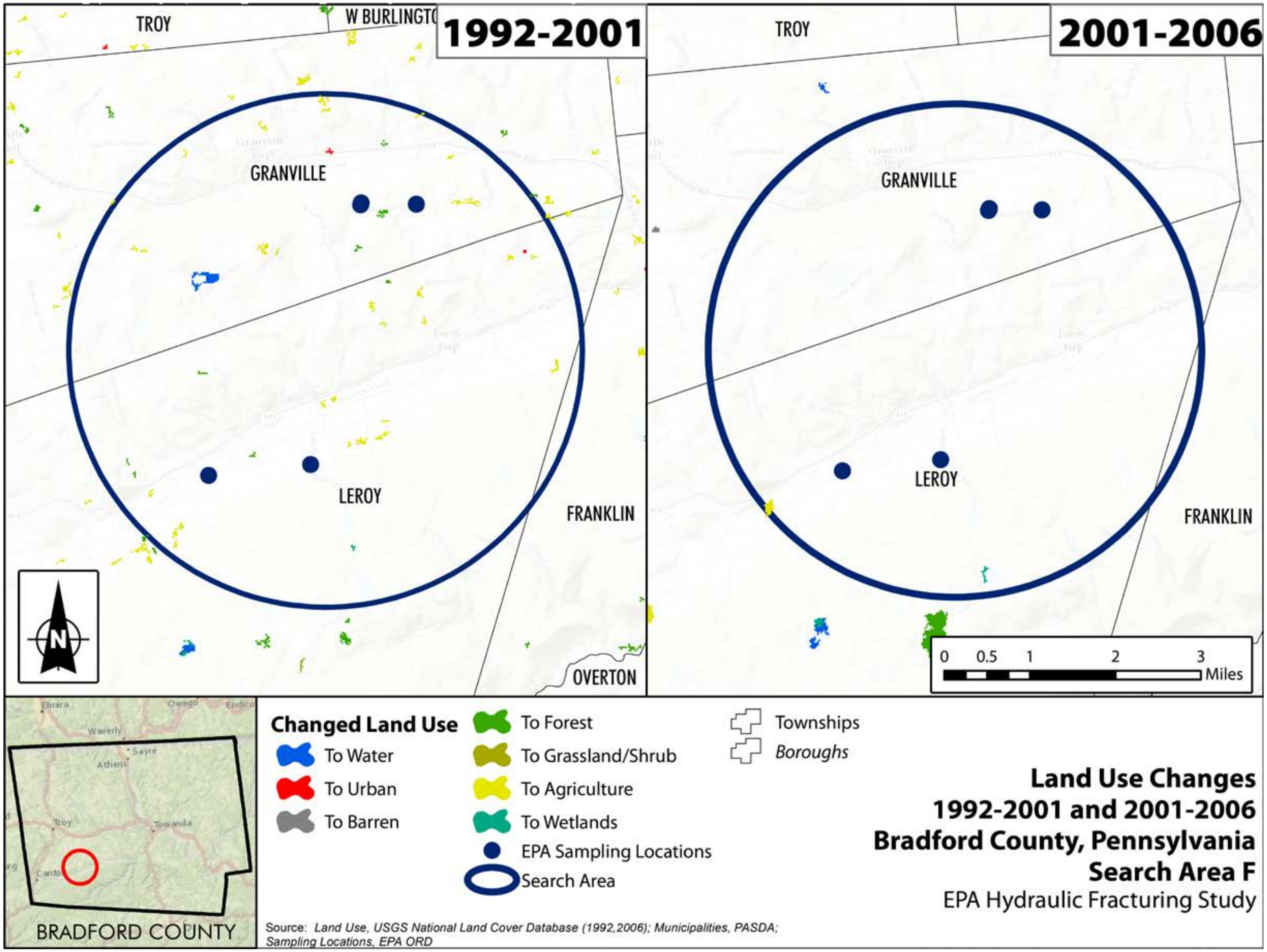


Figure C29 Land Use Changes 1992-2001 and 2001-2006, Bradford County, Site F

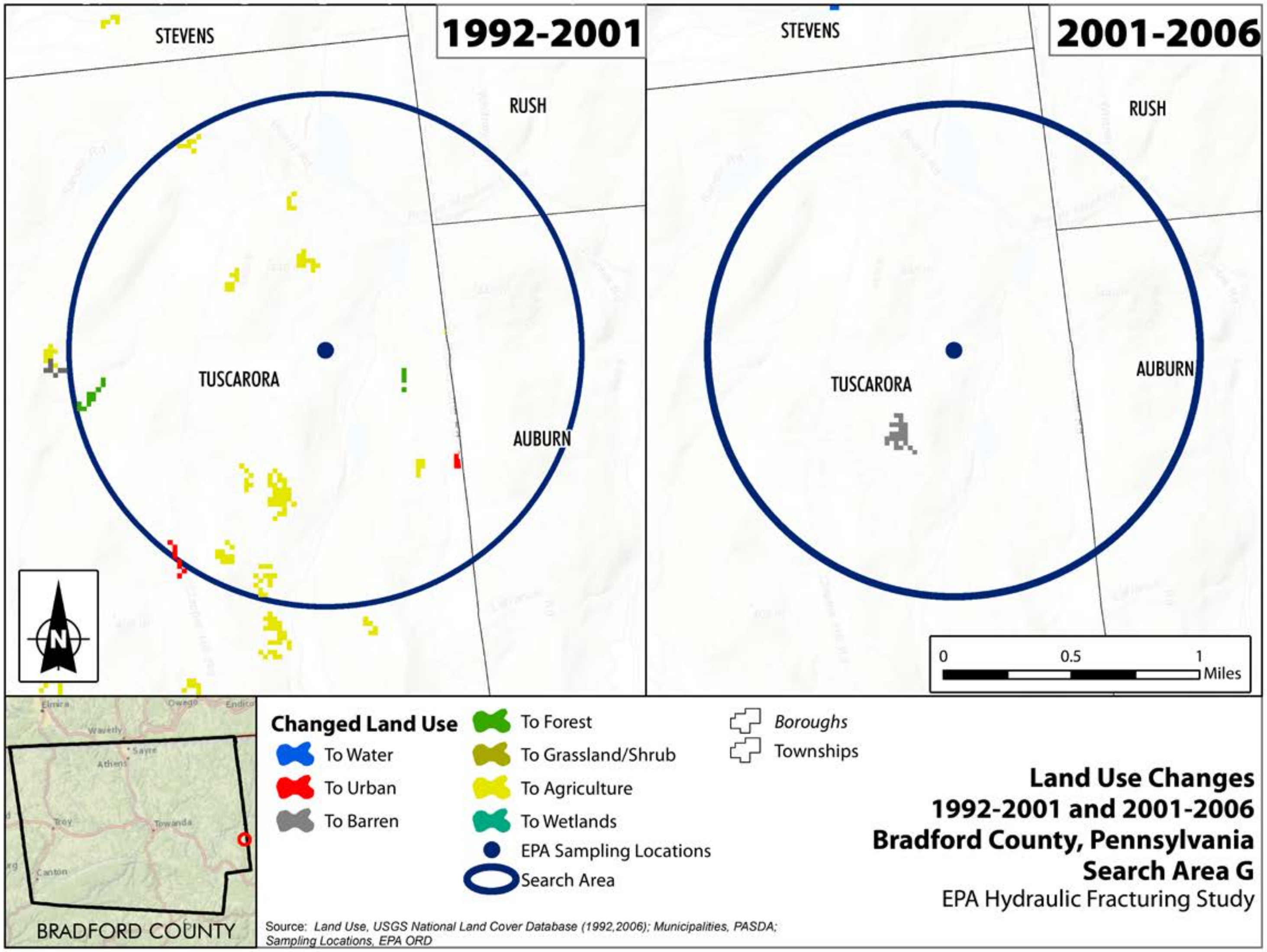


Figure C30 Land Use Changes 1992-2001 and 2001-2006, Bradford County, Site G

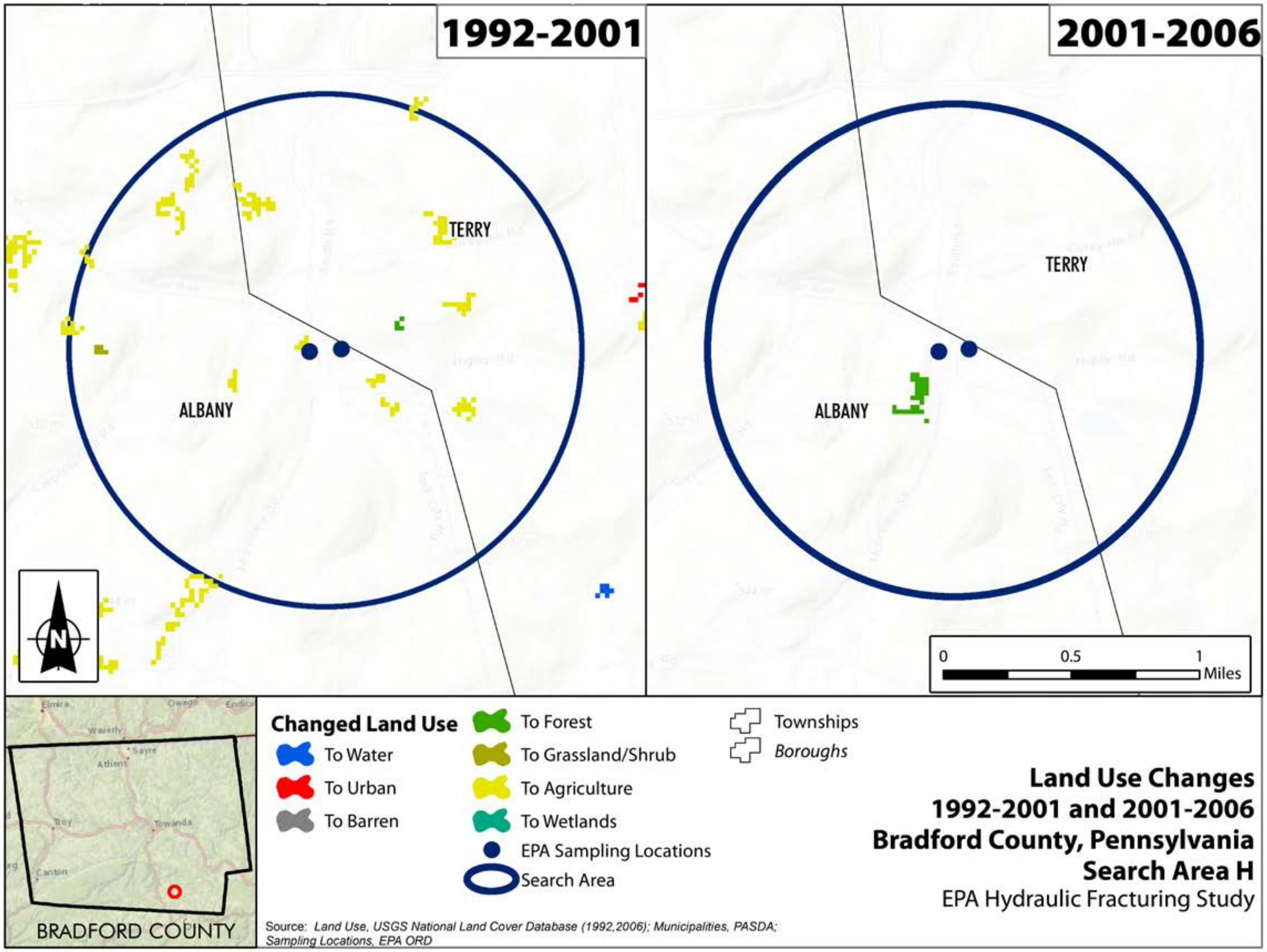


Figure C31 Land Use Changes 1992-2001 and 2001-2006, Bradford County, Site H

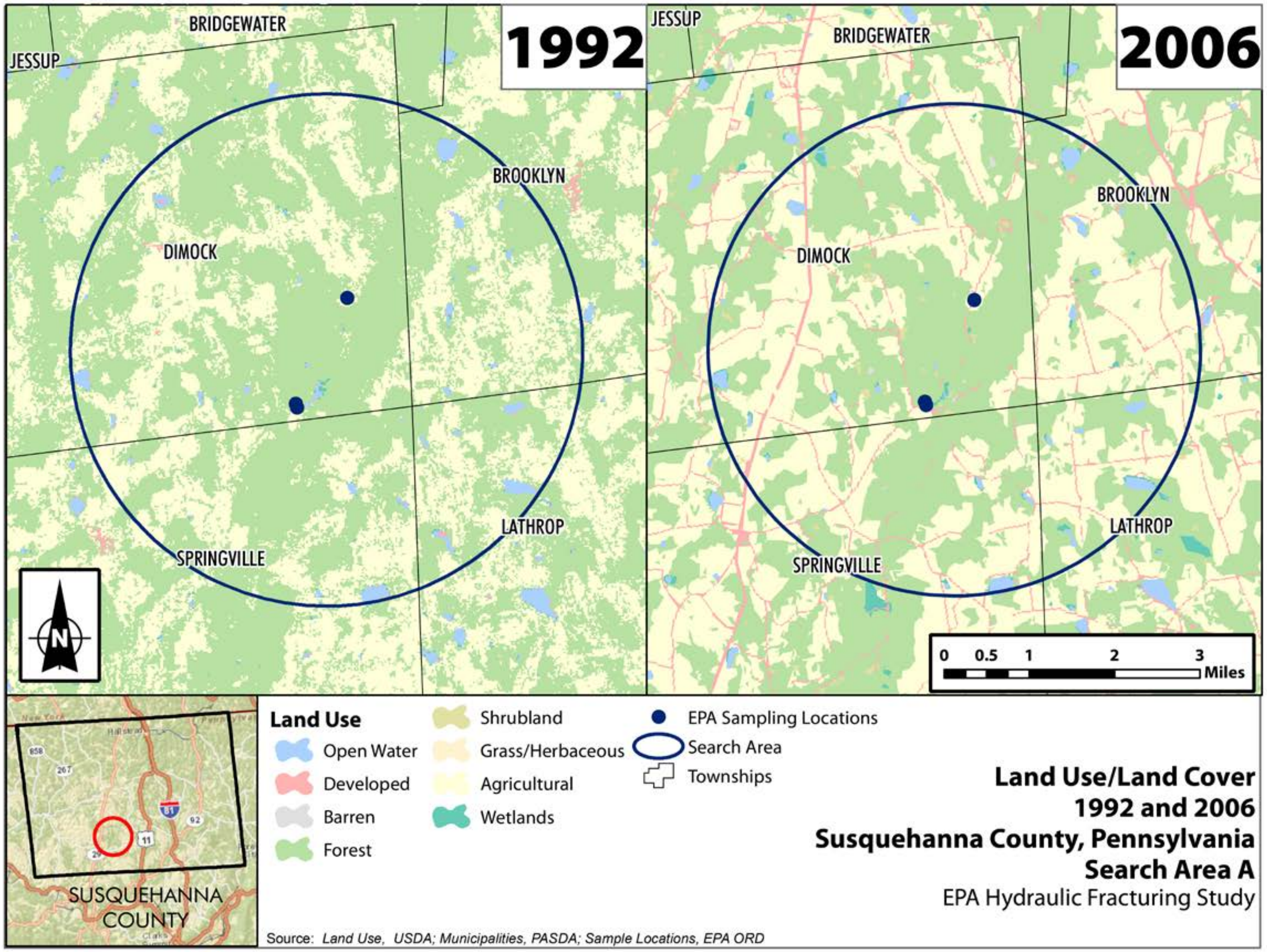


Figure C32 Land Use Changes 1992-2001 and 2001-2006, Susquehanna County, Site A

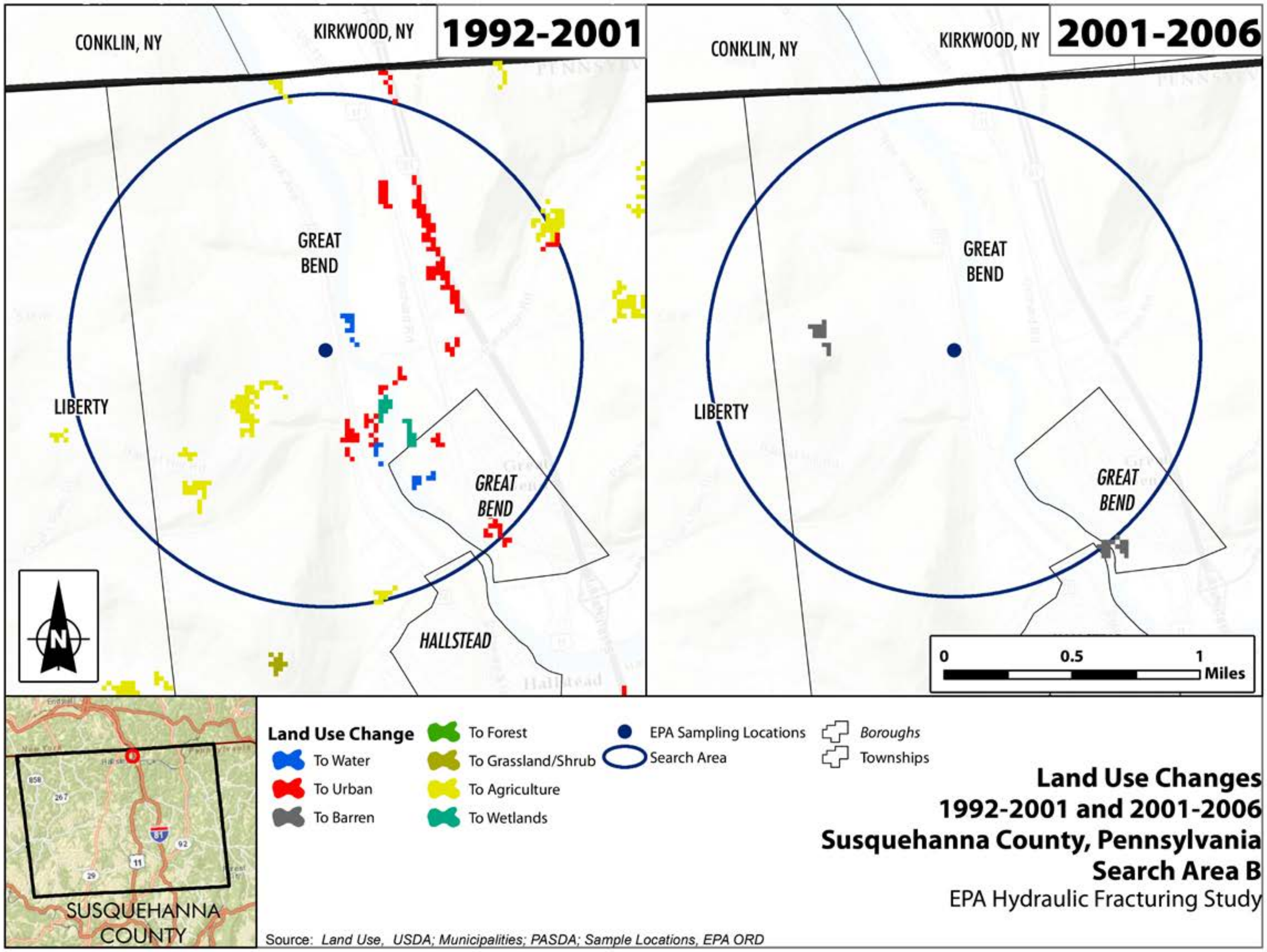


Figure C33 Land Use Changes 1992-2001 and 2001-2006, Susquehanna County, Site B

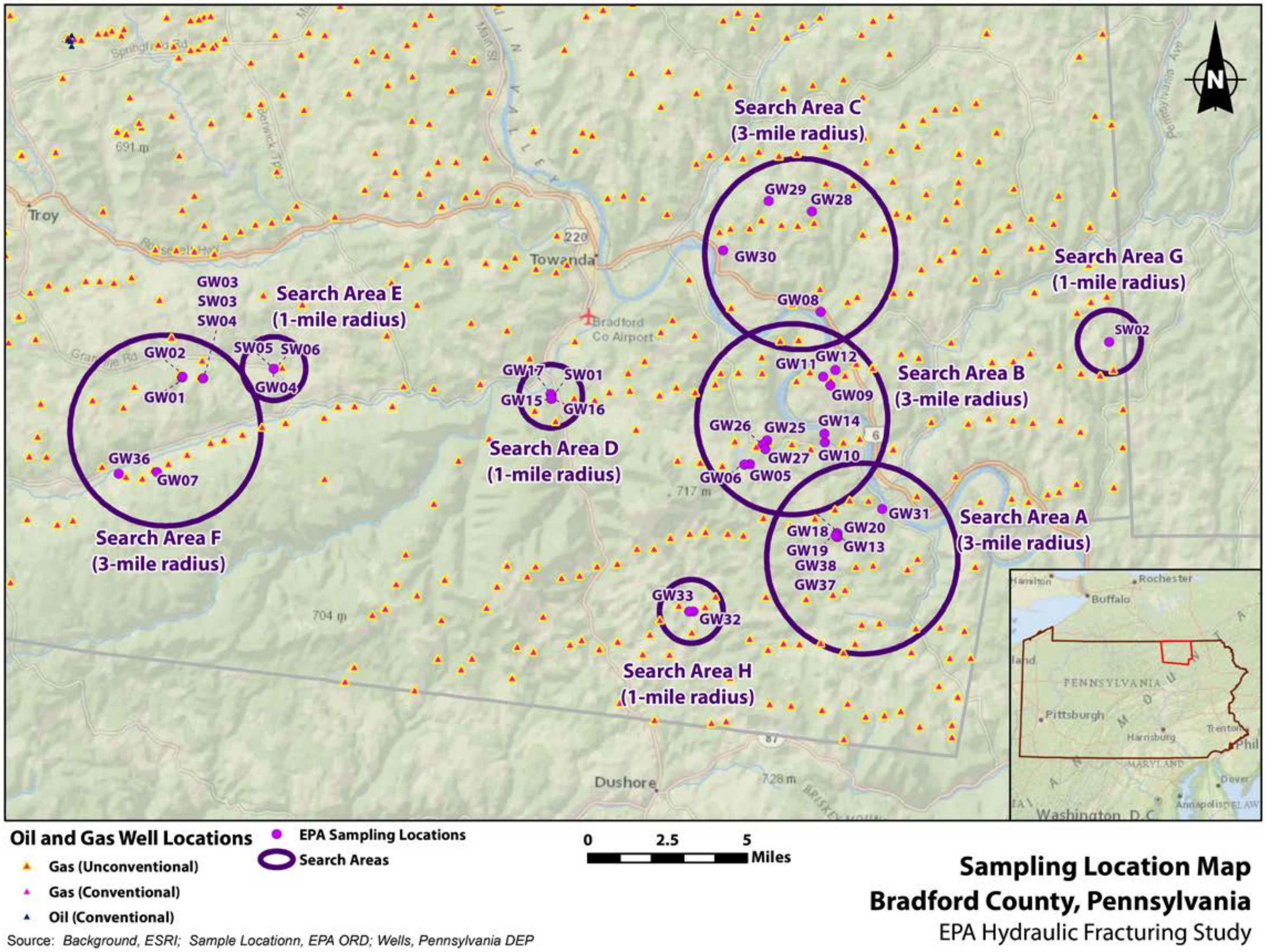


Figure C34a **Sampling Location Map, Bradford County**

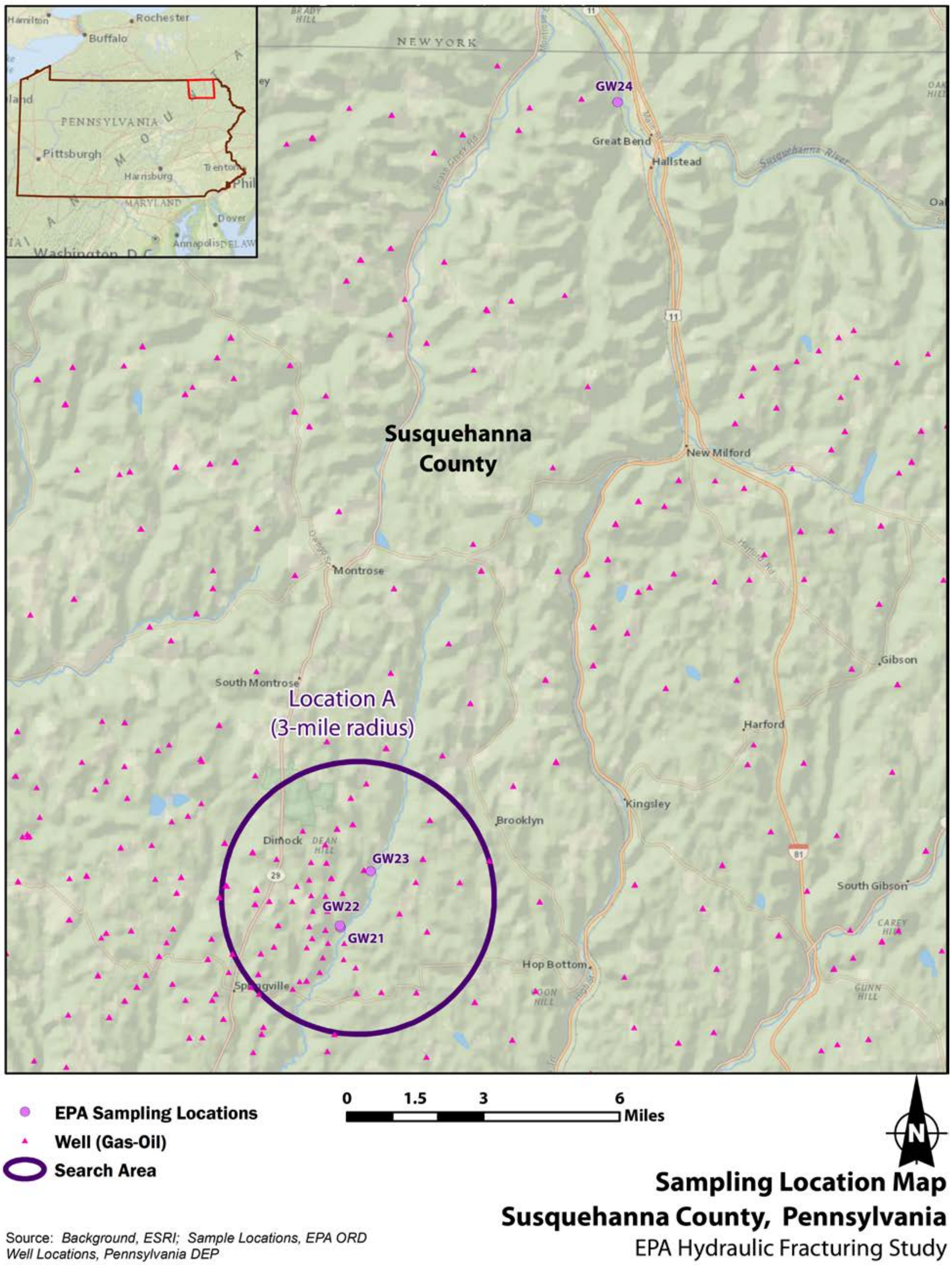


Figure C34b Sampling Location Map, Susquehanna County

Attachment 1 EDR Record Search

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 12

Source: EPA
Telephone: N/A
Last EDR Contact: 05/09/2013
Next Scheduled EDR Contact: 07/22/2013
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 12

Source: EPA
Telephone: N/A
Last EDR Contact: 05/09/2013
Next Scheduled EDR Contact: 07/22/2013
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 12

Source: EPA
Telephone: N/A
Last EDR Contact: 05/09/2013
Next Scheduled EDR Contact: 07/22/2013
Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 02/04/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 12

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 04/05/2013
Next Scheduled EDR Contact: 06/10/2013
Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 10/09/2012
Date Made Active in Reports: 12/20/2012
Number of Days to Update: 72

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 04/10/2013
Next Scheduled EDR Contact: 07/22/2013
Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 02/05/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 12

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 04/05/2013
Next Scheduled EDR Contact: 03/11/2013
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 02/12/2013	Source: EPA
Date Data Arrived at EDR: 02/21/2013	Telephone: 800-424-9346
Date Made Active in Reports: 02/27/2013	Last EDR Contact: 05/02/2013
Number of Days to Update: 6	Next Scheduled EDR Contact: 07/15/2013
	Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 02/12/2013	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/15/2013	Telephone: 800-438-2474
Date Made Active in Reports: 02/27/2013	Last EDR Contact: 05/02/2013
Number of Days to Update: 12	Next Scheduled EDR Contact: 07/15/2013
	Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/12/2013	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/15/2013	Telephone: 800-438-2474
Date Made Active in Reports: 02/27/2013	Last EDR Contact: 05/02/2013
Number of Days to Update: 12	Next Scheduled EDR Contact: 07/15/2013
	Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 02/12/2013	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/15/2013	Telephone: 800-438-2474
Date Made Active in Reports: 02/27/2013	Last EDR Contact: 05/02/2013
Number of Days to Update: 12	Next Scheduled EDR Contact: 07/15/2013
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/12/2013	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/15/2013	Telephone: 800-438-2474
Date Made Active in Reports: 02/27/2013	Last EDR Contact: 05/02/2013
Number of Days to Update: 12	Next Scheduled EDR Contact: 07/15/2013
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 12/19/2012
Date Data Arrived at EDR: 12/26/2012
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 03/11/2013
Next Scheduled EDR Contact: 06/24/2013
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 12/19/2012
Date Data Arrived at EDR: 12/26/2012
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 03/11/2013
Next Scheduled EDR Contact: 06/24/2013
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005
Date Data Arrived at EDR: 12/11/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 31

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 02/18/2013
Next Scheduled EDR Contact: 06/03/2013
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 01/17/2013
Date Made Active in Reports: 02/15/2013
Number of Days to Update: 29

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 04/02/2013
Next Scheduled EDR Contact: 07/15/2013
Data Release Frequency: Annually

State- and tribal - equivalent NPL

SHWS: Hazardous Sites Cleanup Act Site List

The Hazardous Sites Cleanup Act Site List includes sites listed on PA Priority List, sites delisted from PA Priority List, Interim Response Completed sites, and Sites Being Studied or Response Being Planned.

Date of Government Version: 01/08/2013
Date Data Arrived at EDR: 01/24/2013
Date Made Active in Reports: 02/19/2013
Number of Days to Update: 26

Source: Department Environmental Protection
Telephone: 717-783-7816
Last EDR Contact: 04/26/2013
Next Scheduled EDR Contact: 08/05/2013
Data Release Frequency: Semi-Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

HSCA: HSCA Remedial Sites Listing

A list of remedial sites on the PA Priority List. This is the PA state equivalent of the federal NPL superfund list.

Date of Government Version: 12/31/2012	Source: Department of Environmental Protection
Date Data Arrived at EDR: 01/25/2013	Telephone: 717-783-7816
Date Made Active in Reports: 02/19/2013	Last EDR Contact: 04/24/2013
Number of Days to Update: 25	Next Scheduled EDR Contact: 08/05/2013
	Data Release Frequency: Varies

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Operating Facilities

The listing includes Municipal Waste Landfills, Construction/Demolition Waste Landfills and Waste-to-Energy Facilities.

Date of Government Version: 02/26/2013	Source: Department of Environmental Protection
Date Data Arrived at EDR: 02/28/2013	Telephone: 717-787-7564
Date Made Active in Reports: 04/17/2013	Last EDR Contact: 02/26/2013
Number of Days to Update: 48	Next Scheduled EDR Contact: 06/10/2013
	Data Release Frequency: Semi-Annually

State and tribal leaking storage tank lists

LUST: Storage Tank Release Sites

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 03/04/2013	Source: Department of Environmental Protection
Date Data Arrived at EDR: 03/20/2013	Telephone: 717-783-7509
Date Made Active in Reports: 04/18/2013	Last EDR Contact: 05/02/2013
Number of Days to Update: 29	Next Scheduled EDR Contact: 07/01/2013
	Data Release Frequency: Semi-Annually

UNREG LTANKS: Unregulated Tank Cases

Leaking storage tank cases from unregulated storage tanks.

Date of Government Version: 04/12/2002	Source: Department of Environmental Protection
Date Data Arrived at EDR: 08/14/2003	Telephone: 717-783-7509
Date Made Active in Reports: 08/29/2003	Last EDR Contact: 08/14/2003
Number of Days to Update: 15	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

LAST: Storage Tank Release Sites

Leaking Aboveground Storage Tank Incident Reports.

Date of Government Version: 03/04/2013	Source: Department of Environmental Protection
Date Data Arrived at EDR: 03/20/2013	Telephone: 717-783-7509
Date Made Active in Reports: 04/18/2013	Last EDR Contact: 05/02/2013
Number of Days to Update: 29	Next Scheduled EDR Contact: 07/01/2013
	Data Release Frequency: Semi-Annually

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 08/27/2012	Source: EPA Region 8
Date Data Arrived at EDR: 08/28/2012	Telephone: 303-312-6271
Date Made Active in Reports: 10/16/2012	Last EDR Contact: 04/29/2013
Number of Days to Update: 49	Next Scheduled EDR Contact: 08/12/2013
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 02/05/2013
Date Data Arrived at EDR: 02/06/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 65

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Quarterly

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 09/28/2012
Date Data Arrived at EDR: 11/01/2012
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 162

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 05/01/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 02/28/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 43

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 09/12/2011
Date Data Arrived at EDR: 09/13/2011
Date Made Active in Reports: 11/11/2011
Number of Days to Update: 59

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 02/06/2013
Date Data Arrived at EDR: 02/08/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 63

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Semi-Annually

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 03/01/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Quarterly

State and tribal registered storage tank lists

UST: Listing of Pennsylvania Regulated Underground Storage Tanks
Registered Underground Storage Tanks. UST’s are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 03/01/2013
Date Data Arrived at EDR: 03/21/2013
Date Made Active in Reports: 04/17/2013
Number of Days to Update: 27

Source: Department of Environmental Protection
Telephone: 717-772-5599
Last EDR Contact: 05/02/2013
Next Scheduled EDR Contact: 07/01/2013
Data Release Frequency: Varies

AST: Listing of Pennsylvania Regulated Aboveground Storage Tanks
Registered Aboveground Storage Tanks.

Date of Government Version: 03/01/2013
Date Data Arrived at EDR: 03/21/2013
Date Made Active in Reports: 04/17/2013
Number of Days to Update: 27

Source: Department of Environmental Protection
Telephone: 717-772-5599
Last EDR Contact: 05/02/2013
Next Scheduled EDR Contact: 07/01/2013
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 02/06/2013
Date Data Arrived at EDR: 02/08/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 63

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 02/28/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 43

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 08/02/2012
Date Data Arrived at EDR: 08/03/2012
Date Made Active in Reports: 11/05/2012
Number of Days to Update: 94

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/10/2011
Date Data Arrived at EDR: 05/11/2011
Date Made Active in Reports: 06/14/2011
Number of Days to Update: 34

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Semi-Annually

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 09/28/2012
Date Data Arrived at EDR: 11/07/2012
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 156

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 02/05/2013
Date Data Arrived at EDR: 02/06/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 65

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 02/21/2013
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 45

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 08/27/2012
Date Data Arrived at EDR: 08/28/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 49

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Quarterly

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 04/18/2013
Next Scheduled EDR Contact: 07/29/2013
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

ENG CONTROLS: Engineering Controls Site Listing

Under the Land Recycling Act (Act 2) persons who perform a site cleanup using the site-specific standard or the special industrial area standard may use engineering or institutional controls as part of the response action. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 05/15/2008
Date Data Arrived at EDR: 05/16/2008
Date Made Active in Reports: 06/12/2008
Number of Days to Update: 27

Source: Department of Environmental Protection
Telephone: 717-783-9470
Last EDR Contact: 04/24/2013
Next Scheduled EDR Contact: 08/05/2013
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

AUL: Environmental Covenants Listing
A listing of sites with environmental covenants.

Date of Government Version: 01/22/2013
Date Data Arrived at EDR: 01/24/2013
Date Made Active in Reports: 02/19/2013
Number of Days to Update: 26

Source: Department of Environmental Protection
Telephone: 717-783-7509
Last EDR Contact: 04/23/2013
Next Scheduled EDR Contact: 08/05/2013
Data Release Frequency: Varies

INST CONTROL: Institutional Controls Site Listing
Under the Land Recycling Act (Act 2) persons who perform a site cleanup using the site-specific standard or the special industrial area standard may use engineering or institutional controls as part of the response action. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 05/15/2008
Date Data Arrived at EDR: 05/16/2008
Date Made Active in Reports: 06/12/2008
Number of Days to Update: 27

Source: Department of Environmental Protection
Telephone: 717-783-9470
Last EDR Contact: 04/24/2013
Next Scheduled EDR Contact: 08/05/2013
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/28/2012
Date Data Arrived at EDR: 10/02/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 14

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 04/05/2013
Next Scheduled EDR Contact: 07/15/2013
Data Release Frequency: Varies

VCP: Voluntary Cleanup Program Sites
The VCP listings included Completed Sites, Sites in Progress and Act 2 Non-Use Aquifer Determinations Sites. Formerly known as the Act 2, the Land Recycling Program encourages the voluntary cleanup and reuse of contaminated commercial and industrial sites.

Date of Government Version: 01/15/2013
Date Data Arrived at EDR: 01/16/2013
Date Made Active in Reports: 02/19/2013
Number of Days to Update: 34

Source: Department of Environmental Protection
Telephone: 717-783-2388
Last EDR Contact: 04/17/2013
Next Scheduled EDR Contact: 07/29/2013
Data Release Frequency: Semi-Annually

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Sites
Brownfields are generally defined as abandoned or underused industrial or commercial properties where redevelopment is complicated by actual or perceived environmental contamination. Brownfields vary in size, location, age and past use. They can range from a small, abandoned corner gas station to a large, multi-acre former manufacturing plant that has been closed for years.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 02/19/2013
Date Data Arrived at EDR: 02/21/2013
Date Made Active in Reports: 04/17/2013
Number of Days to Update: 55

Source: Department of Environmental Protection
Telephone: 717-783-1566
Last EDR Contact: 04/24/2013
Next Scheduled EDR Contact: 08/05/2013
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 12/10/2012
Date Data Arrived at EDR: 12/11/2012
Date Made Active in Reports: 12/20/2012
Number of Days to Update: 9

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 03/26/2013
Next Scheduled EDR Contact: 07/08/2013
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: No Update Planned

HIST LF INACTIVE: Inactive Facilities List

A listing of inactive non-hazardous facilities (10000 & 300000 series). This listing is no longer updated or maintained by the Department of Environmental Protection. At the time the listing was available, the DEP?s name was the Department of Environmental Resources.

Date of Government Version: 12/20/1994
Date Data Arrived at EDR: 07/12/2005
Date Made Active in Reports: 08/11/2005
Number of Days to Update: 30

Source: Department of Environmental Protection
Telephone: 717-787-7381
Last EDR Contact: 06/21/2005
Next Scheduled EDR Contact: 12/19/2005
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

HIST LF INVENTORY: Facility Inventory
A listing of solid waste facilities. This listing is no longer updated or maintained by the Department of Environmental Protection. At the time the listing was available, the DEP?s name was the Department of Environmental Resources.

Date of Government Version: 06/02/1999
Date Data Arrived at EDR: 07/12/2005
Date Made Active in Reports: 08/11/2005
Number of Days to Update: 30

Source: Department of Environmental Protection
Telephone: 717-787-7381
Last EDR Contact: 09/19/2005
Next Scheduled EDR Contact: 12/19/2005
Data Release Frequency: No Update Planned

HIST LF ALI: Abandoned Landfill Inventory
The report provides facility information recorded in the Pennsylvania Department of Environmental Protection ALI database. Some of this information has been abstracted from old records and may not accurately reflect the current conditions and status at these facilities

Date of Government Version: 01/04/2005
Date Data Arrived at EDR: 01/04/2005
Date Made Active in Reports: 02/04/2005
Number of Days to Update: 31

Source: Department of Environmental Protection
Telephone: 717-787-7564
Last EDR Contact: 11/26/2012
Next Scheduled EDR Contact: 03/11/2013
Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 05/03/2013
Next Scheduled EDR Contact: 08/19/2013
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 11/14/2012
Date Data Arrived at EDR: 12/11/2012
Date Made Active in Reports: 02/15/2013
Number of Days to Update: 66

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/04/2013
Next Scheduled EDR Contact: 06/17/2013
Data Release Frequency: Quarterly

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

Local Lists of Registered Storage Tanks

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ARCHIVE UST: Archived Underground Storage Tank Sites

The list includes tanks storing highly hazardous substances that were removed from the DEP's Storage Tank Information database because of the Department's policy on sensitive information. The list also may include tanks that are removed or permanently closed.

Date of Government Version: 03/01/2013
Date Data Arrived at EDR: 03/21/2013
Date Made Active in Reports: 04/18/2013
Number of Days to Update: 28

Source: Department of Environmental Protection
Telephone: 717-772-5599
Last EDR Contact: 05/02/2013
Next Scheduled EDR Contact: 07/01/2013
Data Release Frequency: Varies

ARCHIVE AST: Archived Aboveground Storage Tank Sites

The list includes aboveground tanks with a capacity greater than 21,000 gallons that were removed from the DEP's Storage Tank Information database because of the Department's policy on sensitive information. The list also may include tanks that are removed or permanently closed.

Date of Government Version: 03/01/2013
Date Data Arrived at EDR: 03/21/2013
Date Made Active in Reports: 04/18/2013
Number of Days to Update: 28

Source: Department of Environmental Protection
Telephone: 717-772-5599
Last EDR Contact: 05/02/2013
Next Scheduled EDR Contact: 07/01/2013
Data Release Frequency: Varies

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/16/2012
Date Data Arrived at EDR: 03/26/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 80

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Varies

ACT 2-DEED: Act 2-Deed Acknowledgment Sites

This listing pertains to sites where the Department has approved a cleanup requiring a deed acknowledgment under Act 2. This list includes sites remediated to a non-residential Statewide health standard (Section 303(g)); all sites demonstrating attainment of a Site-specific standard (Section 304(m)); and sites being remediated as a special industrial area (Section 305(g)). Persons who remediated a site to a standard that requires a deed acknowledgment shall comply with the requirements of the Solid Waste Management Act or the Hazardous Sites Cleanup Act, as referenced in Act 2. These statutes require a property description section in the deed concerning the hazardous substance disposal on the site. The location of disposed hazardous substances and a description of the type of hazardous substances disposed on the site shall be included in the deed acknowledgment. A deed acknowledgment is required at the time of conveyance of the property.

Date of Government Version: 04/23/2010
Date Data Arrived at EDR: 04/28/2010
Date Made Active in Reports: 04/30/2010
Number of Days to Update: 2

Source: Department of Environmental Protection
Telephone: 717-783-9470
Last EDR Contact: 07/22/2011
Next Scheduled EDR Contact: 11/07/2011
Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 55

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 04/02/2013
Next Scheduled EDR Contact: 07/15/2013
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

SPILLS: State spills
A listing of hazardous material incidents.

Date of Government Version: 01/16/2013
Date Data Arrived at EDR: 01/24/2013
Date Made Active in Reports: 02/19/2013
Number of Days to Update: 26

Source: DEP, Emergency Response
Telephone: 717-787-5715
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 07/29/2013
Data Release Frequency: Varies

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 02/12/2013
Date Data Arrived at EDR: 02/15/2013
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 12

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 05/02/2013
Next Scheduled EDR Contact: 07/15/2013
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data
Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 05/07/2013
Next Scheduled EDR Contact: 08/19/2013
Data Release Frequency: Varies

DOD: Department of Defense Sites
This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 04/19/2013
Next Scheduled EDR Contact: 07/29/2013
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites
The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 15

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 03/11/2013
Next Scheduled EDR Contact: 06/24/2013
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 01/15/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 57

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 04/01/2013
Next Scheduled EDR Contact: 07/15/2013
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 12/18/2012	Source: EPA
Date Data Arrived at EDR: 03/13/2013	Telephone: 703-416-0223
Date Made Active in Reports: 04/12/2013	Last EDR Contact: 03/13/2013
Number of Days to Update: 30	Next Scheduled EDR Contact: 06/24/2013
	Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010	Source: Department of Energy
Date Data Arrived at EDR: 10/07/2011	Telephone: 505-845-0011
Date Made Active in Reports: 03/01/2012	Last EDR Contact: 02/25/2013
Number of Days to Update: 146	Next Scheduled EDR Contact: 06/10/2013
	Data Release Frequency: Varies

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/18/2011	Source: Department of Labor, Mine Safety and Health Administration
Date Data Arrived at EDR: 09/08/2011	Telephone: 303-231-5959
Date Made Active in Reports: 09/29/2011	Last EDR Contact: 03/06/2013
Number of Days to Update: 21	Next Scheduled EDR Contact: 06/17/2013
	Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2009	Source: EPA
Date Data Arrived at EDR: 09/01/2011	Telephone: 202-566-0250
Date Made Active in Reports: 01/10/2012	Last EDR Contact: 02/26/2013
Number of Days to Update: 131	Next Scheduled EDR Contact: 06/10/2013
	Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006	Source: EPA
Date Data Arrived at EDR: 09/29/2010	Telephone: 202-260-5521
Date Made Active in Reports: 12/02/2010	Last EDR Contact: 03/28/2013
Number of Days to Update: 64	Next Scheduled EDR Contact: 07/08/2013
	Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009	Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 02/25/2013
Number of Days to Update: 25	Next Scheduled EDR Contact: 06/10/2013
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 02/25/2013
Next Scheduled EDR Contact: 06/10/2013
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing
A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing
A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System
The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 07/20/2011
Date Data Arrived at EDR: 11/10/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 04/15/2013
Next Scheduled EDR Contact: 07/29/2013
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/10/2010
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 98

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 04/19/2013
Next Scheduled EDR Contact: 07/29/2013
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 06/21/2011
Date Data Arrived at EDR: 07/15/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 60

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 03/11/2013
Next Scheduled EDR Contact: 06/24/2013
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 01/08/2013
Date Data Arrived at EDR: 01/09/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 93

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 04/11/2013
Next Scheduled EDR Contact: 07/22/2013
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 10/23/2011
Date Data Arrived at EDR: 12/13/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 79

Source: EPA
Telephone: (215) 814-5000
Last EDR Contact: 03/12/2013
Next Scheduled EDR Contact: 06/24/2013
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

RMP: Risk Management Plans

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 05/08/2012
Date Data Arrived at EDR: 05/25/2012
Date Made Active in Reports: 07/10/2012
Number of Days to Update: 46

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 04/29/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 04/19/2013
Number of Days to Update: 52

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 02/26/2013
Next Scheduled EDR Contact: 06/10/2013
Data Release Frequency: Biennially

UIC: Underground Injection Wells

A listing of underground injection well locations.

Date of Government Version: 03/26/2013
Date Data Arrived at EDR: 03/26/2013
Date Made Active in Reports: 04/18/2013
Number of Days to Update: 23

Source: Department of Environmental Protection
Telephone: 717-783-7209
Last EDR Contact: 03/26/2013
Next Scheduled EDR Contact: 07/08/2013
Data Release Frequency: Varies

NPDES: NPDES Permit Listing

A listing of facilities with an NPDES permit.

Date of Government Version: 12/26/2012
Date Data Arrived at EDR: 03/13/2013
Date Made Active in Reports: 04/18/2013
Number of Days to Update: 36

Source: Department of Environmental Protection
Telephone: 717-787-9642
Last EDR Contact: 03/13/2013
Next Scheduled EDR Contact: 06/24/2013
Data Release Frequency: Varies

PA MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/23/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 57

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 04/23/2013
Next Scheduled EDR Contact: 08/05/2013
Data Release Frequency: Annually

DRYCLEANERS: Drycleaner Facility Locations

A listing of drycleaner facility locations.

Date of Government Version: 03/25/2013
Date Data Arrived at EDR: 03/25/2013
Date Made Active in Reports: 04/18/2013
Number of Days to Update: 24

Source: Department of Environmental Protection
Telephone: 717-787-9702
Last EDR Contact: 03/25/2013
Next Scheduled EDR Contact: 07/08/2013
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

AIRS: Permit and Emissions Inventory Data
Permit and emissions inventory data.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 01/04/2013
Date Made Active in Reports: 02/15/2013
Number of Days to Update: 42

Source: Department of Environmental Protection
Telephone: 717-787-9702
Last EDR Contact: 04/01/2013
Next Scheduled EDR Contact: 07/15/2013
Data Release Frequency: Annually

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 04/19/2013
Next Scheduled EDR Contact: 07/29/2013
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing
The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 05/06/2013
Next Scheduled EDR Contact: 08/05/2013
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 05/03/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information
All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 11/20/2012
Date Data Arrived at EDR: 11/30/2012
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 89

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 02/19/2013
Next Scheduled EDR Contact: 06/03/2013
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST
EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/13/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 36

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 02/12/2013
Next Scheduled EDR Contact: 05/27/2013
Data Release Frequency: Quarterly

US AIRS MINOR: Air Facility System Data
A listing of minor source facilities.

Date of Government Version: 11/15/2012
Date Data Arrived at EDR: 11/16/2012
Date Made Active in Reports: 02/15/2013
Number of Days to Update: 91

Source: EPA
Telephone: 202-564-5962
Last EDR Contact: 04/01/2013
Next Scheduled EDR Contact: 07/15/2013
Data Release Frequency: Annually

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)
The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 11/15/2012
Date Data Arrived at EDR: 11/16/2012
Date Made Active in Reports: 02/15/2013
Number of Days to Update: 91

Source: EPA
Telephone: 202-564-5962
Last EDR Contact: 04/01/2013
Next Scheduled EDR Contact: 07/15/2013
Data Release Frequency: Annually

MINES: Abandoned Mine Land Inventory
This data set portrays the approximate location of Abandoned Mine Land Problem Areas containing public health, safety, and public welfare problems created by past coal mining.

Date of Government Version: 10/02/2012
Date Data Arrived at EDR: 01/30/2013
Date Made Active in Reports: 02/21/2013
Number of Days to Update: 22

Source: PASDA
Telephone: 814-863-0104
Last EDR Contact: 05/02/2013
Next Scheduled EDR Contact: 08/12/2013
Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands
Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 04/19/2013
Next Scheduled EDR Contact: 07/29/2013
Data Release Frequency: N/A

PRP: Potentially Responsible Parties
A listing of verified Potentially Responsible Parties

Date of Government Version: 12/02/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 69

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 04/04/2013
Next Scheduled EDR Contact: 07/15/2013
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 11/11/2011
Date Data Arrived at EDR: 05/18/2012
Date Made Active in Reports: 05/25/2012
Number of Days to Update: 7

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 02/15/2013
Next Scheduled EDR Contact: 05/27/2013
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 01/29/2013
Date Data Arrived at EDR: 02/14/2013
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 13

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 04/08/2013
Next Scheduled EDR Contact: 07/22/2013
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 08/17/2010
Date Data Arrived at EDR: 01/03/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 77

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 03/15/2013
Next Scheduled EDR Contact: 06/24/2013
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 04/18/2013
Next Scheduled EDR Contact: 07/29/2013
Data Release Frequency: Varies

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR US Hist Auto Stat: EDR Exclusive Historic Gas Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Exclusive Historic Dry Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Proprietary Historic Dry Cleaners - Cole

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: N/A
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Auto Stat: EDR Proprietary Historic Gas Stations - Cole

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: N/A
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

CT MANIFEST: Hazardous Waste Manifest Data

Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 02/18/2013
Date Data Arrived at EDR: 02/18/2013
Date Made Active in Reports: 03/21/2013
Number of Days to Update: 31

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 02/18/2013
Next Scheduled EDR Contact: 06/03/2013
Data Release Frequency: Annually

NJ MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/19/2012
Date Made Active in Reports: 08/28/2012
Number of Days to Update: 40

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 04/19/2013
Next Scheduled EDR Contact: 07/29/2013
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data

Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 02/07/2013
Date Made Active in Reports: 03/15/2013
Number of Days to Update: 36

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 05/09/2013
Next Scheduled EDR Contact: 08/19/2013
Data Release Frequency: Annually

RI MANIFEST: Manifest information

Hazardous waste manifest information

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 06/22/2012
Date Made Active in Reports: 07/31/2012
Number of Days to Update: 39

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 02/25/2013
Next Scheduled EDR Contact: 06/10/2013
Data Release Frequency: Annually

VT MANIFEST: Hazardous Waste Manifest Data

Hazardous waste manifest information.

Date of Government Version: 02/15/2013
Date Data Arrived at EDR: 02/21/2013
Date Made Active in Reports: 03/15/2013
Number of Days to Update: 22

Source: Department of Environmental Conservation
Telephone: 802-241-3443
Last EDR Contact: 01/21/2013
Next Scheduled EDR Contact: 05/06/2013
Data Release Frequency: Annually

WI MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/19/2012
Date Made Active in Reports: 09/27/2012
Number of Days to Update: 70

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 03/18/2013
Next Scheduled EDR Contact: 07/01/2013
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data

Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Care Facility List
Source: Department of Public Welfare
Telephone: 717-783-3856

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

Appendix D
PA DEP Investigations for Study Area
Retrospective Case Study in Northeastern Pennsylvania

U.S. Environmental Protection Agency
Office of Research and Development
Washington, DC

May 2015
EPA/600/R-14/088

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

IN THE MATTER OF:

Chesapeake Appalachia, LLC	:	Violations of The Oil and Gas Act,
Tuscarora, Terry, Monroe, Towanda,	:	and The Clean Streams Law
and Wilmot Townships	:	
Bradford County	:	

CONSENT ORDER AND AGREEMENT

This Consent Order and Agreement is entered into this 16th day of May, 2011, by and between the Commonwealth of Pennsylvania, Department of Environmental Protection (hereinafter "Department"), and Chesapeake Appalachia, LLC (hereinafter "Chesapeake").

The Department has found and determined the following:

A. The Department is the agency with the duty and authority to administer and enforce the Oil and Gas Act, Act of December 19, 1984, P.L. 1140, as amended, 58 P.S. §§ 601.101-601.605 ("Oil and Gas Act"); The Clean Streams Law, Act of June 22, 1937, P.L. 1987, as amended, 35 P.S. §§ 691.1-691.1001 ("Clean Streams Law"); Section 1917-A of the Administrative Code of 1929, Act of April 9, 1929, P.L. 177, as amended, 71 P.S. §§ 510-17 ("Administrative Code"); and the rules and regulations promulgated thereunder (hereinafter "Regulations").

B. Chesapeake Appalachia, LLC (hereinafter "Chesapeake") is an Oklahoma Limited Liability Company authorized to do business in Pennsylvania which maintains a business address of P.O. Box 18496, Oklahoma City, OK 73154-0496.

C. Chesapeake constitutes a "person" as that term is defined by Section 103 of the Oil and Gas Act, 58 P.S. § 601.103, and by Section 1 of the Clean Streams Law, 35 P.S. § 691.1.

D. Chesapeake is the "owner" and "operator," as those terms are defined by Section 103 of the Oil and Gas Act, 58 P.S. §601.103, of certain gas wells within the areas defined by the Department as follows: the Miller/Luce area of Towanda Township, Bradford County (hereinafter "Miller/Luce Area"); the Sivers area in Tuscarora Township, Bradford County (hereinafter "Sivers Area"); the Paradise Road area of Terry Township, Bradford County (hereinafter "Paradise Road Area"); the Dan Ellis area in Monroe Township, Bradford County (hereinafter "Dan Ellis Area"); the Sugar Run area of Wilmot Township, Bradford County (hereinafter "Sugar Run Area"); the Spring Hill Road area of Tuscarora Township, Bradford County (hereinafter "Spring Hill Road Area"); and the Vargson residence. Maps of the Miller/Luce Area, Sivers Area, Paradise Road Area, Dan Ellis Area, Sugar Run Area, Spring Hill Road Area, and Vargson Area, are attached as Exhibit A and incorporated herein.

Miller/Luce Area

E. In February of 2010, Mr. Luce contacted Chesapeake to complain about his water supply well producing black water and "churning."

F. Chesapeake responded and provided Mr. Luce with temporary replacement water.

G. On February 26, 2010, Chesapeake contacted the Department about the Luce water well and the actions Chesapeake intended to take in response to Mr. Luce's complaint.

H. The Department reviewed Chesapeake's planned tasks and asked that additional measures be taken, including on-site gas screening of residences, low lying areas, and springs/streams; and that the annulus pressures at the Miller, Farr and Kent well pads be checked.

I. Chesapeake carried out the additional measures requested by the Department.

J. On March 1, 2010, Mr. Luce informed Chesapeake that a pond on his property was bubbling.

K. On March 3, 2010, Chesapeake installed a PVC riser pipe (vent stack) on the Luce water well. An elevated concentration of methane was detected in the well headspace. Methane also was detected at low levels in the basement and upstairs of the Luce residence.

L. On March 4, 2010, Chesapeake installed a methane monitor in the basement of the Luce residence.

M. On March 24, 2010, a second landowner, Mr. Mignano, contacted Chesapeake about problems with his water well. Chesapeake responded and notified the Department.

N. Chesapeake installed methane monitoring equipment in a total of five residential locations in the Miller/Luce area.

O. On March 29, 2010, with the approval of the Department, Chesapeake began remedial work at the Miller gas wells.

P. On April 13, 2010, the Department issued Chesapeake a Notice of Violation for the failure to prevent the migration of gas into sources of fresh groundwater and for defective casing or cementing of the Miller gas wells.

Q. By approximately April 20, 2010, visible water disturbance had subsided in the Luce pond. Chesapeake drilled a new water well for the Luce residence in May, 2010.

Sivers Area

R. On June 25, 2010, the Department received a complaint of bubbling in a beaver pond in Tuscarora Township, Bradford County.

S. The nearest gas wells to the beaver pond are operated by Chesapeake. Chesapeake's Sivers well pad is 1,700 feet from the pond and Chesapeake's Mowry 2 well pad is 3,600 feet from the beaver pond.

T. The Department notified Chesapeake of this complaint on June 30, 2010 and Chesapeake initiated an investigation.

U. On July 26, 2010, Chesapeake provided the Department with a summary of its investigation relating to the Sivers well pad, including an isotopic analysis of the gas emitted from the beaver pond and of gas found in the annular space of the surface casing of Chesapeake's wells on three surrounding pads. A plan of action was also submitted that called for modifying the wellbore construction, particularly with respect to cementing; additional testing; and implementing a 3-string casing design.

V. On August 6, 2010, the Department issued Chesapeake a Notice of Violation for the unpermitted discharge of polluting substances and failure to prevent the migration of gas into sources of fresh groundwater for the Sivers area.

W. On August 7, 2010, Chesapeake instituted a monitoring plan which included inspections of the beaver pond, private residences, and gas wells in the Sivers area.

X. Gas emitted from the beaver pond had similar characteristics to gas found in the annular space of the surface casing of Chesapeake's Mowry 2 gas well.

Y. Bubbling at the beaver pond continued from June 25, 2010, in diminishing amounts, to August 26, 2010.

Z. Chesapeake completed remedial work on their nearby gas wells between August 18, 2010, and August 30, 2010.

AA. Since August 26, 2010 to the present, no bubbling has been observed at the beaver pond.

Paradise Road Area

AB. On July 13, 2010, the Department became aware of water supply complaints by Michael Phillips and Jared McMicken, who reside on Paradise Road, Terry Township, Bradford County.

AC. On July 15, 2010, the Department investigated the complaints and collected groundwater samples at the Phillips and McMicken residences.

AD. On July 21, 2010, the Department became aware of a water supply complaint by Scott Spencer, also on Paradise Road, Terry Township, Bradford County. The Department investigated and collected samples of the Spencer well on the same day.

AE. On August 2 and 3, 2010, Chesapeake collected water samples and installed methane alarm systems at the McMicken, Spencer and Phillips residences.

AF. On August 6, 2010, the Department issued Chesapeake a Notice of Violation for the unpermitted discharge of polluting substances and failure to prevent the migration of gas into sources of fresh groundwater for the Paradise Road Area.

AG. Chesapeake has provided temporary replacement water, installed water well vent stacks, drilled replacement wells, and installed water treatment systems at the McMicken, Phillips and Spencer residences.

AH. Isotopic analyses of gas from a residence and water wells in the Paradise Road Area indicate that the gas at the homes is not microbial in origin and is consistent with isotopic analyses of gas found in the annular space of surface casing of Chesapeake's Welles gas wells.

Dan Ellis Area

AI. On August 4, 2010, Chesapeake responded to a landowner complaint of possible methane intrusion in a water supply at a home on Brockton Road, Monroe Township, Bradford

County. Chesapeake responded and, that same day, notified the Department that methane was detected in three private water supplies and one home along Brockton Road.

AJ. On August 6, 2010, the Department confirmed the presence of methane in the headspace of the three home water wells along Brockton Road.

AK. On August 6, 2010, Chesapeake instituted a monitoring plan of certain residences in the area of Chesapeake's Dan Ellis well pad, which is located approximately 4,700 feet to the South.

AL. On August 6, 2010, the Department issued Chesapeake a Notice of Violation for the unpermitted discharge of polluting substances and the failure to prevent the migration of gas into sources of fresh groundwater for the Dan Ellis area.

Sugar Run Area

AM. On September 2, 2010, the Department received information of bubbling in the Susquehanna River near the community of Sugar Run, in Wilmot Township, Bradford County.

AN. On September 3, 2010, the Department inspected the Sugar Run Area and found gas bubbling at numerous locations in the Susquehanna River. A sample of the gas was collected and sent to an independent laboratory to be analyzed. In addition, the Department inspected numerous residential dwellings in the Sugar Run Area and found methane in several water supply wells.

AO. On September 3, 2010, Chesapeake began screening the locations of bubbling in the river, certain residential water wells, and soils in the Sugar Run Area.

AP. On September 7, 2010, the Department collected water samples from the potentially impacted water wells in the Sugar Run Area.

AQ. Chesapeake installed vent stacks on water supply wells at residences in the Sugar Run Area owned or occupied by Dale Dunklee, Donald Pickett, Carl Postupak, Kenneth

Reinhart, David Buck (Rental Unit 1), and Robert Baldwin. Chesapeake also provided temporary replacement water for Donald Pickett and Carl Postupak.

AR. On September 9, 2010, the Department issued Chesapeake a Notice of Violation for the unpermitted discharge of polluting substances and the failure to prevent the migration of gas into sources of fresh groundwater for the Sugar Run Area.

Spring Hill Road Area

AS. On September 16, 2010, Chesapeake notified the Department that methane gas was detected in a water supply located along Spring Hill Road in Tuscarora Township, Bradford County.

AT. The nearest drilled Marcellus well, Chesapeake's Champdale well, is approximately 880 feet from the water supply referenced in paragraph AT, above.

AU. On September 24, 2010, the Department issued Chesapeake a Notice of Violation for the unpermitted discharge of polluting substances and the failure to prevent the migration of gas into sources of fresh groundwater for the Spring Hill Road Area, and for defective casing or cementing of the Champdale/Champluvier gas wells.

Vargson Residence

AV. On or about June 24, 2010, Bruce and Sherry Vargson contacted Chesapeake with a complaint about their water at 2331 Baileys Corners, in Granville Township, Bradford County. Chesapeake initiated an investigation and determined that an elevated concentration of methane gas was present in the well headspace.

AW. A water sample collected from the Vargson's water supply on June 26, 2010, indicated an elevated level of methane.

AX. On July 8, 2011, Sherry Vargson filed a complaint with the Department alleging her water supply had been impacted by gas drilling activity.

AY. On July 14, 2010, methane was detected in the headspace of the Vargson water well.

AZ. On September 15, 2010, the Department issued Chesapeake a Notice of Violation for the unpermitted discharge of polluting substances and the failure to prevent the migration of gas into sources of fresh groundwater.

Additional Investigations

AAA. Since August of 2010, the Department has inspected various Chesapeake gas wells in the Sivers, Dan Ellis, Paradise Road, Sugar Run, and Spring Hill Road Areas. As a follow-up and precaution, Chesapeake has perforated and squeezed additional cement behind the casing in a number of its gas wells in the subject areas.

AAB. In the course of its investigation, the Department has collected water samples from drinking water wells at residences in the Paradise Road, Dan Ellis, Sugar Run, and Spring Hill Road Areas. The Department also has collected isotopic gas samples to compare the gas from various gas wells drilled by Chesapeake to gas from various locations.

Determination of Discharge of Natural Gas into the Groundwater

AAC. Chesapeake has caused or allowed the unpermitted discharge of natural gas, a polluting substance, into the groundwater, which constitutes a "water of the Commonwealth" as that term is defined in 35 P.S. §691.1, in violation of Section 401 of the Clean Streams Law, 35 P.S. §691.401.

AAD. As of the date of this Consent Order and Agreement, Chesapeake has taken certain actions approved by the Department to prevent the ongoing, unpermitted discharge of natural gas into the waters of the Commonwealth.

Determination of Gas Migration Violations

AAE. Chesapeake failed to properly case and cement the gas wells and to prevent the migration of gas into sources of fresh groundwater in violation 25 Pa. Code §§ 78.73(a), 78.81(a), and 78.86, as in effect prior to February 5, 2011.

AAF. The violations described in Paragraphs AAC through AAE, above constitute unlawful conduct under the laws and regulations administered by the Department, including Section 509, of the Oil and Gas Act, 58 P.S. § 601.509 and Section 611 of the Clean Streams Law, 35 P.S. § 691.611; constitute a public nuisance under Section 502 of the Oil and Gas Act, 58 P.S. § 601, and Section 401 of the Clean Streams Law, 35 P.S. § 691.401; require restoration or replacement of certain water supplies pursuant to Section 208 of the Oil and Gas Act, 58 P.S. § 601.208 and 25 Pa. Code § 78.51; and subject Chesapeake to civil penalty liability under Section 506, of the Oil and Gas Act, 58 P.S. § 601.506 and Section 605 of the Clean Streams Law, 35 P.S. §§ 691.605.

Order

After full and complete negotiation of all matters set forth in this Consent Order and Agreement, and upon mutual exchange of the covenants contained herein, the parties desiring to avoid litigation and intending to be legally bound, it is hereby ORDERED by the Department and AGREED to by Chesapeake as follows:

1. **Authority.** This Consent Order and Agreement is an Order of the Department authorized and issued pursuant to Section 503, of the Oil and Gas Act, 58 P.S. § 601.503; Section 5 of the Clean Streams Law, 35 P.S. § 691.5; and Section 1917-A of the Administrative Code, supra.

2. **Findings.**

a. Chesapeake agrees that the findings in Paragraphs A through AAB above are true and correct and, in any matter or proceeding involving Chesapeake and the Department, Chesapeake shall not challenge the accuracy or validity of these findings.

b. The parties do not authorize any other persons to use the findings in this Consent Order and Agreement in any matter or proceeding.

c. Chesapeake disagrees with the determinations stated in Paragraphs AAC through AAF above.

3. **Corrective Actions.**

a. Within fourteen (14) days after the date of this Consent Order and Agreement, Chesapeake shall submit to the Department, for review and approval, a plan which:

1) includes a list of all gas wells drilled by or on behalf of Chesapeake in the areas depicted on Exhibit A and identifies the number of casings used in each well and the depth to which the strings of casing are set;

2) includes the defined logging protocol (hereinafter "wellbore evaluations") which Chesapeake shall employ to evaluate the integrity of wells appearing on the list submitted pursuant to Paragraph 3.a.1), identification of a hierarchy of the wells that will be so evaluated, and an explanation of the rationale for selecting the hierarchy of such wells, above;

3) includes an implementation schedule not to exceed six (6) months which sets forth, at a minimum, the date on which Chesapeake shall commence the wellbore evaluation on the wells identified for evaluation pursuant to Paragraph 3.a.2), above; and

4) identifies the actions Chesapeake shall take to analyze each and every gas well identified for evaluation pursuant to Paragraph 3.a.2), above, and recommendations for the rehabilitation work necessary to control and mitigate shut-in surface casing pressure and stray gas from those wells;

b. Within five (5) days of approval by the Department, Chesapeake shall implement the plan submitted pursuant to Paragraph 3.a., above, as approved by the Department;

c. Within seven (7) days of the date of the approval of the plan submitted pursuant to Paragraph 3.a, above, Chesapeake shall begin pressure testing of each accessible annuli on each of the gas wells identified for evaluation pursuant to Paragraph 3.a.2), above. Chesapeake shall pressure test each annuli for forty-eight (48) consecutive hours, and shall provide the test results for each tested well within five (5) days of completion of the pressure test on each respective well. At least twenty-four (24) hours before Chesapeake begins pressure testing in accordance with this Paragraph, Chesapeake shall provide the Department written notice of the gas well to be tested, and the date and approximate time that Chesapeake shall begin such pressure test.

d. Within sixty (60) days of the date of the approval of the plan submitted pursuant to Paragraph 3.a, above, in all cases Chesapeake shall have completed the 48-hour pressure test of the annuli on all of the gas wells identified pursuant to Paragraph 3.a.2), above, and shall provide the Department with the results of the pressure tests for all of those wells.

e. Every other Monday following the approval of the plan submitted pursuant to Paragraph 3.a., above, Chesapeake shall submit a report containing the following information for each well identified pursuant to Paragraph 3.a.2):

1) the status of the work at each well (i.e., 'Deemed Finished,' 'In Progress,' or 'Scheduled');

2) Chesapeake's analysis of each well's logs and recommended actions to be taken based on all of the information available to Chesapeake.

3) For wells In Progress:

i. the date logged; date or dates on which cement was squeezed; depth of squeezes; date and time the 48-hour casing pressure build-up test was started, supported by information in the form of a chart or digital recording;

ii. a daily well work activity summary, separate from any monitoring report, that includes a brief description of that work and of the wellhead's status; and

iii. Chesapeake's daily completion reports, including all of the days of work on each well.

f. Chesapeake's obligation to submit the weekly reports required in Paragraph 3.e. shall terminate when the Department determines in writing that Chesapeake has eliminated the unpermitted discharge of natural gas into the waters of the Commonwealth from any well owned and/or operated by Chesapeake within the areas of Bradford County identified in Paragraph D, above, in this Consent Order and Agreement.

4. **Specifications of New Wells.** All gas wells drilled by or on behalf of Chesapeake in the areas identified in Paragraph D, above on or after the date of this Consent Order and Agreement shall be cased and cemented in a manner consistent with the specifications and practices described in Exhibit D unless, based on conditions observed in advance of or at the time of drilling, Chesapeake determines that alternate specifications or practices are warranted.

In the event that Chesapeake determines that alternate specifications or practices are warranted, Chesapeake shall notify the Department of the alternate specifications or practices utilized.

5. **Installation of Pressure Gauges**. Within ninety (90) days after the date of this Consent Order and Agreement, Chesapeake shall install pressure gauges on all existing wells within the areas described in Paragraph D, above, at the surface and intermediate casing ports in a manner allowing pressures to be inspected at any time by the Department. Chesapeake shall install such gauges on all wells drilled by or on behalf of Chesapeake within the areas described in Paragraph D, above, on or after the date of this Consent Order and Agreement.

6. **Reporting Water Supply Complaints.** Attached as Exhibit B is a Protocol For Reporting Water Supply Complaints identifying (i) the procedures Chesapeake shall implement within the areas identified in Paragraph D, above, to report to the Department water supply complaints within twenty four (24) hours after Chesapeake receives any such complaint, in accordance with 25 Pa. Code § 78.51(h) (effective February 5, 2011); (ii) the actions Chesapeake shall take to investigate any such complaint; (iii) the information to be reported to the Department based on such investigation; and (iv) the timing and form of such reports. Chesapeake shall implement the plan for any future complaint within the areas identified in Paragraph D, above.

7. **Remediation of Water Supplies.**

a. Beginning upon execution of this Consent Order and Agreement, with respect to the water supplies listed on Exhibit C, Chesapeake shall:

1) at least once every two weeks, screen the well at each water supply listed in Exhibit C for percentage of free combustible gas, and sample the well at each of those water supplies, provided the landowner consents to such screening and sampling;

2) for each water sample collected at a water supply listed in Exhibit C, Chesapeake shall have the water sample analyzed in a Pennsylvania-accredited laboratory for dissolved methane, dissolved ethane, and dissolved propane;

3) Chesapeake shall continue to conduct the screening and sampling under Paragraph 7.a.1), above, once every two weeks at each water supply listed in Exhibit C, provided the landowner consents, until the results of the screenings and sampling done by the Department or by Chesapeake under Paragraph 7.a.1), above, show (A) that either no combustible free gas is present at the water supply's wellhead, or, that such levels of combustible free gas, if properly vented pursuant to applicable regulations and Department practice, do not pose a danger to persons or property *and* (B) that the concentration of dissolved methane is below 7 milligrams/liter. However, Chesapeake may petition the Department, based on information obtained in accordance with this Paragraph for a determination that the concentration of methane in the water supply is at background levels for the aquifer that supplies the water supply. Chesapeake may further petition the Department for a determination that the concentration of combustible free gas at the wellhead is at levels that do not present a danger to persons or property if properly vented according to applicable regulations and Department practice;

4) for each water supply that meets the standards under Paragraph 7.a.3), above, or for which a plan has been submitted and approved pursuant to Paragraph 7.b and 7.c, Chesapeake shall continue to screen each such water supply for free combustible gas and shall sample each such water supply at least once per quarter, and shall have the water sample analyzed in a Pennsylvania-

accredited laboratory for the parameters listed in Exhibit E, provided the landowner consents to such screening and sampling; and

5) unless the Department determines that the concentration of methane in the water supply is at background levels for the aquifer that supplies the water supply, Chesapeake shall continue such screenings and sampling under paragraph 7.a.4), above, for each quarter until the results of the screenings and sampling done by the Department and by Chesapeake under this Paragraph 7 show that, for eight consecutive quarters, seventy-five percent (75%) of the water samples within each monitoring point over time contain seven (7) milligrams per liter or less of dissolved methane (or meets the standard then prescribed by applicable regulations), and no individual water sample exceeds two times this standard.

b. If after 60 days beyond the date of this Consent Order and Agreement, the dissolved methane is equal to or greater than 7 mg/l, or the measured free gas in the headspace is greater than 25% of the L.E.L., then Chesapeake shall submit to the Department for review and approval a plan and schedule to address each water supply listed on Exhibit C, including such remedial actions as Chesapeake may already have implemented. The quality of a restored or replaced water supply will be deemed adequate if it meets the standards established under the Pennsylvania Safe Drinking Water Act (35 P.S. §§ 721.1—721.17), or is comparable to the quality of the water supply before it was affected if that water supply did not meet these standards. Despite the filing of such a plan, Chesapeake shall remain obligated to monitor and screen such water supplies as required by this Paragraph 7.

c. Within fourteen (14) days of the Department's approval of any plan submitted pursuant to Paragraph 7.b., above, Chesapeake shall fully implement that plan as approved by the Department, subject to any determination by the Department that the concentration of methane in the water supply is at background or otherwise acceptable levels for the aquifer that supplies the water supply and the concentration of combustible free gas at the wellhead is at levels that do not present a danger to persons or property if properly vented according to applicable regulations and Department practice.

d. In the event that the owner of a residence identified in Exhibit C does not allow Chesapeake to fully implement the plan approved by the Department pursuant to Paragraph 7.d., above, then for each such residence Chesapeake shall establish an escrow account, or a common account for all such residences, in an amount approved by the Department to be used for the exclusive purpose of funding all of the expenses associated with providing either a treatment system or a replacement permanent water supply to the residence(s).

e. Chesapeake shall be responsible for paying any fees, charges, or taxes associated with every required escrow account or any common account.

f. Chesapeake shall maintain each escrow account, or the common account, until such time as the occupants of the residence(s) for which the account has been established notify Chesapeake in writing that installation of a treatment system or a replacement permanent water supply either has occurred at the residence owner's expense, or the funds in the escrow account may be used to install a permanent water supply at the residence.

g. Within thirty (30) days of the Department's receipt of notice that the funds in an escrow account may be used to install a treatment system or a replacement permanent water supply at a residence, Chesapeake shall make all necessary arrangements with any necessary vendors or contractors for the purchase and installation of a treatment system or replacement permanent water supply at the residence at issue. Chesapeake shall provide copies of the paid invoice(s) from the vendors or contractors to the Department.

h. Within fourteen (14) days of receiving the paid invoice(s) for the purchase and installation of the treatment system or replacement permanent water supply, the Department shall draw on the appropriate escrow account, or the common account, in the amount necessary to reimburse Chesapeake for the payments to the vendors or contractors for such.

i. Following the purchase and installation of any system or water supply using funds drawn against an escrow account, Chesapeake shall maintain the escrow account to secure the long term operation and maintenance expenses of such systems or supply.

j. In the absence of any notification referenced in Paragraph 7.g., Chesapeake shall maintain each escrow account, or the common account, until such time as other arrangements for disposition of the escrow account are made by the Department.

8. **Sampling Protocol.** All water samples gathered and analyzed by or on behalf of Chesapeake, and submitted to the Department pursuant to this Consent Order and Agreement, shall be collected in accordance with the following protocol, or other method approved by the Department:

After purging the well, fill the 5 gallon bucket with water. Attach a nozzle and 12" length of ¼ inch diameter tubing to the end of the 5/8 inch hose connected to a faucet. Make sure that the flow rates through the tubing are low. Remove the cap of the 1 L bottle (or vial) and fill it with water. Once the bottle filled, immerse it in the 5 gallon bucket full of water, keeping the tubing at the bottom of the bottle. Place the bottle at the bottom of the bucket under a head of water, and keep water flowing at a low rate until another 2 volumes of water have been displaced from the bottle. Then slowly lift the tubing out of the bottle and immediately cap it under water. No air should be allowed into the 1 L bottle. When finished, tape the cap to the bottle around the neck, pack the bottle upside down in ice, and ship it overnight.

9. **Submission of Documents.** With regard to any document that Chesapeake is required to submit pursuant to this Consent Order and Agreement, the Department will review Chesapeake's document and will approve, modify or disapprove the document, or a portion thereof, in writing. If the document, or any portion of the document, is found to be deficient by the Department, within 14 days of receipt of the deficiencies, Chesapeake shall submit a revised document to the Department that addresses the Department's concerns. The Department will approve, modify or disapprove the revised document in writing. Upon approval by the Department, the document, and any schedule therein, shall become a part of this Consent Order and Agreement for all purposes and shall be enforceable as such.

10. **Civil Penalty Settlement.** In settlement of any claim for civil penalties which the Department is authorized to pursue under law, including Section 506 of the Oil and Gas Act, 58 P.S. § 601.506, and Section 605 of the Clean Streams Law, 35 P.S. §§ 691.605, the Department hereby assesses a civil penalty of Seven Hundred Thousand Dollars ($700,000) for the violations set forth in the Findings, above. The payment shall be made by corporate check or the like, made payable to the "Commonwealth of Pennsylvania," and forwarded to the Department pursuant to Paragraph 17, below, or by an alternate method approved by the Department, within five days of execution of the Consent Order and Agreement.

11. **Donation to Well Plugging Fund.** Chesapeake agrees to donate Two Hundred Thousand Dollars ($200,000) to the Department's Well Plugging Fund. Chesapeake shall make such payment in the manner described in Paragraph 10, within five days of execution of the Consent Order and Agreement.

12. **Stipulated Civil Penalties.**

a. **If Chesapeake fails to comply with any provision of this Consent Order and Agreement, Chesapeake shall be in violation of this Consent Order and Agreement and, in addition to other applicable remedies, shall pay a civil penalty as follows:** If Chesapeake fails to comply with any obligation imposed upon it pursuant to this Consent Order and Agreement, Chesapeake shall be in violation of this Consent order and Agreement, and, in addition to other applicable remedies, shall pay a civil penalty in the amount of One Thousand Dollars ($1000) per day for each day, or any portion thereof, that Chesapeake fails to comply with its obligation.

b. Stipulated civil penalties shall be due automatically without further notice on or before the 15th day of each succeeding month, shall be made by corporate check or the like made payable to "Commonwealth of Pennsylvania," and shall be sent to the Department at the address set forth in Paragraph 17, below.

c. Any payment under this Paragraph shall neither waive Chesapeake's duty to meet its obligations under this Consent Order and Agreement, nor preclude the Department from commencing an action to compel Chesapeake's compliance with the terms and conditions of this Consent Order and Agreement for which payment is made.

13. **Additional Remedies.**

a. In the event Chesapeake fails to comply with any provision of this Consent Order and Agreement, the Department may, in addition to the remedies prescribed herein, pursue any remedy available for a violation of an order of the Department.

b. The remedies provided by this paragraph and Paragraph 12 (Stipulated Civil Penalties) are cumulative and the exercise of one does not preclude the exercise of any other. The failure of the Department to pursue any remedy shall not be deemed to be a waiver of that remedy. The payment of a stipulated civil penalty, however, shall preclude any further assessment of civil penalties for the violation for which the stipulated civil penalty is paid.

14. **Reservation of Rights.** The Department reserves the right to require additional measures to achieve compliance with applicable law. Chesapeake reserves the right to challenge any action which the Department may take to require those measures.

15. **Liability of Chesapeake.** Chesapeake shall be liable for any violations of the Consent Order and Agreement, including those caused by, contributed to, or allowed by its officers, directors, agents, employees, contractors, successors, and assigns.

16. **Transfer of Gas Wells.**

a. Chesapeake's duties and obligations under this Consent Order and Agreement shall not be modified, diminished, terminated or otherwise altered by the transfer of any legal or equitable interest in any of the gas wells identified on the list submitted pursuant to paragraph 3.a.1), above, or any other Chesapeake gas wells covered hereby.

b. If before the termination of this Consent Order and Agreement, Chesapeake intends to transfer any legal or equitable interest in any of the gas wells on the list submitted pursuant to paragraph 3.a.1), above, Chesapeake shall provide a copy of this Consent Order and Agreement to the prospective transferee at least thirty (30) days prior to the contemplated transfer and shall simultaneously inform the Department of such intent at the address set forth in Paragraph 17, below.

c. The Department, in its discretion, may agree to modify or terminate Chesapeake's duties and obligations under this Consent Order and Agreement and may agree to a transfer upon determination that Chesapeake is in full compliance with this Consent Order and Agreement, including payment of any stipulated penalties owed, and upon the transferee entering into a Consent Order and Agreement with the Department concerning the gas wells at issue. Chesapeake agrees to waive any right that it may have to challenge the department's decision in this regard.

17. **Correspondence with Department.** All correspondence with the Department concerning this Consent Order and Agreement shall be addressed to:

Jennifer W. Means
Environmental Program Manager
Eastern Region Oil and Gas Management
Department of Environmental Protection
208 West Third Street – Suite 101
Williamsport, PA 17701-6448
Phone (business hours): (570) 321-6557
Phone (non-business hours): (570)327-3636
e-Mail: jenmeans@state.pa.us

18. **Correspondence with Chesapeake.** All correspondence with Chesapeake concerning this Consent Order and Agreement shall be addressed to:

Tal Oden
Regulatory Manager North, East Division
Chesapeake Energy Corporation
P.O. Box 18496
Oklahoma City, OK 73154
Phone: (405) 935-4073
e-Mail: tal.oden@chk.com

Chesapeake shall notify the Department whenever there is a change in the contact person's name, title, or address. Service of any notice or any legal process for any purpose under this

Consent Order and Agreement, including its enforcement, may be made by mailing a copy by first class mail to the above address.

19. **Severability.** The paragraphs of this Consent Order and Agreement shall be severable and should any part hereof be declared invalid or unenforceable, the remainder shall continue in full force and effect between the parties.

20. **Entire Agreement.** This Consent Order and Agreement shall constitute the entire integrated agreement of the parties. No prior or contemporaneous communications or prior drafts shall be relevant or admissible for purposes of determining the meaning or intent of any provisions herein in any litigation or any other proceeding.

21. **Attorneys Fees.** The parties shall bear their respective attorney fees, expenses and other costs in the prosecution or defense of this matter or any related matters, arising prior to execution of this Consent Order and Agreement.

22. **Modifications.** No changes, additions, modifications, or amendments of this Consent Order and Agreement shall be effective unless they are set out in writing and signed by the parties hereto.

23. **Titles.** A title used at the beginning of any paragraph of this Consent Order and Agreement may be used to aid in the construction of that paragraph, but shall not be treated as controlling.

24. **Decisions under Consent Order and Agreement.** Except for Paragraph 16.c., above, any decision which the Department makes under the provisions of this Consent Order and Agreement, including a notice that stipulated civil penalties are due, is intended to be neither a final action under 25 Pa. Code § 1021.2, nor an adjudication under 2 Pa. C.S. § 101. Any objection which Chesapeake may have to the decision will be preserved until the Department enforces this Consent Order and Agreement.

25. **Termination.** Chesapeake's obligations, but not the Findings, of this Consent Order and Agreement shall terminate when the Department provides written notice that Chesapeake has completed all of the requirements of this Consent Order and Agreement, and has paid any outstanding stipulated civil penalties due under Paragraph 12, above.

26. **Execution of Agreement.** This Consent Order and Agreement may be signed in counterparts, each of which shall be deemed to be an original and all of which together shall constitute one and the same instrument. Facsimile signatures shall be valid and effective.

IN WITNESS WHEREOF, the parties hereto have caused this Consent Order and Agreement to be executed by their duly authorized representatives. The undersigned representatives of Chesapeake certify under penalty of law, as provided by 18 Pa. C.S. § 4904, that they are authorized to execute this Consent Order and Agreement on behalf of Chesapeake; that Chesapeake consents to the entry of this Consent Order and Agreement as a final Order of the Department; and that Chesapeake hereby knowingly waives its rights to appeal this Consent Order and Agreement and to challenge its content or validity, which rights may be available under Section 4 of the Environmental Hearing Board, the Act of July 13, 1988, P.L. 530, No. 1988-94, 35 P.S. § 7514; the Administrative Agency Law, 2 Pa. C.S. § 103(a) and Chapters 5A and 7A; or any other provision of law.

Signature by Chesapeake's attorney certifies only that the agreement has been signed after consulting with counsel.

FOR CHESAPEAKE APPALACHIA, L.L.C.:	FOR THE COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION:
13MAY11 John K. Reinhart (Date) Vice President, Operations-Eastern Division	5/13/11 Jennifer W. Means (Date) Environmental Program Manager East Region Oil & Gas Management
5-13-11 Craig P. Wilson, Esq. (Date) Attorney for Chesapeake Appalachia, L.L.C.	5/13/2011 Geoffrey J. Ayers (Date) Regional Counsel Northcentral Region
	5/16/11 David J. Raphael (Date) Chief Counsel Department of Environmental Protection

Exhibit A

Maps of:

Miller/Luce Area

Sivers Area

Paradise Road Area

Dan Ellis Area

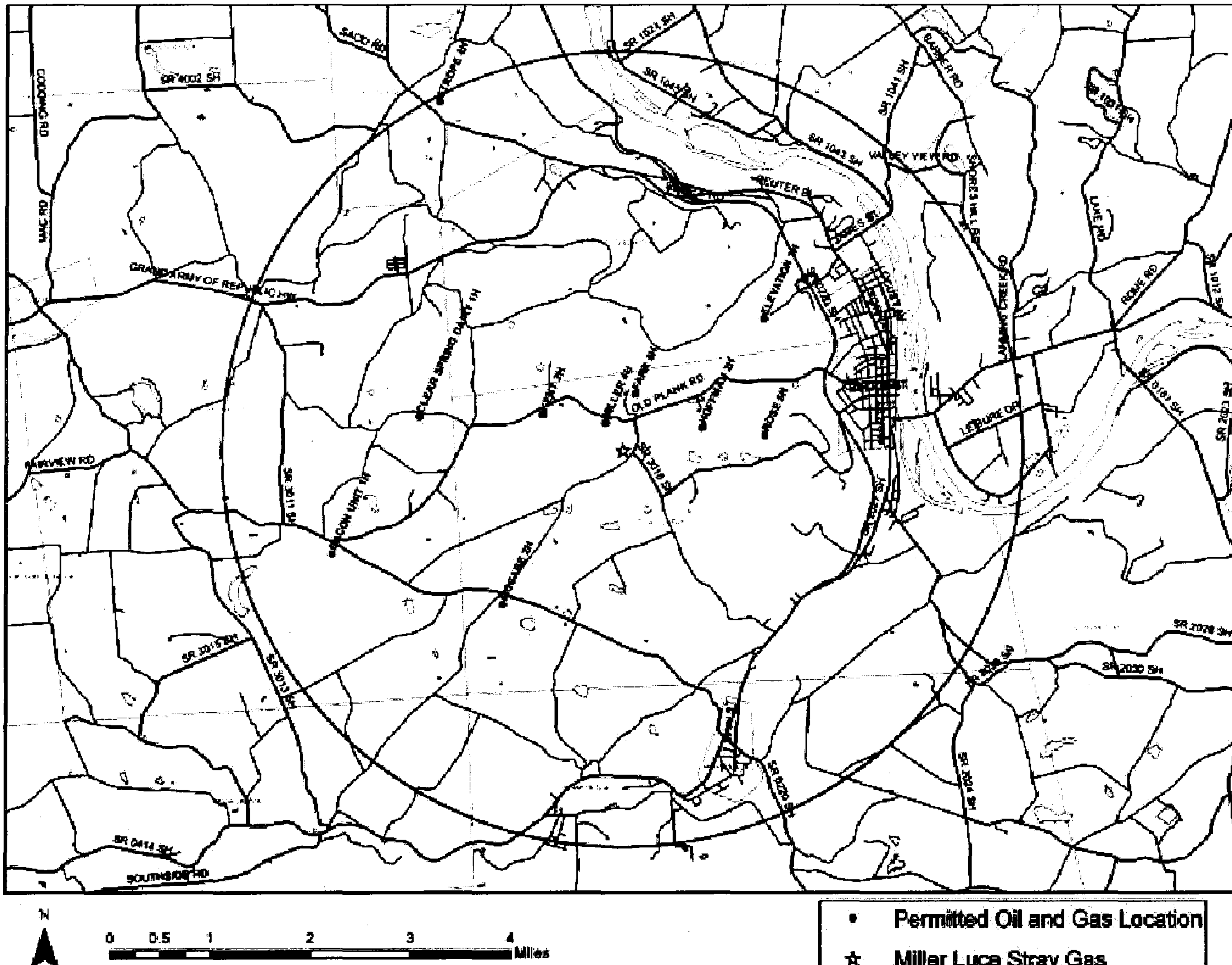
Sugar Run Area

Spring Hill Area

Vargson Area

9/27/2010

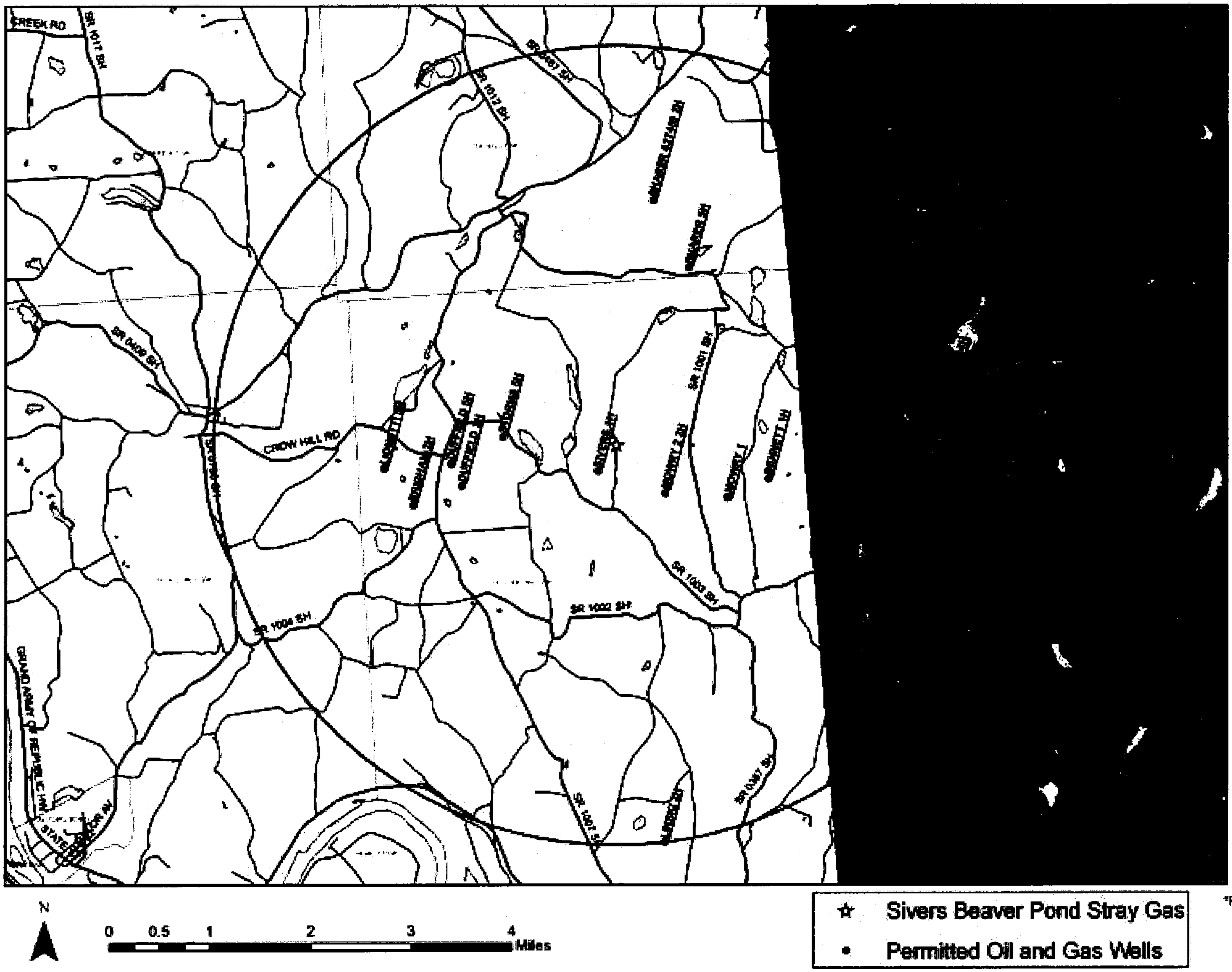
Miller / Luce Stray Gas Area - 4 Mile Radius



*Permitted Oil and Gas Locations may contain multiple wells per location. Refer to attached table.

9/27/2010

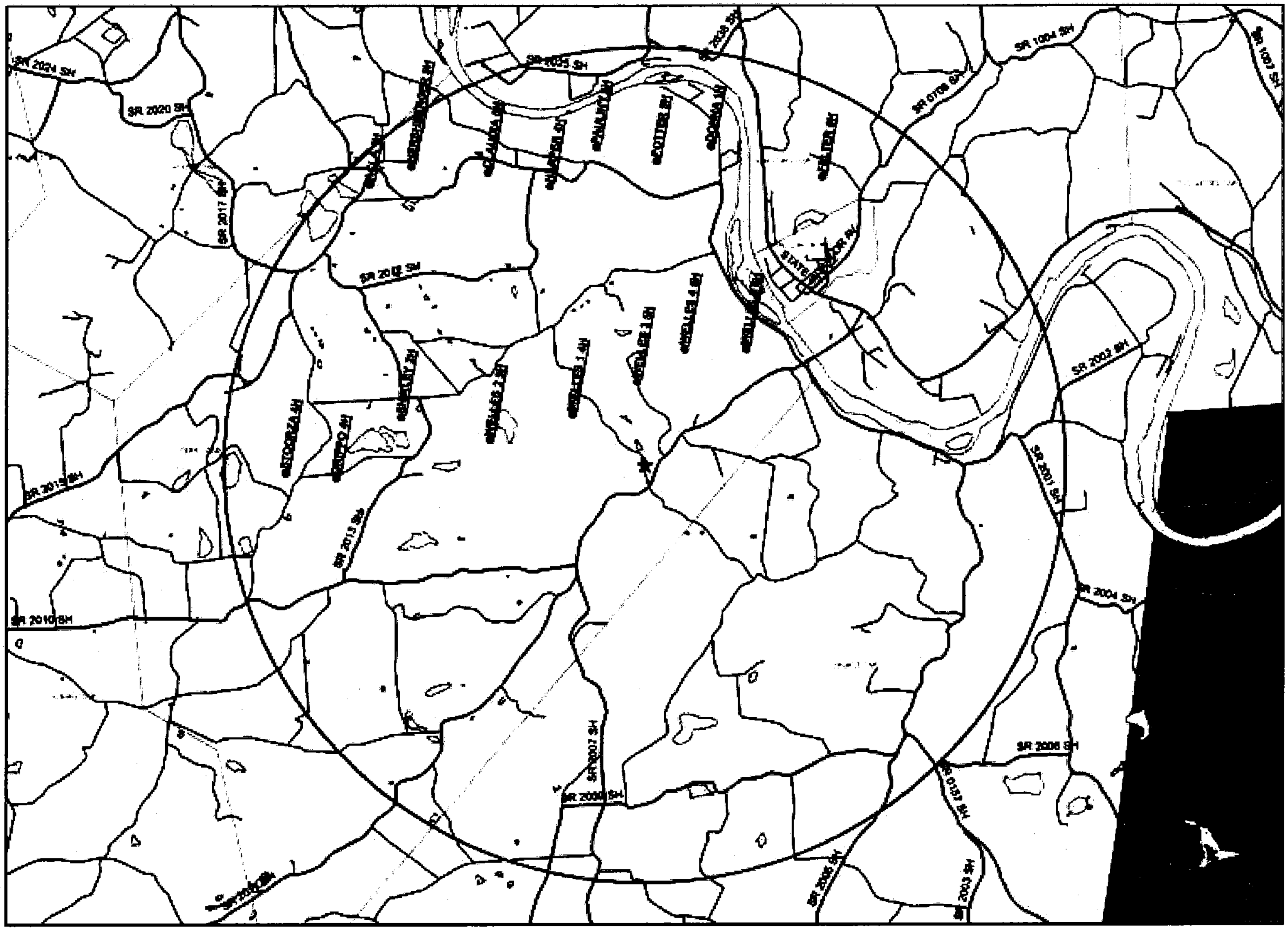
Sivers Beaver Pond Stray Gas Area - 4 Mile Radius



*Permitted Oil and Gas Locations mat contain multiple wells per location. Refer to attached table.

9/27/2010

Paradise Rd Stray Gas Area - 4 Mile Radius



N

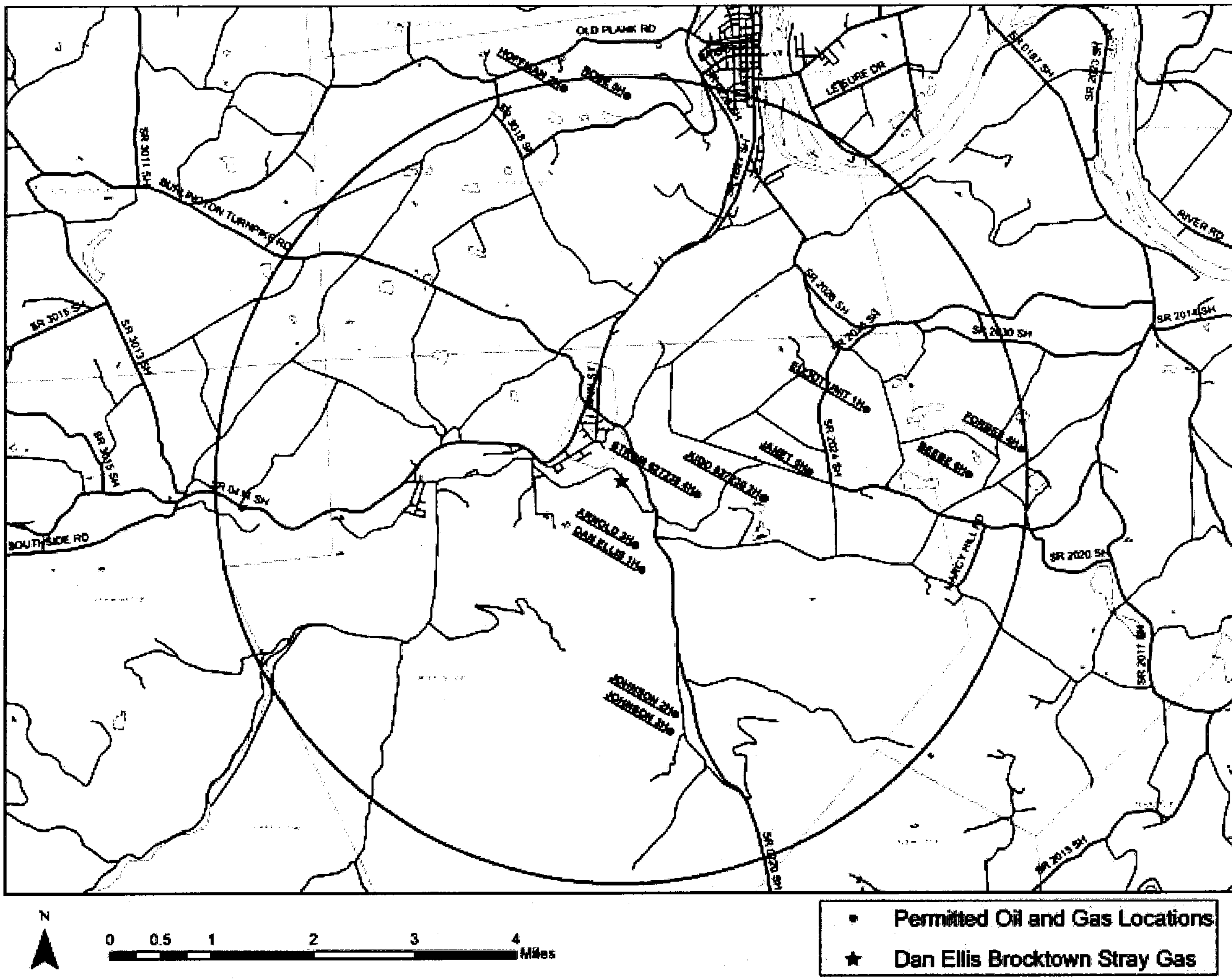
0 0.5 1 2 3 4 Miles

- • Permitted Oil and Gas Location
- ★ Paradise Rd Stray Gas

*Permitted Oil and Gas Locations mat contain multiple wells per location. Refer to attached table

9/27/2010

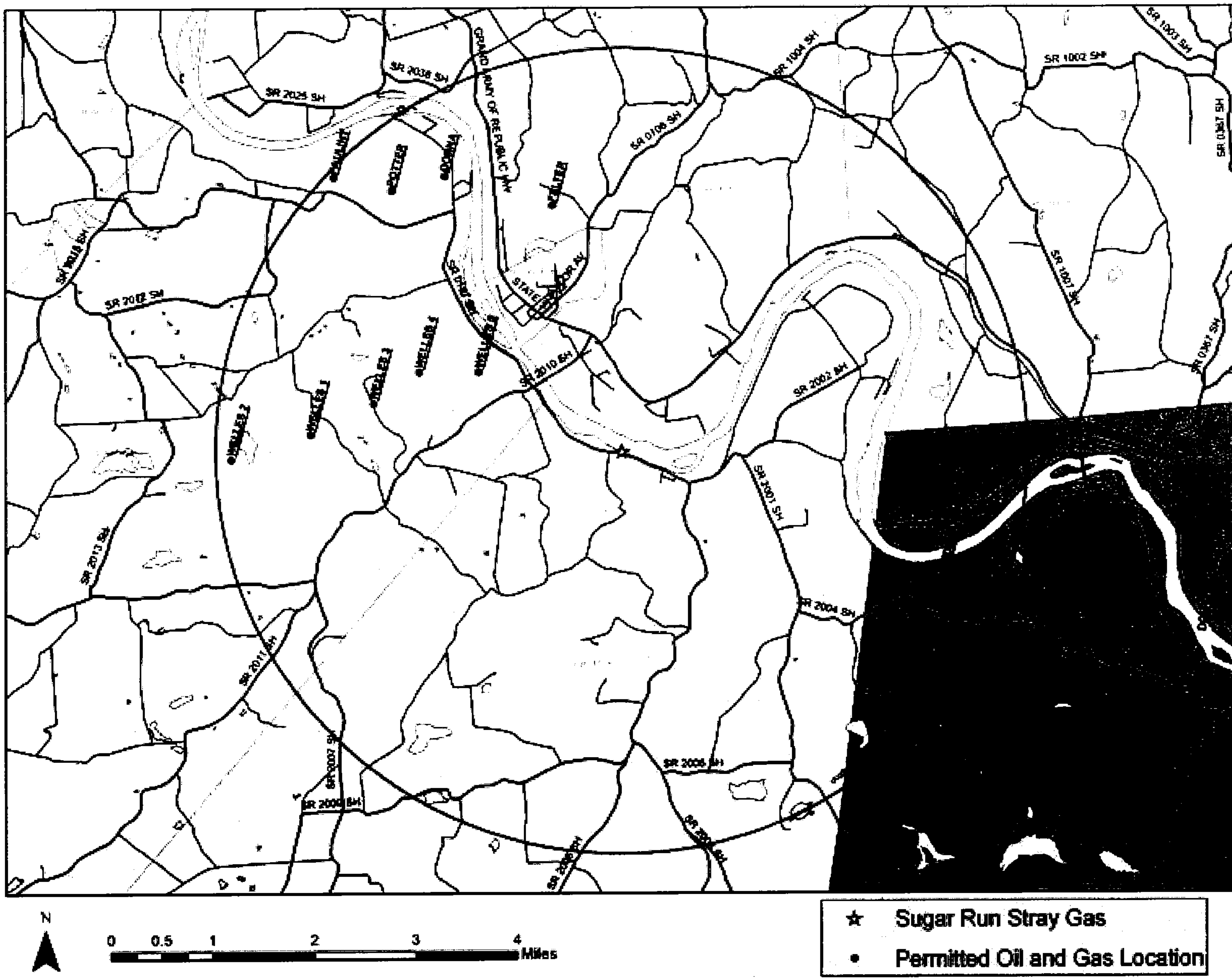
Dan Ellis / Brocktown Rd Stray Gas Area - 4 Mile Radius



*Permitted Oil and Gas Locations mat contain multiple wells per location. Refer to attached table.

9/27/2010

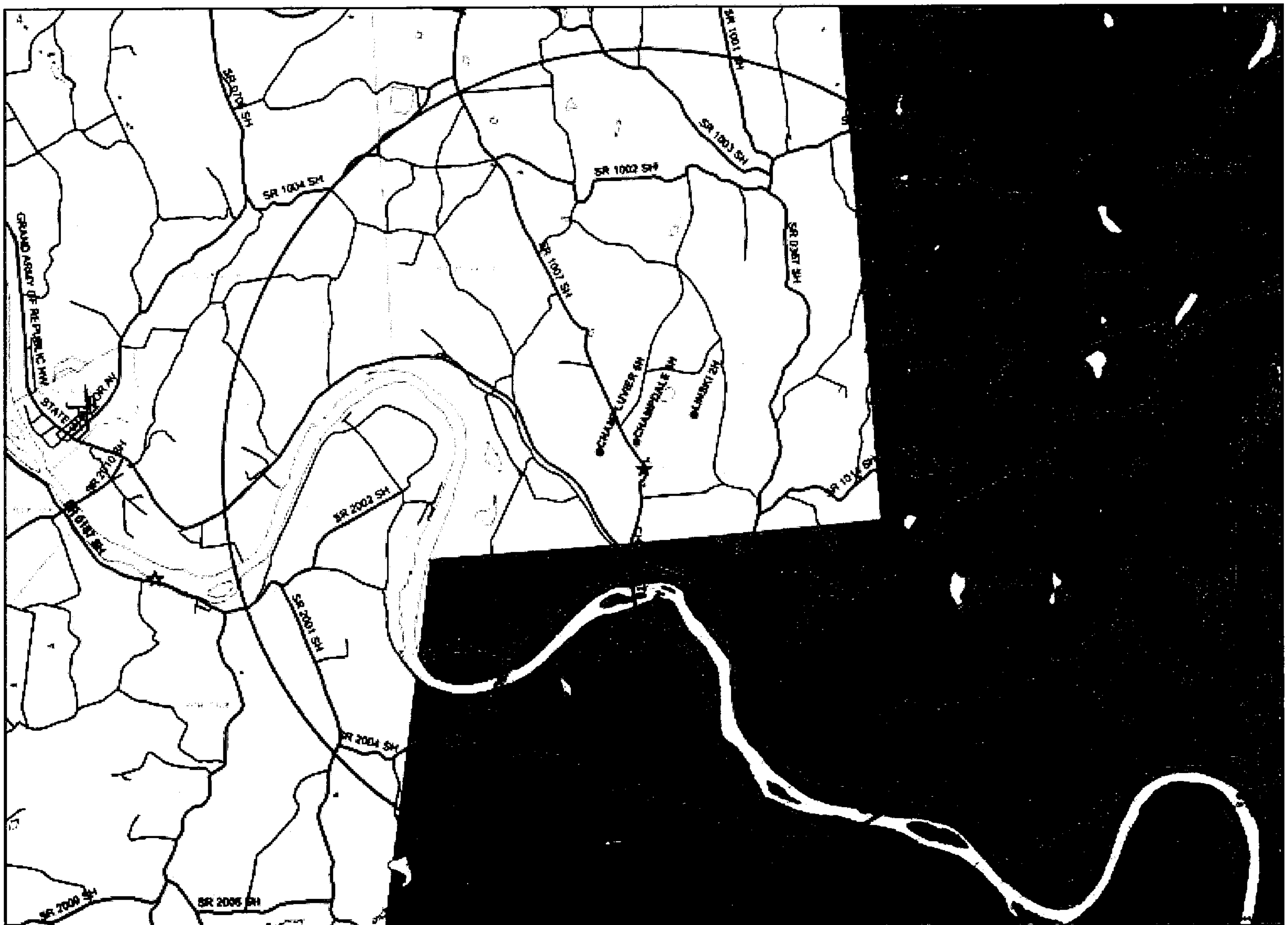
Sugar Run Stray Gas Area - 4 Mile Radius



*Permitted Oil and Gas Locations mat contain multiple wells per location. Refer to attached table.

9/27/2010

Springhill Rd Stray Gas Area - 4 Mile Radius



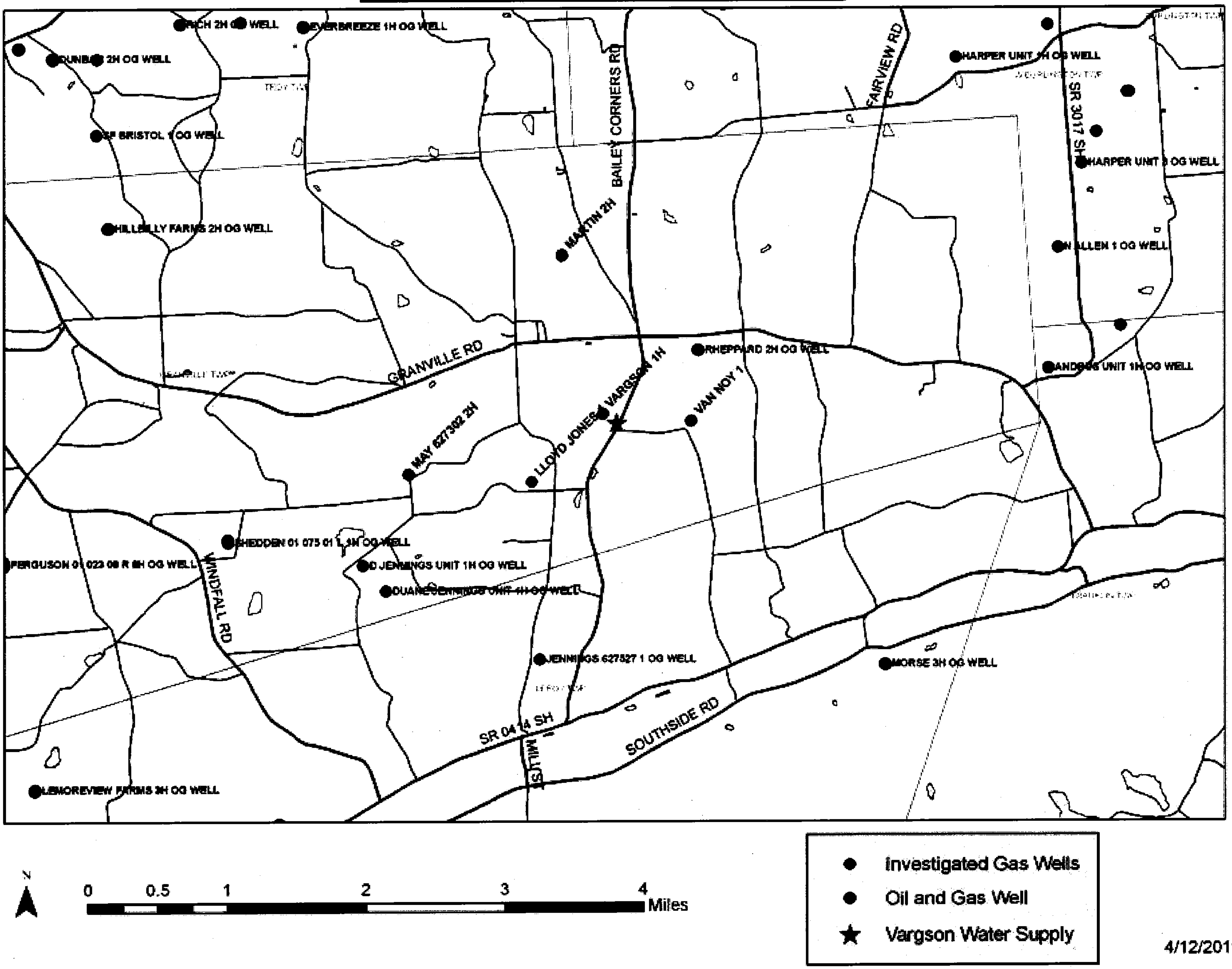
N

0 0.5 1 2 3 4 Miles

★	Springhill Rd Stray Gas
•	Permitted Oil and Gas Location

*Permitted Oil and Gas Locations mat contain multiple wells per location. Refer to attached table.

Vargson - Granville Twp., Bradford County



4/12/2011

EXHIBIT B

PROTOCOL FOR REPORTING WATER SUPPLY COMPLAINTS

(1) Reporting of water supply complaints – combustible gas detected = 10 % LEL

If combustible gas is detected inside a building or structure at a concentration equal to or greater than 10 % LEL, then (A) immediate notification shall be made to the Department, (B) a report shall be filed with the Department by phone and email within 24 hours after the interview with the complainant and field survey of the extent of natural gas, and (C) weekly reports shall be provided to the Department in accordance with (3) and (4) below.

(2) Investigating water supply complaints

All investigations of potential gas migration incidents shall be conducted in accordance with 25 Pa. Code § 78.89, or as subsequently prescribed by applicable regulation.

(3) Information to be reported to the Department

Weekly reports required by (1)(C) above shall include, in addition to what is required pursuant to 25 Pa. Code § 78.89, the following:

(A) The location and type of all gas monitoring equipment installed;

(B) Results of methane readings, if any, in tabular form and including % of methane by volume and % of LEL, from each potentially affected location (water wells, headspace, surface water);

(C) Results of water chemistry data from water well samples and surface water samples, when available, including the location of each sampling point; and

(D) An explanation of any corrective actions undertaken, including a description of any equipment installed.

The first weekly report submitted in connection with any investigation shall identify the nearest Chesapeake gas well and include the following well construction information: well depth, number of casings, length of each casing string, wellbore evaluation results, caliper logs, and cement returns.

The first weekly report submitted in connection with any investigation also shall identify the latitude and longitude and street address of each home, business, farm, water well, surface water body, and structure implicated by the complaint, and the owner or occupier of such.

(4) Timing and form of reports

Weekly reports required by (1)(C) above shall be submitted each Monday, beginning one week after the 24-hour report has been made to the Department in accordance with (1)(B) above. The obligation to submit weekly reports shall continue until a final report is submitted for the incident.

EXHIBIT C

List of Water Supplies

Determination letters pursuant to Section 208(b) of the Oil and Gas Act

Sugar Run

Carl Postupak	8156 Route 187S.	Sugar Run, PA	18846
Don Pickett	RR #1 Box 12	Sugar Run, PA	18846
Robert Baldwin	RD 1 Box 1	Sugar Run, PA	18846
David Buck Well#1	7417 Route 187S	Sugar Run, PA	18846
David Buck Well #2	7417 Route 187S	Sugar Run, PA	18846
Dale Dunklee	7939 Route 187S	Sugar Run, PA	18846
Kenneth Reinhart	480 Table Rock Road	Gettysburg, PA	17325

Paradise Rd

Scott Spencer	RR2 Box 37C Paradise Rd	Wyalusing, PA	18853
Michael Phillips	244 Paradise Rd	Wyalusing, PA	18853
Jared McMicken	224 Paradise Rd	Wyalusing, PA	18853

Brocktown/Dan Ellis

Greg Laws	2420 Brocktown Rd.	Monroeton, PA	18832
Earl Sites (owned by Paul Sites)	2600 Brocktown Rd	Monroeton, PA	18832
Sibley (owned by Paul Sites)	2600 Brocktown Rd	Monroeton, PA	18832

Springhill Rd

John Pary	525 Spring Hill Rd	Laceyville, PA	18623
Ron Brown	3096 Springhill Rd	Laceyville, PA	18623

Vargson

Sherry Vargson	2331 Baileys Corner	Granville Summitt, PA	16926

No determination letter

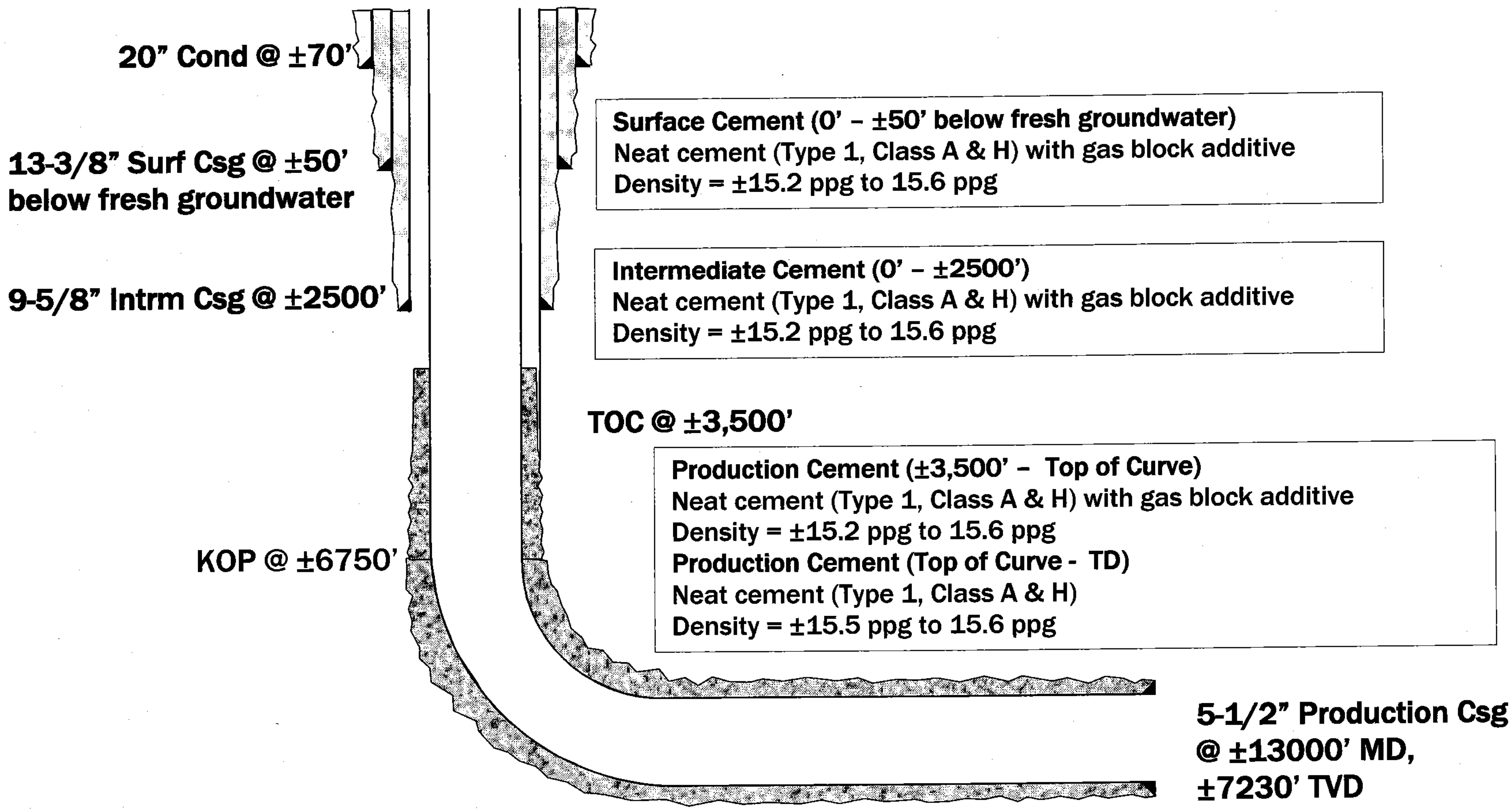
Sugar Run

Peggy Loomis	8081 Rt. 187	Sugar Run, PA	18846

EXHIBIT D

SPECIFICATIONS AND PRACTICES FOR CASING AND CEMENTING

Well Casing and Cement Illustration



Cementing Practices

Conductor

- 26" Hole to minimum depth of ±70'.
- 20" Conductor to be cemented with High Density Cement.
- Record all fresh ground water encountered in the Driller's Log Book.

Surface Section

- 17-1/2" hole to be drilled to minimum of ±50' below base of fresh ground water. In the absence of other data, the depth of fresh ground water is determined primarily by using the known depths of surrounding water wells within a ±2500' radius, and correcting for elevation differences.
- Record all fresh ground water encountered in the Driller's Log Book.
- Circulate and condition hole.
- Run new string of 13-3/8" surface casing.
- Run centralizers in the middle and top of the first joint, top of third joint, and every third to surface.
- Pump ±35 bbls of gelled spacer, ±100 bbls of fresh water, drop bottom plug.
- Pump High Density Cement with gas block additive.
- Drop top plug and displace with water at maximum rate.
- Record volume of cement to surface in the Driller's Log Book.
- Wait on cement for 8 hrs.
- Performing FIT to 15 ppg EMW on surface casing (squeeze shoe if less than 15 ppg EMW).

Cementing Practices (continued)

Intermediate Section

- 12-1/4" hole to be drilled to intermediate casing depth. Intermediate depth is typically at a minimum of ±2000', but is well specific and is based on various data sources and geologic interpretation.
- Circulate and condition hole.
- Run new string of 9-5/8" intermediate casing.
- Run centralizers in the middle and top of the first joint, top of third joint, and every third to surface.
- Reciprocate casing throughout the cement job.
- Pump ±35 bbls of gelled spacer, ±100 bbls of fresh water, drop bottom plug.
- Pump High Density Cement with gas block additive.
- Drop top plug and displace with water at maximum rate.
- Record volume of cement to surface in the Driller's Log Book.
- Wait on cement for 8 hrs.
- Performing FIT to 16 ppg EMW on intermediate casing (squeeze shoe if less than 16 ppg EMW).

Cementing Practices (continued)

Production Section

- 8-3/4", 8-1/2", or 7-7/8" hole to be drilled to casing depth.
- Run new string of 5-1/2" production casing.
- Run centralizers at least from end of curve to TOC on every second joint.
- Prior to cementing, circulate at least three bottoms up annular volumes.
- If possible, reciprocate and rotate casing throughout the cement job.
- Pump minimum of ±50 bbls of weighted chem wash at ±14.0 ppg.
- Drop bottom plug.
- Pump High Density Cement with gas block additive from above curve to TOC.
- Drop top plug and displace with water at maximum rate.
- Wait on cement for 8 hrs and attempt to hold 250 psi on annulus.

EXHIBIT E

STANDARD ANALYSIS CODE 942 LIST OF PARAMETERS

SPECIFIC CONDUCTIVITY @ 25.0 C
pH, LAB (ELECTROMETRIC)
ALKALINITY TOTAL AS CACO3 (TITRIMETRIC)
TOTAL DISSOLVED SOLIDS (TDS)
HARDNESS TOTAL (Calculated)
CALCIUM, TOTAL BY TRACE ELEMENTS IN WATERS & WASTES
MAGNESIUM, TOTAL BY TRACE ELEMENTS IN WATERS &
SODIUM, TOTAL BY TRACE ELEMENTS IN WATERS & WASTES
POTASSIUM, TOTAL BY TRACE ELEMENTS IN WATERS &
CHLORIDE, TOTAL
BARIUM, TOTAL BY TRACE ELEMENTS IN WATERS & WASTES
IRON, TOTAL BY TRACE ELEMENTS IN WATERS & WASTES BY
MANGANESE, TOTAL BY TRACE ELEMENTS IN WATERS &
STRONTIUM, TOTAL BY TRACE ELEMENTS IN WATERS &
TURBIDITY
METHANE
ETHANE
PROPANE

COMMONWEALTH OF PENNSYLVANIA
Dept. of Environmental Protection
Commonwealth News Bureau
Room 308, Main Capitol Building
Harrisburg PA., 17120

FOR IMMEDIATE RELEASE
05/17/2011

CONTACT:
Katy Gresh, Department of Environmental Protection
717-787-1323

DEP Fines Chesapeake Energy More Than $1 Million
Penalties Address Violations in Bradford, Washington Counties

HARRISBURG -- The Department of Environmental Protection today fined Chesapeake Energy $1,088,000 for violations related to natural gas drilling activities.

Under a Consent Order and Agreement, or COA, Chesapeake will pay DEP $900,000 for contaminating private water supplies in Bradford County, of which $200,000 must be dedicated to DEP's well-plugging fund. Under a second COA, Chesapeake will pay $188,000 for a Feb. 23 tank fire at its drilling site in Avella, Washington County.

"It is important to me and to this administration that natural gas drillers are stewards of the environment, take very seriously their responsibilities to comply with our regulations, and that their actions do not risk public health and safety or the environment," DEP Secretary Mike Krancer said. "The water well contamination fine is the largest single penalty DEP has ever assessed against an oil and gas operator, and the Avella tank fire penalty is the highest we could assess under the Oil and Gas Act. Our message to drillers and to the public is clear."

At various times throughout 2010, DEP investigated private water well complaints from residents of Bradford County's Tuscarora, Terry, Monroe, Towanda and Wilmot townships near Chesapeake's shale drilling operations. DEP determined that because of improper well casing and cementing in shallow zones, natural gas from non-shale shallow gas formations had experienced localized migration into groundwater and contaminated 16 families' drinking water supplies.

As part of the Bradford County COA, Chesapeake agrees to take multiple measures to prevent future shallow formation gas migration, including creating a plan to be approved by DEP that outlines corrective actions for the wells in question; remediating the contaminated water supplies; installing necessary equipment; and reporting water supply complaints to DEP. The well plugging fund supports DEP's Oil and Gas program operations and can be used to mitigate historic and recent gas migration problems in cases where the source of the gas cannot be identified.

The Avella action was taken because on Feb. 23, while testing and collecting fluid from wells on a drill site in Avella, Washington County, three condensate separator tanks caught fire, injuring three subcontractors working on-site. DEP conducted an investigation and determined the cause was improper handling and management of condensate, a wet gas only found in certain geologic areas. Under the COA, Chesapeake must submit for approval to the department a Condensate Management Plan for each well site that may produce condensate.

“Natural gas drilling presents a valuable opportunity for Pennsylvania and the nation,” Krancer said. “But, with this opportunity comes responsibilities that we in Pennsylvania expect and insist are met; we have an obligation to enforce our regulations and protect our environment.”

For more information, visit www.depweb.state.pa.us.

Cabot Oil & Gas Corporation
North Region

October 17, 2011

VIA E-MAIL AND OVERNIGHT EXPRESS MAIL

Mr. S. Craig Lobins
Regional Manager
Oil and Gas Management
Pennsylvania Department of Environmental Protection
Northwest Regional Office
230 Chestnut Street
Meadville, PA 16335

Re: -Response to Department's May 9, 2011 letter Dimock and Springville Townships, Susquehanna County
-Request to Resume Natural Gas Drilling and Well Completion Activities
-Consultation Regarding Discontinuation of Temporary Potable Water

Dear Mr. Lobins:

This letter is Cabot Oil & Gas Corporation's response to the Department's letter dated May 9, 2011 ("May 9 Letter").[1] We are hereby renewing our request to resume natural gas drilling and well completion activities in the Dimock/Carter Road Area. In addition, we are seeking your concurrence regarding the discontinuation of the provision of temporary potable water. As further discussed herein, Cabot believes that it is in compliance in all material respects with the Consent Order and Settlement Agreement ("COSA") and that any differences of opinion that may remain regarding Cabot's compliance with the COSA do not pose a risk to allowing Cabot to resume its drilling and well completion activities.

Background

As you know, on December 15, 2010 Cabot and the Department entered into the COSA to address and resolve issues related to methane that exist in water supplies along Carter Road in Dimock, Pennsylvania. Another purpose of the COSA was to provide a mechanism for resumption of gas drilling and completion activities and a mechanism to terminate temporary water supplies. Cabot has aggressively investigated the origin of such methane, including extensive sampling of water supplies in areas where no drilling has yet occurred, to determine comparable background levels of methane in the vicinity. Cabot has also engaged third party consultants and prominent experts to conduct numerous studies and evaluations of these water supplies and Cabot has carefully reviewed its drilling practices with the assistance of these and other experts. Much of this work is memorialized in the COSA, but additional work and study have occurred since the COSA was executed. Cabot has shared this work product with the Department and has also made these experts available to meet and discuss the results with Department representatives. Cabot is happy to provide any additional background information that the Department would require.

As is also memorialized in the COSA, Cabot had agreed to temporarily suspend further drilling and hydraulic fracturing activities in the Dimock/Carter Road Area pending the outcome of these studies. Meanwhile, Cabot continues to undertake natural gas well drilling and hydraulic fracturing activities "outside"

[1] The letter is being sent at this time in accordance with the extension granted by the Department on July 18, 2011, permitting Cabot to submit a response to the May 9 Letter on or before October 17, 2011.

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the Dimock/Carter Road Area and this work has proceeded successfully and in compliance with the Department's regulations. Moreover, other producers with comparable practices have been allowed to proceed with drilling and hydraulic fracturing activities in and around the Dimock/Carter Road Area. This shows that drilling and fracing can be conducted in the Dimock/Carter Road Area without impacting water supplies.

On April 14, 2011, Cabot submitted a letter to the Department requesting notice to resume natural gas well drilling and well completion activities in the Dimock/Carter Road Area. Attached to that letter was the necessary supporting information to allow the Department to provide notice to resume activities, as provided for and set forth in the COSA.

In the May 9 Letter, the Department responded to Cabot's request for notice to resume activities in the Dimock/Carter Road Area and noted that Cabot has complied with most of the obligations set forth in the COSA. However, the Department also suggests that Cabot has not achieved full compliance with some of these obligations. Respectfully, Cabot does not agree that it has not fulfilled all of its obligations under the COSA.

In addition, Cabot had previously requested that it be permitted to discontinue the provision of temporary potable water. The Department's May 9 Letter indicates that Cabot has met all of the requirements contained in the COSA for the discontinuation of temporary potable water. For several residents, the Department requested that Cabot continue providing water for the time being. Cabot now requests that the temporary potable water be discontinued for all residents as the groundwater meets all applicable DEP requirements and there is no valid technical reason to continue providing the water.

Specific Responses to Items Raised in the May 9 Letter[2]

I. Compliance with Environmental Laws and Regulations

The COSA includes a general provision that Cabot agrees to comply with all applicable laws and regulations.

Greenwood 6 Well; Greenwood 7 Well; Greenwood 8 Well

The Department's May 9 Letter identifies three natural gas wells at the Greenwood well pad for which Notices of Violation ("NOVs") were issued and suggests that issues at those wells are considered a failure to comply with the COSA.

First, these three natural gas wells are located outside the Dimock/Carter Road Area and thus are not subject to the compliance obligations set forth in the COSA. Second, it is Cabot's position that the NOVs should not have been issued for these three wells. Cabot believes that each of these wells was properly installed, cased and cemented in accordance with the Department's extensive regulations and the Department-issued permits. Furthermore, the casing and cementing plans were each individually approved by the Department. Cabot, at the Department's request, completed a 30 day pressure build-up test on the annuli identified in the NOVs. At the end of the 30 day test period the annular pressure for all three wells was 0 psi, again supporting Cabot's position that these NOVs should not have been issued.

Finally, an NOV does not constitute a final agency action that determines whether an issue of non-compliance exists. Rather, an NOV serves as the Department's allegation of a non-compliance issue that can be pursued or otherwise resolved. Indeed, the Environmental Hearing Board has held that an NOV is merely a "provisional, interlocutory, decision[]" that does not require a party to take any action, and therefore is not an appealable action. *County of Berks v. DEP*, 2003 EHB 77.

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2 The following items respond point-by-point to the items contained in the Department's May 9, 2011 letter.

Consequently, we request that DEP rescind these NOVs or indicate affirmatively that Cabot has complied with the NOVs. Cabot has worked hard to comply with environmental laws and regulations. In a highly regulated industry, it is always possible that a company will violate a provision of the Department's regulations. Such a violation, however, does not indicate a lack of intent to comply with the laws and regulations or a lack of ability to comply. Thus, the implication that Cabot either has not or will not comply with the Department's laws and regulations is unfounded.

II. Gas in the Annuli of Dimock/Carter Road Natural Gas Production Wells

In the May 9 Letter, the Department states that, "as a general rule, gas (as shown by gas pressure) in an annular space of a gas well indicates that the well has defective, insufficient or improperly cemented casing." This statement is not supported by the comprehensive framework of oil and gas regulations implemented by the Department, which anticipates nominal amounts of gas in the annular space. Specifically,

> [a]fter a well has been completed, recompleted, reconditioned or altered the operator ***shall prevent surface shut-in pressure*** and surface producing back pressure inside the surface casing or coal protective casing ***from exceeding the following pressure: 80% multiplied by 0.433 psi per foot multiplied by the casing length (in feet) of the applicable casing.***

25 Pa. Code § 78.73(c) (emphasis added).

Thus, the "general rule" asserted by the Department neither exists nor is supported by the regulations. Rather, Section 78.73(c) provides the standard for assessing the mechanical integrity of gas wells based on an assessment of the critical hydrostatic pressure exerted on the casing seat. Further, 25 Pa. Code § 78.88 (Mechanical integrity of operating wells) establishes pressure testing as a means of assessing mechanical integrity and includes several references to section 78.73(c).

If the surface shut-in pressure of the annulus is less than 80% of the hydrostatic pressure at the depth of the casing seat then a mechanical failure has not occurred. A pressure of less than 80% presents no risk of migration because any gas in the annular space will follow the path of least resistance to the well head and then be vented into a tank system in accordance with Department regulations.

Gas pressure can and often exists in annular spaces and this is no indication of defective cement or casing. The Department's Technical Advisory Board ("TAB") shares this awareness. Cabot's efforts to survey the Technical Advisory Board ("TAB") suggest that at least four of the five members support the notion that surface shut-in pressure should not exceed 80% x 0.433 psi/ft x the casing length (in feet) of the applicable casing string. *See* 25 Pa. Code § 78.73(c). Thus, the "general rule" asserted by the Department neither exists nor is supported by the TAB or the regulations.

To assert otherwise would require a fundamental and industry-wide attempt to change the Commonwealth's well design criteria and would require considerable input from noted authorities on this topic (i.e., TAB) as well as the various stakeholders involved. None of the wells identified in the May 9 Letter have exceeded the pressure standards set forth in the regulations, except the Teel 7V well. For the Teel 7V well, Cabot is submitting a plan in accordance with the Department's request contained in the May 9 letter.

Further, there is nothing in the Department's regulations that supports the position that 25 Pa. Code § 78.73(c) does not apply to unconventional gas wells. The title of the regulation is "General provision for well construction and operation," 25 Pa. Code § 73, explicitly stating that it applies to all wells Further, since other regulations explicitly discuss unconventional gas wells and 25 Pa. Code § 78.73(c) does not differentiate between conventional and unconventional wells, the regulation applies to both.

It would appear that in the absence of any more specific regulatory definition of what constitutes "defective, insufficient or improperly cemented casing," operators should look to newly promulgated section

78.88 addressing "Mechanical integrity of operating wells." That section identifies progressive corrosion, rusting, and equipment deterioration as indicators of mechanical integrity. None of these indicators were present at the wells at issue in the May 9 Letter. Furthermore, section 78.88 establishes pressure testing as a means of assessing mechanical integrity and includes several references to section 78.73(c). As previously noted, none of the wells at issue here, with the exception of Teel 7V (as discussed above), have exceeded the pressure standards set forth in the regulations.

In addition, no provision of section 78.88 provides that the presence of gas in the annular space is de facto evidence of a "defective, insufficient or improperly cemented casing." While section 78.85(a)(5) provides that the cement that is used in well construction should "prevent gas flow in the annulus," it does not stand for the proposition that there may not be gas present in the annular space. The Marcellus Shale Coalition previously raised this very issue when it provided comments on the Department's proposed "Instructions for Evaluating Well Mechanical Integrity of Operating Oil and Gas Wells - Form 5500-FM-OGXXXX."

Moreover, while not specific to oil and gas wells, 25 Pa. Code Sections 78.401 – 78.407, Subchapter H for Underground Storage Wells, recognize the reality that gas is often found in the annular space of a properly cemented well. In recognition of the venting process that then takes place for these types of wells, the Department has set out a maximum allowable amount of venting per day. The small amounts of gas identified in Cabot's oil and gas wells within the Dimock/Carter Road Area do not come close to reaching the regulatory maximum for underground storage wells. Considering this, the presence of a nominal amount of gas in the annular space is not an indication that Cabot's oil and gas wells are defective, nor is it an indication that Cabot's oil and gas wells pose a threat of methane gas migration into nearby water supplies.

Accordingly, Cabot appreciates the opportunity afforded by the Department to discuss technical issues with respect to nominal amounts of gas in the annular space. Cabot urges the Department to recognize that this very common occurrence is not grounds for further delaying the Company's ability to conduct drilling and hydraulic fracturing activities within the Dimock/Carter Road Area.

Information Requested by DEP:

The May 9 Letter identifies the following and requests a response:

> [T]he Gesford 2 gas well was one of 14 'Defective Wells' identified by the Department in the 2009 Modified Agreement between the Department and Cabot. Nonetheless, Cabot did not inform the Department within 24 hours of discovery of the gas in the Gesford 2 gas well and in the other gas wells that Cabot tested in November and early December. In fact, Cabot did not inform the Department of this gas in the annular space of the Gesford 2 gas well and other gas wells until *after* execution of the 2010 Agreement. [The Department seeks] a written explanation about why [Cabot] did not inform the Department of these material facts within 24 hours of discovery and before execution of the 2010 Agreement.

May 9 Letter at 3.

Cabot's Response:

With respect to the Gesford 2 gas well, Cabot did not believe and still does not believe that any notice obligations under the regulations were triggered by data indicating the presence of nominal amounts of gas in the annular space. Notably, the gas levels detected at the Gesford 2 well (78 psi) were substantially below the conservative threshold set forth in Pennsylvania's regulations (i.e., 80% of hydrostatic pressure which would be 359 psi for the Gesford 2 well). Although 25 Pa. Code Section 78.86 discusses "defective, insufficient or improperly cemented casing," it is our view that Section 78.86 cannot be used to bootstrap a well that is in compliance with all other Department regulations into a well that is in violation. In other words, it is not Section 78.86 that defines what is a defective, insufficient or improperly cemented casing, but rather that Section merely establishes a reporting requirement.

Cabot has been working directly and closely with the Department throughout the process of evaluating the Dimock/Carter Road gas wells, including taking pressure readings and providing data on several occasions at the Department's request, all of which it performed in a timely fashion.

Information Requested by DEP:

DEP seeks information regarding the Category I and II wells. May 9 Letter at 4.

Cabot's Response:

Category I Wells

There are six Category I wells. These wells include:

Brooks 1H
Ely 4V
Ely 5H
Gesford 2
Ratzel 2H
Ratzel 3V

Cabot has conducted additional testing of these wells, including determining the annular flow rate, conducting 48-hour pressure buildups on annuli, and running temperature / noise logs on selected wells. But for the Brooks 1H well, Cabot's additional testing of the Category I wells demonstrate that the wells have a decrease in annular pressure. Further, the temperature / noise logs that have been conducted demonstrate that there is no indication of gas migration. The following table provides a summary of Cabot's additional testing of the Category I wells, the actions taken, and the action plan (where applicable).

Category I Gas Wells

Well Name	Comments	Action Taken	Action Plan
Brooks 1H	Annular pressure increased	Vent Annulus	Cement Squeeze
Ely 4V	Annular pressure zero	Vent Annulus	None
Ely 5H	7x9=1 psi, 4x7=0 psi Temp/noise log shows no gas migration	Vent Annulus	None
Gesford 2	Annual pressure decreased Temp/noise log shows no gas migration	Vent Annulus	None
Ratzel 2H	Temp/noise log shows no gas migration	Vent Annulus	None
Ratzel 3V	7x9=0 psi, 4x7=2 psi Temp/noise log shows no gas migration	Vent Annulus	None

On September 30, 2011, Cabot submitted a proposed workover procedure to the Department's North Central Regional Office to perform a cement squeeze on the Brooks 1H well. On October 13, 2011, Cabot submitted a minor revision to the workover procedure to the Department.

Further detailed information on the Category I wells is provided in slides 174 – 207 of the PowerPoint Presentation included as Attachment A.

Category II Wells

There are eight Category II wells. These wells include:

Costello 1V
Ely 1H
Grimsley 1V
Heitsman 4H
Hubbard 5H
Hull 1H
Teel 6V
Teel 13V

Like the Category I wells, Cabot has conducted additional testing of the Category II wells, including determining the annular flow rate, conducting 48-hour pressure buildups on annuli, and running temperature / noise logs on selected wells. Cabot's additional testing of the Category II wells demonstrate that six of the wells have a decrease in annular pressure, one well had a minor annular pressure increase (to 6 psi), and the remaining well had an annular pressure increase of 21 psi.

The following table provides a summary of Cabot's additional testing of the Category II wells, and the actions taken.

Category II Gas Wells

Well Name	Comments	Action Taken	Action Plan
Costello 1V	4x7 pressure increased	Vent Annulus Ran temp/noise log Shows no gas migration	None
Ely 1H	4x7 pressure decreased	Vent Annulus	None
Grimsley 1V	Annular pressure decreased, 5x9=1 psi	Vent Annulus	None
Heitsman 4H	Annual pressure flat	Vent Annulus	None
Hubbard 5H	7x9=6 psi, minor increase, 4x7=32 psi, minor decrease	Vent Annulus	None
Hull 1H	Annular pressure decreased	Vent Annulus	None
Teel 6V	Annular pressure decreased	Vent Annulus	None
Teel 13V	Annular pressure decreased	Vent Annulus	None

Further detailed information on the Category II wells is provided in slides 208 – 247 of the PowerPoint Presentation included as Attachment A.

Information Requested by DEP:

DEP seeks information regarding the Category III wells. May 9 Letter at 4.

Cabot's Response:

__Category III Wells__

It is our understanding from the meeting held with DEP on June 7, 2011, that Cabot has provided adequate information and the Department does not consider the wells in Category III to be in violation. Cabot will check the Teel 7V well, pursuant to the procedure to be submitted to the Department, to check for a well head seal leak. Other than for the Teel 7V well, no further information is required to be provided to the Department. The following table provides a summary of Cabot's additional testing of the Category III wells, the actions taken, and the action plan (where applicable).

Category III Gas Wells

Well Name	**Comments**	**Action Taken**	**Action Plan**
Ely 7H	Zero annular pressure	Vent Annulus	None
Gesford 1V	Annular pressure decreased, 5x8 =1 psi	Vent Annulus	None
Hubbard 1V	Zero annular pressure	Vent Annulus	None
Kelley, P. 1H	Annular pressure decreased	Vent Annulus	None
Ratzel 1H	Annular pressure decreased	Vent Annulus	None
Teel 2V	Annular pressure increased on 4x7, TOC below shoe	Vent Annulus	Monitor flow
Teel 5V	7x9= 0 psi, 4x7= 3 psi	Vent Annulus	None
Teel 7V	Annular pressure increased	Vent Annulus	Check for wellhead seal leak

Further detailed information on the Category III wells is provided in slides 248 – 287 of the PowerPoint Presentation included as Attachment A.

Information Requested by DEP:

The May 9 Letter identifies the following and requests a response:

> [F]or each Cabot Gas Well in Categories I-III, the Department requests that Cabot: submit sufficient written information to show that Cabot has completed all corrective actions necessary to fix the leak, and/or fix the defective, insufficient, or improperly cemented casing, and/or other defect in

> compliance with 25 Pa. Code § 78.86, and that tests show no gas pressure for the well; or submit a written plan, for approval by the Department, that identifies the specific corrective action that Cabot will take to fix the leak, and/or fix the defective, insufficient, or improperly cemented casing, and/or other defect in compliance with 25 Pa. Code § 78.86.

May 9 Letter at 4.

Cabot's Response:

As a general response, see our statement at the beginning of this section. Cabot disagrees that the mere presence of any gas in the annular space means that the casing is "defective, insufficient, or improperly cemented."

Further, the information provided above concerning the Category I and II wells demonstrates that Cabot has either completed all corrective action regarding the wells, or has submitted a plan for corrective action to the Department. The following additional information responds to the Department's request.

Retesting of pressure in certain annuli

During the meeting with the Department on October 11, 2011, Department staff requested that Cabot re-test the pressure in particular annuli of certain gas wells where Cabot's recent pressure testing data showed anomalous results. These gas wells / annuli include:

Gas Well	Annuli
Costello 1V	4 x 7
Heitsman 4H	4 x 9
Hubbard 5H	4 x 7 and 7 x 9
Hull 1H	5 x 9
Teel 6V	4 x 7
Ratzel 1H	4 x 7

Cabot will re-test the pressure in the above-named wells / annuli using a 72-hour pressure test. Cabot will provide the Department with the results of the re-testing.

Additional information regarding cement squeezes

During the meeting with the Department on October 11, 2011, Department staff requested that Cabot provide to the Department additional information regarding gas wells where Cabot has performed a cement squeeze. Specifically, Department staff requested that Cabot provide the specific location within each wellbore that was squeezed.

Cabot is providing additional information responsive to the Department's request as an attachment to this letter. The information is included as Attachment B.

III. Screenings and Sampling of Water Supplies

Cabot's contractor and DEP-certified laboratory have been regularly testing 7 water supplies out of the 18 identified in the COSA. Of the remaining 11 wells, all are plaintiffs and only six (6) have regularly allowed Cabot to sample. Three (3) of the plaintiffs have refused all efforts to sample their water and two (2) on occasion have permitted sampling. The May 9 Letter requests that Cabot again seek plaintiffs' counsel's consent for access to the remaining plaintiffs' homes to conduct water and CGI testing.

Information Requested by DEP:

DEP requests that "Cabot meet with the current Attorneys for the Appellants and take any and all other reasonable action necessary to obtain the Appellants' consent to assess their properties to conduct the water sampling and well head screening as required under Paragraph 5.b of the 2010 Agreement." May 9 Letter at 5.

Cabot's Response:

By letter dated June 1, 2011, Cabot again asked plaintiffs' counsel for permission to conduct the testing of the plaintiff property owners' water supplies. In response, plaintiffs' counsel again refused to permit Cabot or its contractors, including Quantum Laboratories, to enter their property to conduct water sampling and CGI testing. At plaintiffs' counsels' request, Cabot identified another third-party water testing company for the plaintiffs' counsels' consideration. Cabot will promptly notify the Department if and/or when plaintiffs' counsel responds to Cabot's proposal.

On October 14, 2011, counsel for the plaintiffs advised that his clients would now provide Cabot access in order to conduct testing of their water.

Information Requested by DEP:

DEP states the following:

> If, within forty (40) days of the date of this letter, Cabot provides sufficient information in writing, to show that, after meeting(s) and other reasonable actions by Cabot, the current attorneys for the Appellants continue to deny Cabot the necessary access, the Department will consider the option of the Department obtaining access from the Appellants and conducting the water sampling and well head screening at their properties in accordance with Paragraph 5.b. of the 2010 Agreement. However the Department will consider this option only upon Cabot's agreement, in writing, to reimburse the Department within thirty (30) days of receipt of the invoice for all applicable costs incurred by the Department for the previous month.

May 9 Letter at 5-6.

Cabot's Response:

Cabot intends to communicate immediately with plaintiffs' counsel to obtain access for testing in accordance with counsel's October 14, 2011 e-mail. If such effort is unsuccessful, Cabot will request that the Department obtain access to Appellants' respective properties and conduct sampling, or assist Cabot in obtaining access to Appellants' respective properties. Cabot agrees to reimburse the Department within thirty days of receipt of an invoice for reasonable expenses incurred in obtaining access to Appellants' properties and sampling (if conducted by the Department).

IV. Ely 2H and Ely 6H Gas Wells

Cabot agrees with and appreciates the Department's acknowledgement that the Ely 2H and 6H wells are in compliance with the COSA.

V. Escrow Funds and Temporary Water

a. Cabot's Compliance with the COSA Escrow Fund Obligations

The Department contends that Cabot failed to timely fund an escrow account. Exhibit D of the COSA expressly identifies only 18 property owners and the corresponding dollar amount that Cabot was required to fund for each of those property owners. Cabot funded each of those 18 escrow accounts on January 14, 2011, within the time set forth in the COSA. On January 19, 2011, Cabot advised the 18 property owners identified on Exhibit D of the COSA that Cabot had funded the escrow accounts and provided instructions for obtaining the funds. Thus, Cabot had fully complied with its escrow funding requirements under the COSA.

The Department later informed Cabot that a tenant (and son) of one of the property owners had been inadvertently excluded from Exhibit D. Cabot then worked closely with the Department to address promptly the concern and subsequently funded a nineteenth escrow account with a portion of the funds escrowed for the owner of the subject property. It is not clear what more Cabot could or should have done under these circumstances.

Thus, we request that you rescind the suggested civil penalty under these circumstances.

b. The Department's Request that Cabot Continue to Supply Temporary Potable Water and Cabot's Request that DEP permit the termination of Temporary Potable Water

Termination of Temporary Potable Water

Cabot appreciates the Department's acknowledgement that Cabot has complied with its obligations under Paragraphs 6.b. through 6.f. of the COSA as relates to the restoration and replacement of water supplies. However, in its May 9 letter, the Department requested that Cabot continue to provide temporary potable water to Dimock/Carter Road residents.

As you know, Cabot has been providing temporary supplies of fresh water to many residents in the Dimock area for many months and, in some cases, for years. Some of the temporary water supply systems were installed in January 2009. Others were installed or began[3] later. During the past few months, at my direction, Cabot has undertaken a careful review of this temporary water supply situation. I have spoken with the Cabot professionals and the third-party experts who have been involved with the water supply concerns in Dimock, reviewed their reports and I also have reviewed the history of the various Department enforcement actions and settlements.

Furthermore, Cabot's extensive evaluations of undrilled areas throughout Susquehanna County demonstrate that pre-existing, naturally-occurring methane is common in groundwater. Specifically, data from approximately 2,000 pre-drill samples demonstrate that 80% of groundwater samples have detectable levels of pre-existing methane.

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[3] These temporary water supplies have been delivered or arranged using different containers or methods as selected by the homeowners. In some cases, Cabot has arranged for deliveries of bottles of drinking water, since that was the preference of the homeowner. In other cases, whole house systems have been installed and plumbed into homes so as to temporarily substitute the source of fresh water by a connection to a homeowner's water well.

As a result of this review, we have reached several conclusions. First, these temporary water supplies were initiated because of a concern for potential impacts to permanent water supplies. Cabot unilaterally arranged for the first temporary water supplies when it decided in January 2009 to provide whole house temporary water supplies to four homes on Carter Road in Dimock. Second, Cabot installed those systems because Cabot was informed that there was a safety concern and it was not immediately clear that Cabot was not the cause of that safety concern. I am proud to work for a company that responds in this fashion. We made sure that these four homes were safe, even if these temporary measures later turned out to be unnecessary. Third, subsequently, it was decided that several more homes and homeowners should receive temporary water supplies – and this decision was later memorialized in a settlement agreement. Specifically, the COSA identified nineteen[4] Dimock-area property owners (the "Property Owners") who were to continue to receive temporary water supplies until certain conditions were met. Cabot and the Department had the same interest in mind – to put temporary measures in place to ensure the safety of homeowners and residents while scientific studies could be completed and, based upon those studies if or where necessary, permanent remedies could be implemented. Fourth, now that those studies are complete, and for other reasons discussed below, we have concluded that it is appropriate to discontinue the temporary water supplies.[5]

Consequently, Cabot is writing to inform you that it seeks the Department's concurrence to discontinue deliveries of bottled and bulk fresh water to the Property Owners effective November 30, 2011. The Property Owners' permanent water supplies have been repeatedly tested by Department-approved, Pennsylvania-certified professional laboratories and the results confirm that the water supplies are safe to drink and are safe to use for residential purposes (bathing, drinking, laundry, showering, dishwashing, etc.) relative to the parameters analyzed. The various test results were submitted to the Department via e-mail on October 12, 2011, and are enclosed with this letter as Attachment C.

All of the identified substances present in the Property Owners' water supplies are at levels below the Department's and EPA's primary drinking water regulations maximum contaminant levels, established to protect the public health. To the extent that there are various miscellaneous elements, metals or minerals present in the water supplies, Cabot has discussed these results with its professional environmental consultants who compared the results with those from other water wells in Susquehanna County and from adjacent counties in areas where natural gas well drilling has yet to occur. Our professional consultants confirm that the substances found in the Dimock water supply are typical of what is found in these other undrilled areas. The presence of any of these constituents may be naturally-occurring or caused by other activities, but they are unrelated to natural gas exploration and production activities.

Thus, the primary reason to discontinue these temporary water supplies now is, simply, that they are no longer needed (and have not been necessary for quite some time or never needed). As mentioned above, each of the water wells have been professionally sampled and professionally tested on multiple occasions over many months by independent, state-approved environmental testing laboratories and this testing confirms that the water is safe to use and to drink relative to the parameters analyzed. To the extent that there is any concern with the detectable presence of methane in some of these water wells (as you know, there are no known health effects associated with the ingestion of water containing methane), Cabot either has installed or remains

[4] As noted on page 8 of this letter, the COSA identified eighteen property owners. The parties included a nineteenth property owner upon the realization that one property owner had been inadvertently excluded.

[5] We appreciate that the Department earlier confirmed in the May 9 Letter that Cabot had satisfied the restoration and replacement of water supplies requirements under the COSA section entitled "Settlement of Restoration/Replacement Obligation," paragraphs 6.a through 6.f,. Thus, we believe that pursuant to paragraph 6.c, Cabot was officially informed that it could cease further efforts related to provision of temporary water supplies for the Property Owners.

willing to install a whole-house methane mitigation water treatment device that removes methane from the water to a level of 5 mg/l (5 parts per million) or less.

To effectuate discontinuance of temporary water supplies, on or before November 1, 2011, Cabot will send written notices to the Property Owners (through counsel as necessary). In that notice, Cabot will inform each Property Owner that, for a period of sixty days, a professional plumber will be available to reconnect water well supplies at no expense to the Property Owner and, if requested, to install a whole house methane removal system, again at no expense to the Property Owner. Homeowners who accept this offer, in writing, prior to November 30, 2011 will continue to receive temporary water supplies until the work is completed, unless Cabot determines that any delay in scheduling the work is the result of failure to allow access on a reasonable schedule. Cabot will explain in the notice that, for those Property Owners who refuse to allow testing of their permanent water well supply, Cabot will discontinue deliveries at its earliest opportunity, and will not wait until November 30, 2011 to discontinue deliveries of fresh water.

Cabot seeks the Department's concurrence in this request.

VI. Status of Request for Notice to Resume Drilling/Hydro-fracturing Within the Dimock/Carter Road Area

We disagree with the Department's position that Cabot may not begin any "hydro-fracturing" or new drilling in the Dimock/Carter Road Area until the Department receives and approves further information and/or remedial work. In the May 9 Letter, the Department attempts to apply different standards and conditions beyond those expressly established in the COSA. Cabot, however, has complied with the COSA.

As is discussed above, there has never been a basis or reason to interrupt hydraulic fracturing and thus notice to resume this work should be provided immediately. In fact, the Department has publicly stated that hydraulic fracturing is neither a suspected or actual cause of any groundwater/water supply issue. Indeed, other drilling companies ***currently*** are drilling and conducting hydraulic fracturing activities within the Dimock/Carter Road Area – the same area that Cabot is precluded from.

In addition, Cabot has successfully proceeded with the drilling and fracing of new gas wells outside the Dimock/Carter Road Area in compliance with Department regulations. Cabot and the Department have worked closely to develop and implement drilling, casing and cementing approaches that meet or exceed both the prior and newly-revised regulations. Thus, gas drilling is occurring all around the Dimock/Carter Road Area without any threat to water supplies. Cabot should be permitted to resume this work in the Dimock/Carter Road Area.

<u>Additional Information Discussed in October 11, 2011 Meeting</u>

1. Background on methane concentration

The Upper Devonian age Catskill formation is charged with pre-existing natural gas that is naturally occurring and that pre-exists oil and gas drilling activity. As a result of erosion, the Catskill formation crops out and forms the bedrock throughout most of Susquehanna County. In other portions of Susquehanna County, the Catskill formation underlies layers of glacial till and/or recent alluvium. Valleys and drainages in Susquehanna County are developed parallel and coincident with joints and fractures in the Catskill bedrock. Furthermore, organic material contained within the sandstones and siltstones of the Catskill formation has matured through deep burial over geologic time and has reached a maturation level sufficient to produce dry methane gas from the organic material. The naturally occurring 'stray gas' is now contained within the various lithologic layers of the Catskill formation located at or near the ground surface in Susquehanna County. Based upon Cabot's (1) direct observation and measurement of shallow, background, stray gas while drilling gas wells and from locating at least one natural gas seep in outcrop, (2) interviews with experienced water well drillers and long time resident Citizens in Susquehanna County and, (3) data collected from extensive review of the technical and popular literature, it is indisputable that the occurrence of the 'stray gas' is a natural phenomenon in northeast Pennsylvania. *See* PowerPoint slides 13-21, Attachment A.

Most water wells in Susquehanna County are drilled into the Catskill formation to a depth sufficient to encounter water production rates to supply a single family home and also penetrate the sandstone and siltstone layers in the Catskill bedrock that can contain 'stray gas.' Based upon the sampling and mapping of the dissolved methane in more than 1800 water wells that produce from the Catskill formation and interviews with area drillers and homeowners, the measurement of 'stray gas' in the water wells of the region is observed to have a higher rate of occurrence in water wells located in valleys. The interpretation of data from isotopic measurements from these water wells also shows that the source of the 'stray gas' is the Upper Devonian age rocks of the Catskill formation (and not Marcellus shale gas). In addition, water wells that produce from the glacial till or alluvium may or may not have as much methane as water wells drilled into the Catskill formation and based upon the interpretation of isotopic measurements from these types of water wells that do contain methane, the 'stray gas' found in these water wells is biogenic in origin (or stray Catskill formation gas).

The background levels of naturally occurring methane measured in water wells in Susquehanna County is highlighted in Attachment D.

The data used to generate the above map is included in this response as Attachment E. The data demonstrates the presence of naturally occurring methane in literally thousands of locations in Susquehanna County. Importantly, the geographic distribution patterns of pre-existing methane in areas where there has been no oil and gas drilling activity is statistically equivalent to the methane concentrations within the Dimock / Carter Road Area.

2. Methane concentrations fluctuate naturally

Methane concentrations in water fluctuate naturally based on many factors. These factors include the domestic use of water, precipitation and the hydrostatic column of a water well, the seasonal fluctuation in aquifer levels, barometric pressure (impacting head space gas), the presence of a snow / ice cap, the maintenance of a water well, and the use of surrounding water wells.

Thus, the background of methane concentration is a range and not a fixed number. The variability of methane concentrations is indicative of this background range. The water well data collected by Cabot over the last several months (and in some cases years) illustrate this variability.

3. There is no correlation between methane concentrations and the concentration of aluminum, iron, manganese, and pH.

Cabot has collected water sampling data on the water wells throughout the Dimock / Carter Road Area. The data include extensive information on the concentration of methane, in addition to the concentration of metals such as aluminum, iron, manganese, along with pH.

Cabot has not identified any correlation between methane concentrations and the concentration of aluminum, iron, manganese, and pH. The lack of any correlation suggests that the concentration of aluminum, iron, manganese, and pH in the samples represents background levels for those constituents.

4. Depth of Water Wells

During the meeting with the Department on October 11, 2011, Department staff raised questions about the depth of certain water wells within the Dimock / Carter Road Area. Although Cabot has sought construction records for these water wells, such records do not exist for all of the wells. In those cases, Cabot has either obtained anecdotal information from the property owner regarding the presumed depth of the water well, or determined that information on the depth of the water well is unavailable. Attached hereto as

Attachment F is a table that sets forth the depth (or presumed depth, where indicated) of the water wells in the Dimock / Carter Road Area.

The data indicate that the depth of water wells within the Dimock / Carter Road Area vary significantly. Further, the presence of e. coli in certain water wells (as demonstrated in the water sampling data supplied to the Department on October 12, 2011) indicates that such wells are under the influence of surface water and/or septic systems.

Conclusion

Cabot wishes to thank the Department for providing Cabot with the opportunity to present this information to the Department. In light of Cabot's compliance with the COSA, we are renewing our request to resume natural gas drilling and well completion activities in the Dimock/Carter Road Area. In addition, we are seeking the Department's concurrence regarding the discontinuation of the provision of temporary potable water.

In closing, please allow Cabot to express its appreciation for the time and attention the Department has invested in this matter.

Sincerely,

Phillip L. Stalnaker
Vice President, Regional Manager – North Region

ATTACHMENTS

cc: Alisa Harris, Special Deputy Secretary for External Affairs (w/ attachments)
Scott R. Perry, Deputy Secretary for Oil and Gas (w/ attachments)
David J. Raphael, Chief Counsel (w/ attachments)

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

NORTHCENTRAL REGION

October 20, 2011

CERTIFIED MAIL NO. 7010 2780 0001 8652 0278

Mr. Phil Stalnaker
Cabot Oil and Gas
Five Penn Center West
Suite 401
Pittsburgh, PA 15276

Re: Gas Migration Investigation
Springville Township, Susquehanna County

Dear Mr. Stalnaker:

In June 2010, Cabot Oil and Gas (Cabot) provided to the Department a list of private residences that were being supplied drinking water by Cabot as required by the Consent Order and Agreement (which was initially signed on November 4, 2009, and subsequently modified on both April 15 and July 19, 2010) related to the Consent Order and Settlement Agreement finalized on December 15, 2010. The Department subsequently visited all of the residences on the list provided, and collected water samples from each location. One of the residences sampled is within close proximity to the G. Shields well pads located on Township Rd T-382 in Springville Township. Cabot indicated they have been providing supplied water to this residence since January 15, 2010. The private water supply is located approximately 700 feet from the gas well pad housing the G. Shields 2H Well, Permit 115-20118, and the G. Shields 4H Well, Permit 115-20181, and is approximately 1700 feet from the gas well pad housing the G. Shields 1V Well, Permit 115-20092, and the G. Shields 5H Well, Permit 115-20170. Samples were collected from the private water supply on November 18, 2010, February 7, 2011, March 2, 2011, April 19, 2011, and June 29, 2011. Below is a table showing the levels of dissolved methane detected in the water supply.

Date Collected	Dissolved Methane (mg/L)
Pre – drill August 20, 2009	23
November 18, 2010	83.7
February 7, 2011	78
March 2, 2011	67.6
April 19, 2011	76.6
June 29, 2011	53.6

Combustible gas was also detected in the headspace of the affected private water well. Additionally, an inspection of the above referenced four natural gas wells documented the presence of natural gas between various casing strings.

The Department's investigation has revealed the following violations of the Oil and Gas Act, 58 P.S. § 601.101 et seq., the Clean Streams law, 35 P.S. § 691.1 et seq., and the rules and regulations promulgated under these statutes:

1. Failure to prevent migration of gas or other fluids into sources of fresh groundwater

   The Department's investigation revealed that Cabot has caused or allowed gas from lower formations to enter fresh groundwater in Springville Township, Susquehanna County. This is a violation of the Department's regulations, 25 Pa Code §78.81(a) (2) and (3) which provides:

   "The operator shall conduct casing and cementing activities under this section and §§78.82-78.87 or an approved alternate method under §78.75 (relating to alternative methods). The operator shall case and cement a well to accomplish the following:

   Prevent the migration of gas or other fluids into sources of fresh groundwater. Prevent pollution or diminution of fresh groundwater."

2. Defective Casing or Cementing

   Cabot failed to report the defective, insufficient, or improperly cemented casing. This is a violation of the Department's regulations, 25 Pa Code §78.86(a) which provides:

   "In a well that has defective, insufficient or improperly cemented casing, the operator shall report the defect to the Department within 24 hours of discovery by the operator and shall correct the defect. The operator shall correct the defect or submit a plan to correct the defect for approval by the Department within 30 days. If the defect cannot be corrected or an alternate method is not approved by the Department, the well shall be plugged under §§ 78.91 – 78.98 (relating to plugging)."

3. Unpermitted discharge of polluting substances

   Our investigation revealed that Cabot has caused or allowed the unpermitted discharge of natural gas, a polluting substance, to the waters of the Commonwealth. This is a violation of Section 401 of the Clean Streams Law, 35 P.S. § 691.401, which provide:

> "It shall be unlawful for any person or municipality to put or place into any of the waters of the Commonwealth, or allow or permit to be discharged from property owned or occupied by such person into any waters of the Commonwealth, any substance of any kind or character resulting in pollution as herein defined."

A violation of the Oil and Gas Act or the rules or regulations promulgated thereunder is contrary to Sections 505 and 509 of that Act, for which the Department could institute administrative, civil, and/or criminal proceedings. The Act provides for up to $25,000 in civil penalties plus $1,000 for each day of a continued violation, up to $300 in summary criminal penalties, and up to $5,000 in misdemeanor criminal penalties for each violation. Each day of continued violation constitutes a separate offense.

A violation of the Clean Streams Law or the rules or regulations promulgated thereunder is contrary to sections 602 and 611 of the Act, for which the Department could institute administrative, civil, and/or criminal proceedings. The Act provides for up to $10,000 per day in civil penalties, up to $10,000 in summary criminal penalties, and up to $25,000 in misdemeanor criminal penalties for each violation. Each day of continued violation constitutes a separate offense.

Please provide a written response within 30 days of your receipt of this letter, as to when the above listed violations will be corrected, and what steps are being taken to prevent their recurrence. The Department requests that your response be in the form of a summary report of your investigation as required by 25 PA Code § 78.89 and that it include:

- Efforts taken, or planned to be taken, to mitigate the problem both at the gas wells and in the areas impacted by the migration including homes, wells, surface waters and subsurface soils;

- A plan to correct the defective casing for approval by the Department;

- On-going measures that will be needed to maintain public safety as a result of the gas migration;

- An explanation of the cause of the gas migration. Please discuss casing pressures and monitoring prior to and during the incident; evidence indicating which well is the likely source of the migration including water quality and isotopic data; the hydrologic connection of formations below the depth(s) of the surface casings and the surface expression or gas detection; information relative to the specification of the casing pipe utilized for the nearby wells. Please provide copies of all casing and cement information and field documents, daily drilling reports and digital copies of all logging information obtained (i.e. mud logs, open hole electronic logs, cement bond logs, etc.). At a minimum, this information should be provided for the wells located on each of the G. Shields well pads, but also for any other nearby Cabot Oil & Gas wells that are suspected potential sources.

- Preventative measures that will be utilized to prevent similar situations from occurring in the future. Include any changes to well construction/materials that Cabot Oil & Gas will employ; also include any changes to casing pressure monitoring, venting, or other relevant practices and procedures.

All reports submitted in accordance with the above requirements that contain an analysis of geological or engineering data shall be prepared and sealed by a geologist or engineer licensed in this Commonwealth.

This Notice of Violation is neither an order nor any other final action of the Department of Environmental Protection. It neither imposes nor waives any enforcement action available to the Department under any of its statutes. If the Department determines that additional enforcement action is appropriate, you will be notified of the action.

Should you have any questions, please contact me at (570) 327-0553 or by electronic mail at mcooley@pa.gov.

Sincerely,

Marc B Cooley

Marc B. Cooley
Environmental Group Manager
Oil and Gas Management
Scranton District Office

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

SECRETARY

July 12, 2012

Joseph Otis Minott, Esq.
Executive Director, Clean Air Council
135 South 19th Street, Suite 300
Philadelphia, PA 19013

Dear Mr. Minott:

Thank you for your June 26, 2012, letter regarding a methane sampling survey in Leroy Township, Bradford County. The Department of Environmental Protection (DEP) has reviewed your letter and the attached June 8, 2012, report titled "Report to the Clean Air Council on Field Inspection and Methane Sampling Survey of Leroy Township, Bradford County, Pennsylvania, 8 June 2012 performed by Gas Safety, Inc."

First, let me tell you that this situation was immediately grasped by the Department and DEP immediately responded. The situation is, and at all times was, under control by DEP. Indeed, at this point in time the situation is for the most part over.

On May 19, 2012, DEP was notified of a methane gas migration event in Leroy Township. An immediate response to address potential safety concerns and to delineate the areal extent of the incident was jointly undertaken by DEP and Chesapeake Energy staff. At all times, DEP's activities in this regard were very transparent to the public. Indeed, on May 21, 2012, two weeks prior to the Clean Air Council's (CAC) investigation, DEP issued a press statement describing these activities. I have enclosed a copy of that statement to the press herein.

Additionally, an evaluation of Chesapeake's nearby Morse well pad was undertaken, revealing the presence of a failed packer that was installed to protect previously installed up-hole perforations, which were squeezed with cement. Those remedial activities occurred as part of a remediation effort that was being conducted under a previous Consent Order and Agreement between Chesapeake and DEP. During the operations to repair/replace the packer, the up-hole perforations were exposed to gas pressure from deeper in the well. It appears that the pressure may have caused gas to escape through these perforations into the shallow subsurface geologic section. Operations have been undertaken to "re-squeeze" the up-hole perforations and the gas wells are being monitored to determine the effectiveness of the repairs. At present, we continue to monitor the site and those remedial actions have proven to be successful.

Since the onset of the incident, DEP has undertaken considerable monitoring and investigative activities in the area. While investigatory activities are still ongoing, a significant improvement (i.e. substantial decrease in observed methane concentrations/expressions) has been observed in the private water supplies and surface water bodies in the area.

The Department has been responsive to the gas migration incident in Leroy Township since its initial onset, and we continue to work to resolve this issue. Should you have any further questions regarding the Leroy gas migration investigation, please feel free to contact Jennifer Means, Eastern District Oil and Gas Manager, by e-mail at jenmeans@pa.gov or by telephone at 570.321.6550.

Sincerely,

Michael L. Krancer
Secretary

Enclosure

cc: Shawn M. Garvin, Regional Administrator, U.S. EPA Region 3
Diana Esher, Air Protection Division Director, U.S. EPA Region 3
Michael D'Andrea, U.S. EPA Region 3
Lora Werner, Regional Director, Agency for Toxic Substances and Disease Registry, U.S. EPA Region 3
Representative Tina Pickett
Vince Brisini, Deputy for Waste, Air and Radiation and Remediation, PA DEP
Muhammad Zaman, Environmental Program Manager, PA DEP

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

News for Immediate Release

May 21, 2012

DEP Statement on Leroy Township Gas Migration Investigation

Williamsport – DEP's Oil and Gas Program and Chesapeake Energy are currently investigating a possible methane gas migration issue in Leroy Township, Bradford County, first reported to DEP on Saturday evening, May 19.

Two private drinking water wells have methane in the headspace and have been vented. A mobile water treatment unit has been set up at one residence and a methane monitor installed in the home; a temporary water supply tank has been set up at the other residence.

There has also been gas bubbling documented in nearby wetlands. Chesapeake's Morse well pad contains two wells and is about one-half mile from the impacted private wells.

DEP has sampled four private wells in the area. Chesapeake's consultant is screening all private wells within a 2,500 foot radius of the Morse pad. The investigation is continuing and no determination has been made as to the source or sources of the methane.

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Appendix E
Supplementary Reference Data/Maps
Retrospective Case Study in Northeastern Pennsylvania

U.S. Environmental Protection Agency
Office of Research and Development
Washington, DC

May 2015
EPA/600/R-14/088

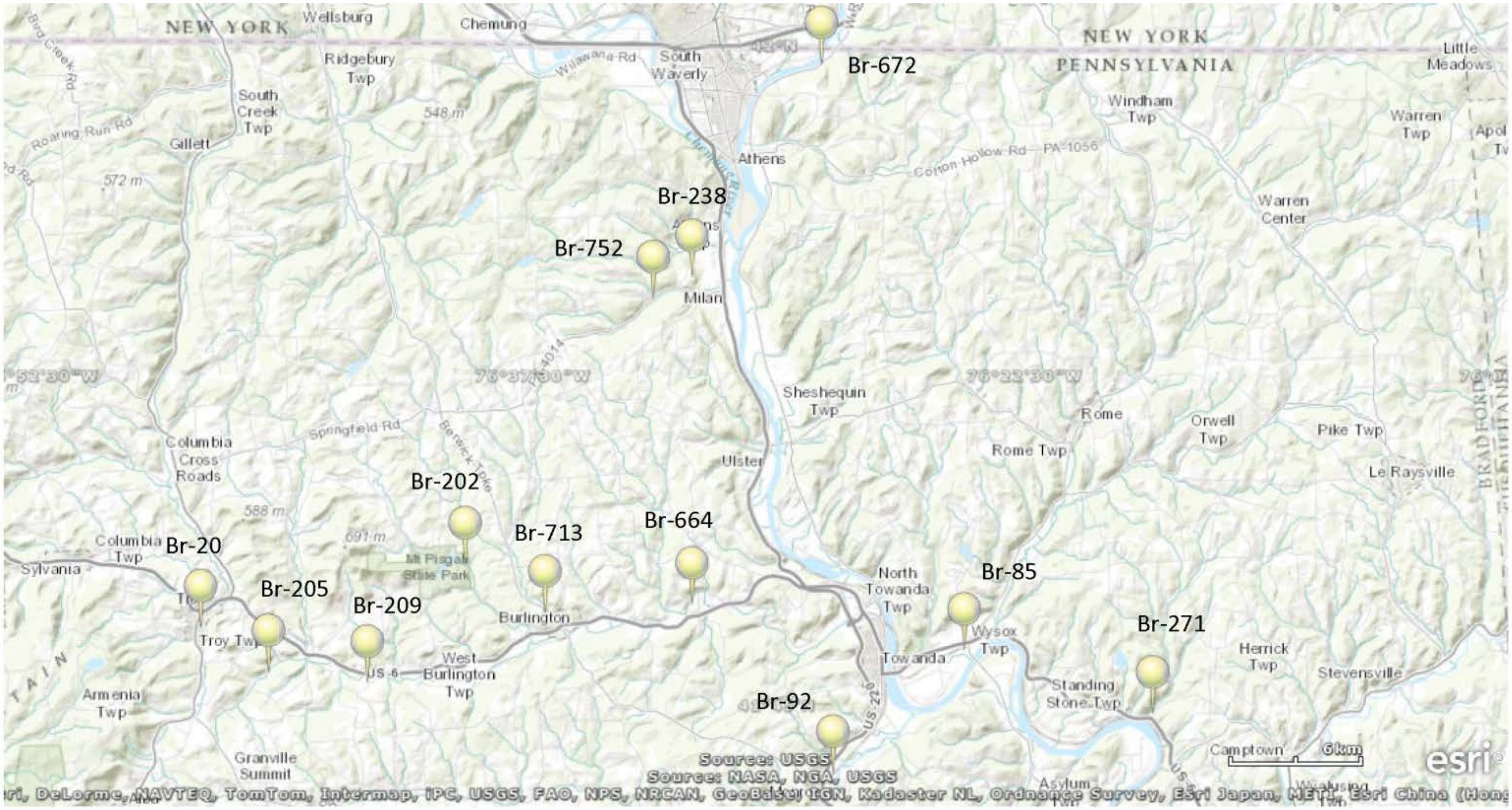

Figure E-1 Locations in Bradford County with Na-Cl type water as identified by Williams et al. (1998).

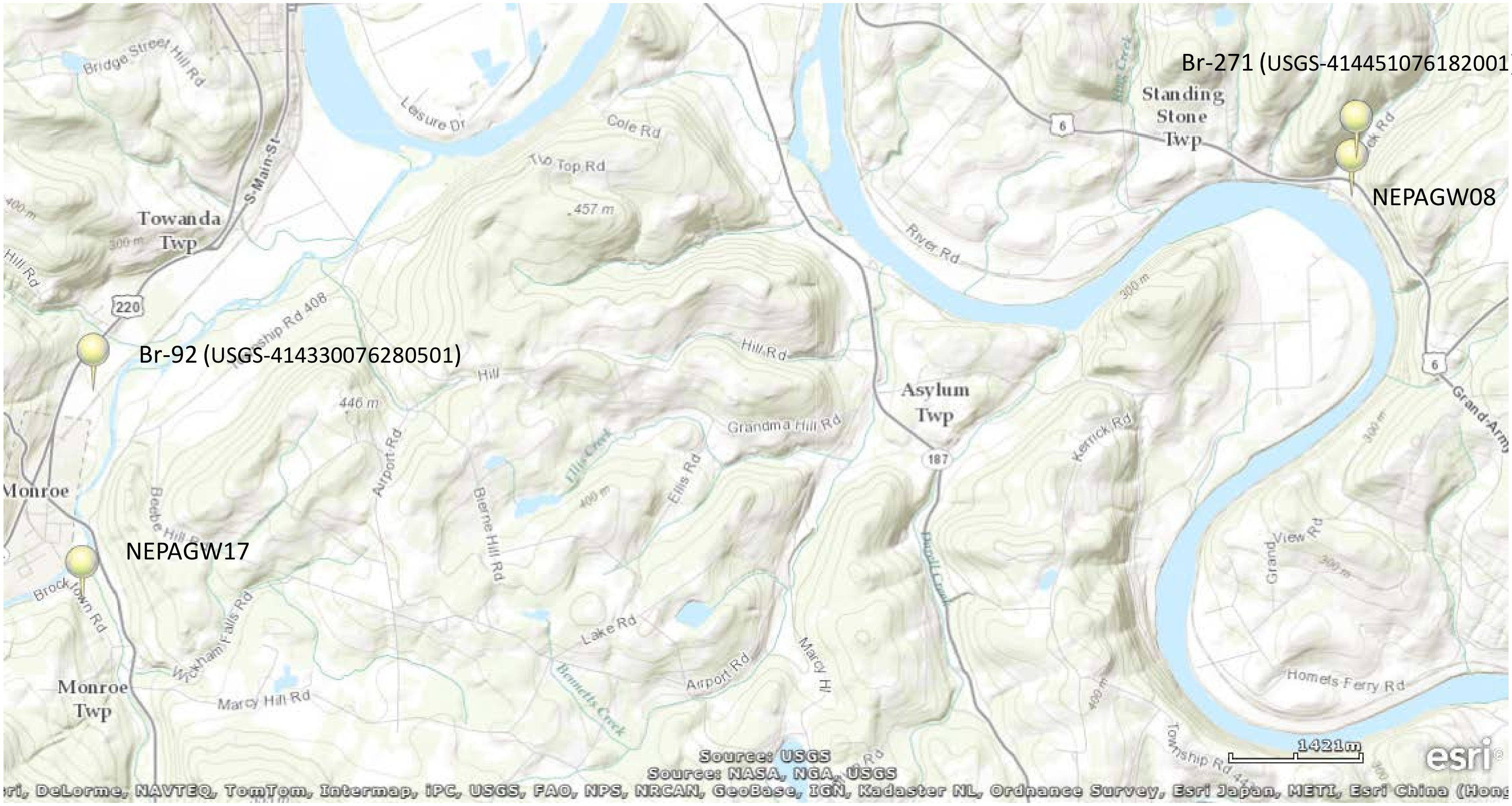

Figure E-2 Pre-2007 NWIS database locations (also in Williams et al., 1998) with Na-Cl type water in vicinity of homeowner wells NEPAGW17 and NEPAGW08 sampled in this study.

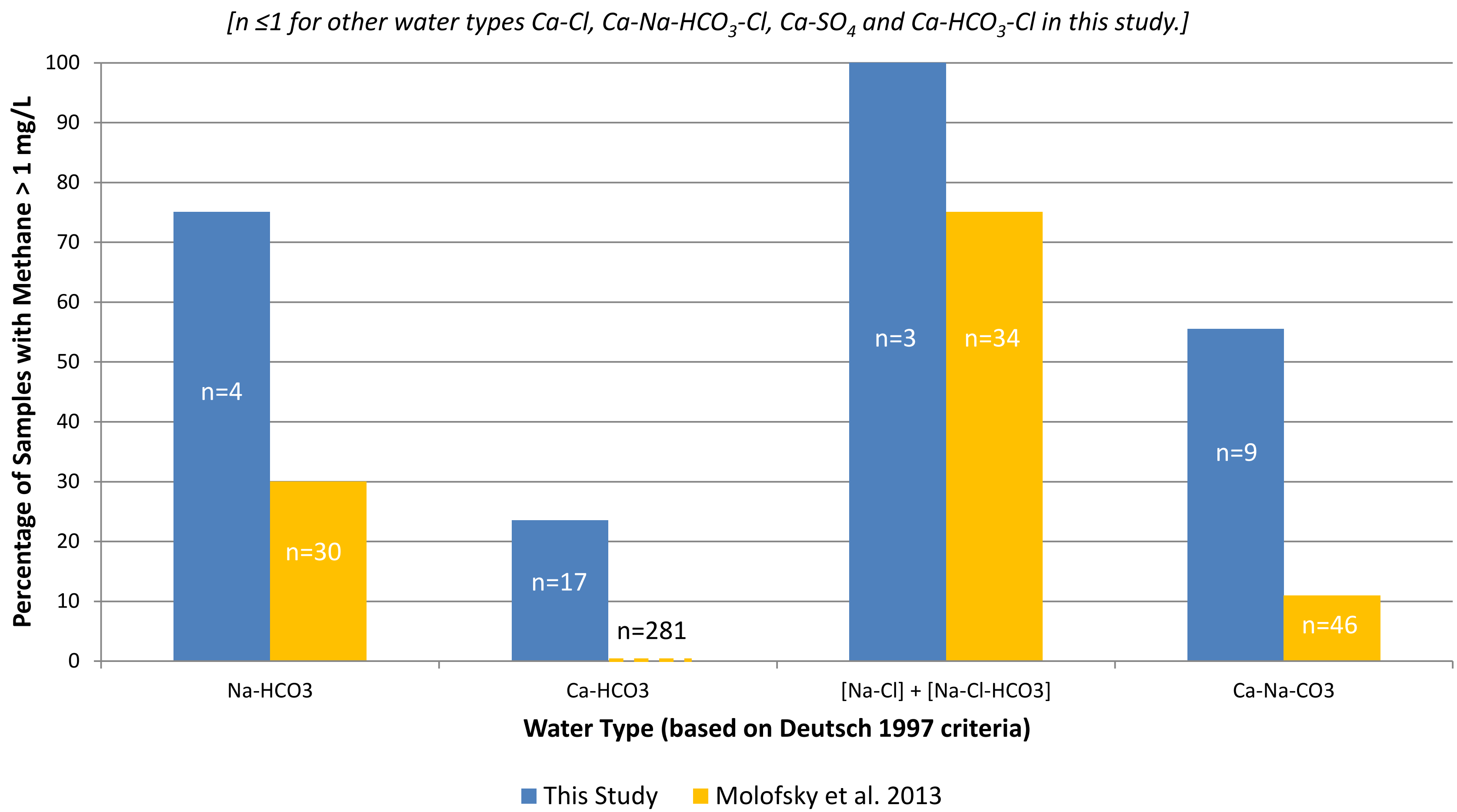

Figure E-3 Percent detections of methane >1 mg/L per water type in this study compared to observations of Molofsky et al. (2013) study in Susquehanna County using water-type criteria of Deutsch (1997). Note: No Ca-HCO_3 type waters (n=281) showed methane >1 mg/L in Molofsky et al. study.

NORTHCENTRAL REGIONAL OFFICE

Units =mg/L unless otherwise noted -ND: NonDetect -n/a: Not Analyzed For	Place Predrill – 12/4/2008 & 12/11/2008 Benchmark	Bohlander – 4/1/2010 DEP	Place – 4/1/2010 DEP	Place-4/7/2010 Chesapeake	Place – 4/21/2010 DEP	Place-6/23/2010 Chesapeake	Place-10/13/2010 DEP	*Place-10/13/2010 Chesapeake	*Place-10/13/2010 Farnham *(Full List of Parameters in File)*	MCL (mg/l) **** Denotes Primary MCL
Chloride	18.6	4.9	13.7	9.86	13.9	n/a	46.4	43.5	42.2	250
TSS	n/a	6	144	21.5	n/a	n/a	n/a	n/a	n/a	n/a
Magnesium	5.80	4.95	6.9	5.51	5.804	4.45	5.929	5.71	6.35	n/a
Strontium	n/a	1.41	1.33	n/a	1.34	n/a	1.390	1.320	1.65	n/a
Barium	0.414	0.486	0.519	0.362	0.387	0.345	0.417	0.411	0.451	****2
Potassium	n/a	1.75	2.92	2.96	1.653	1.66	1.738	1.73	1.79	n/a
TDS	177.0	170.0	186.0	189	206.0	n/a	252	253	250	500
Manganese	<0.002	<0.010	0.260	0.0337	<0.010	0.131	0.018	ND	0.015	0.05
pH *(pH Units)*	7.45	8.2	8.1	7.1	8.0	7.3	7.5	7.7	7.85	n/a
Sodium	10.0	16.8	12.1	10.4	10.5	9.5	28.7	25.3	30.1	n/a
Turbidity *(ntu)*	n/a	<1	**259.25**	**5.8**	**5.76**	n/a	**20.29**	**14**	n/a	**1 NTU
MBAS	n/a	<0.20	<0.20	0.0775	<0.20	0.0973	<0.20	ND	n/a	n/a
SPC*(umhos/cm*	n/a	301.0	322.0	318	327.0	282	434.0	394	457	n/a
Calcium	44.4 – 53.0	44.2	50.4	46.1	48.4	39.2	50.7	47.4	50.4	n/a
Alkalinity	122.0	146.8	129.0	125	126.6	n/a	127.6	130	120	n/a
Iron	<0.005	<0.020	**8.83**	**1.02**	0.100	ND	**0.449**	**0.368**	**0.548**	0.3
Hardness	122	131	154	ND	145	116	151	142	152	n/a
Methane	0.010	0.013	**19.2**	**13.5**	5.0	1.58	1.880	1.92	1.0	***7
Ethane	n/a	<0.019	0.575	0.484	0.150	ND	0.0459	0.0614	0.037	n/a
Ethene	<0.0198	<0.0198	<0.0198	n/a	<0.0198	n/a	<0.0198	n/a	n/a	n/a
Propane	<0.0198	<0.0198	<0.0198	ND	<0.0198	ND	<0.0198	ND	n/a	n/a
Chloroform	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0174	0.0174	0.1
Bromodichl-oromethane	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00129	0.0011	0.1

*Abbreviate list of results. Volatile organic compounds not detected not included.
**Applicable only to unfiltered surface water sources.
*** The Department notifies home owners when methane exceeds 7 mg/l.

208 West Third Street | Suite 101 | Williamsport, PA 17701-6448
570.327.3636 | Fax 570.327.3565 www.depweb.state.pa.us

Table E-1 Pre- and post-drill data from homeowner location NEPAGW06 (Source: PADEP).

Appendix F
Statistical Evaluation of Groundwater Data for Bradford County, Pennsylvania
Retrospective Case Study in Northeastern Pennsylvania

U.S. Environmental Protection Agency
Office of Research and Development
Washington, DC

May 2015
EPA/600/R-14/088

Statistical Evaluation of Ground Water Data for Bradford County, Pennsylvania

General

All of the statistical evaluations except the post-hoc tests were performed using the US Environmental Protection Agency's (EPA) ProUCL program version 5.0 (US EPA, 2013). The post-hoc tests were performed using Statistica, version 12 (StatSoft, 2012).

F.1 Data Sources

Ground water data for Bradford County, Pennsylvania, was obtained from three sources:

- Geochemical analyses of water samples collected by the hydrogeochemical and stream sediment reconnaissance (HSSR) phase of the National Uranium Resource Evaluation (NURE) program. Analytical data for well water samples from this source were downloaded from the United States Geological Survey's (USGS) Mineral Resources On-Line Spatial Data portal (http://mrdata.usgs.gov/nure/water/find-nurewtr.php). Water samples from this source were collected during October 1977.
- National Water Information System (NWIS). Data from this source were downloaded from the National Water Quality Monitoring Council Water Quality Portal (http://www.waterqualitydata.us/portal.jsp). Water samples from this source were collected prior to January 1, 2007.
- Data from the present study were obtained from the EPA's Office of Research and Development.

Samples from the NURE and NWIS datasets were collected before hydraulic-fracturing activities began in Bradford County and are considered background samples.

The three studies included data on a large number of parameters but not necessarily the same parameters or the same sample types (total or dissolved). Therefore, data were not available from the NURE and NWIS studies for all of the parameters and sample types analyzed in this study.

F.2 Statistical Analyses

F.2.1 Preliminary Data Evaluations

A preliminary review of the data was performed to determine the statistical distributions of the data using ProUCL's Goodness of Fit tests. This was done to determine the most appropriate group-wise comparison test – parametric or nonparametric. One of the assumptions underlying parametric statistical procedures is that the data are normally distributed or can be transformed to a normally distributed form. A summary of the findings is provided in Table F1.

As shown in Table F1, most of the data sets did not exhibit common distribution patterns (normal, log-normal, or gamma) with greater than 95% confidence; therefore, parametric methods may not provide reliable hypothesis test results. However, parametric methods are sometimes more powerful than nonparametric equivalents, so it was decided to provide hypothesis tests using both parametric and nonparametric procedures.

Table F1

Summary of Results of Goodness of Fit tests at 0.05 Significance Level

Study >	NURE			NWIS			This Study		
Parameter	Normal	Gamma	Lognormal	Normal	Gamma	Lognormal	Normal	Gamma	Lognormal
Alkalinity	Yes	No	No	Yes	Yes	No	Yes	Yes	No
Alkalinity CO3	Yes	No	No	Yes	Yes	No	Yes	Yes	No
Barium,total	--	--	--	No	No	No	No	No	Yes
Bromide, dissolved	No	No	No	--	--	--	Yes	Yes	Yes
Bromide, dissolved - outliers	No	No	Yes	--	--	--	Yes	Yes	Yes
Calcium, dissolved	--	--	--	No	Yes	Yes	No	No	Yes
Calcium, total	--	--	--	No	No	No	No	No	Yes
Chloride, dissolved	No	No	No	No	No	No	No	No	Yes
Inorganic Nitrogen	--	--	--	No	No	No	No	No	No
Iron, dissolved	--	--	--	No	No	Yes	No	No	No
Iron, total	--	--	--	No	No	Yes	No	No	Yes
Magnesium, dissolved	--	--	--	No	Yes	Yes	No	No	Yes
Magnesium, total	--	--	--	No	No	No	No	No	Yes
Manganese, dissolved	No	No	No	No	No	Yes	No	No	Yes
Manganese, total	--	--	--	No	No	No	No	No	Yes
pH	No	No	No	No	No	No	Yes	Yes	Yes
Potassium, dissolved	--	--	--	No	No	No	No	Yes	Yes
Potassium, total	--	--	--	No	No	No	No	Yes	Yes
Sodium, dissolved	No	No	No	No	No	Yes	No	No	Yes
Sodium, total	--	--	--	No	No	Yes	No	No	Yes
Specific Conductance	No	No	No	No	No	No	No	No	No
Specific Conductance - outliers	No	No	Yes	No	Yes	Yes	No	No	No
Strontium, total	--	--	--	No	No	Yes	No	Yes	Yes
Sulfate, dissolved	--	--	--	No	No	No	No	No	No
Temperature	No	No	No	--	--	--	Yes	Yes	Yes
Total Dissolved Solids	--	--	--	No	No	No	No	No	No

The data distributions also were examined graphically using Q-Q plots. If the original data are normally distributed, a Q-Q plot with original values on the y-axis should yield a pattern approximating a straight line; if it is log-normally distributed, a Q-Q plot with a logarithmically scaled y-axis should yield a straight line. All of the parameters except pH yielded straighter lines when plotted on a log scale; pH, which is already a logarithmic function of the hydrogen ion concentration, was best plotted using a linear scale.

From inspection of the Q-Q Plots, some datasets appeared to include possible outlier values. As noted in the ProUCL Technical Guidance Manual (US EPA, 2013b), the presence of outliers in a data set can distort the results of statistical tests and lead to incorrect conclusions. Therefore, datasets that appeared to include potential outliers were formally tested for outliers using the Rosner's test included in ProUCL. The tests indicated that a small number of observations in a number of the datasets were statistical outliers. Even though these values are statistical outliers, they may still be actual high-end values drawn from the populations under investigation. Therefore, subsequent analyses were run with and without the outlier values. Because the datasets were relatively large and there was only a small number of outliers, their presence appeared to have only minor effects on the results of the analyses of variance.

Since comparisons among 2 or 3 data sets were desired, a One-way Analysis of Variance (ANOVA), a parametric procedure, and the Kruskal-Wallis Test, the nonparametric equivalent, were selected as the most appropriate statistical test procedures. Since a few of the datasets to be compared appear to be normally distributed while others exhibit a log-normal or gamma distribution, the classic parametric ANOVA was run on both the original reported values and log-transformed values. A summary of the results of these tests is provided in Table F2. The P-values shown indicate the probability that the datasets are NOT different from one another (the null hypothesis). If the P-values are less than 0.05 (less than a 5% chance that the null hypothesis is true - values shown in red), the null hypothesis is rejected, and the alternate hypothesis—that the data sets in question are different from one another—is accepted.

Significant differences were found among the datasets for many of the parameters. Generally, the most significant differences were seen in the tests of the log-transformed values and in the nonparametric tests. This is probably because most of the data sets appeared to be more nearly log-normally distributed than normally distributed in the Q-Q plots, even if they did conform to a particular distribution with 95% confidence in the Rosner's tests, or they did not conform well to any of the common distributions (normal, log-normal, or gamma). Because most of the data sets appear to be more nearly log-normally than normally distributed, the results of the parametric ANOVAs for the log-transformed values and the nonparametric Kruskal-Wallis ANOVAs are probably more reliable than the results of the parametric ANOVAs for the original untransformed values.

When only two datasets are involved in a comparison, the nature of any significant difference detected in the ANOVAs is clear—the two datasets involved are different from one another. However, when three datasets are involved, it is not clear from the overall ANOVA results which datasets are different from one another. Post-hoc tests were performed to resolve this uncertainty. A number of parametric and nonparametric tests are available for this purpose. Among the parametric tests, the Scheffe test, which is one of the more conservative methods (less prone to false positive results) and is considered most appropriate when all possible pair-wise comparisons among datasets are of potential interest, was selected. The Scheffe test looks for significant differences between the mean values of datasets. For nonparametric comparisons, the Kruskal-Wallis Multiple Comparison test (K-W MCT) was used. The K-W MCT looks for significant differences between the median ranks of the values comprising the datasets but does not use the average numerical values or the variances of the datasets to identify significant differences among the datasets. The results of the Scheffe tests are shown in Table F3 and those of the Kruskal-Wallis Multiple Comparison tests are shown in Table F4. Post-hoc test results are only shown for parameters that showed significant ($p < 0.05$) differences among the datasets on the overall ANOVA or Kruskal-Wallis tests. In Table F3, Scheffe results for original parameter values are shown in the left-hand panels; results for log-transformed values are in the right-hand panels. In Table F4, z' values, the test statistic (like a t-value), are shown in the left-hand panels; the corresponding p values are shown in the right-hand panels. The median rank for each group is shown as the second line in each of the column headers. As with the ANOVA results, the p-values shown indicate the probability that the data groups are NOT different from one another (the null hypothesis). However, if the p-values are less than 0.05 (less than a 5% chance that the null hypothesis is true - values shown in red), the null hypothesis is rejected, and the alternate hypothesis—that the data groups in question are different from one another—is accepted.

F.2.2. Summary of Multiple Comparison Test Results

Significant differences ($p < 0.05$) between datasets found in the multiple comparison tests are summarized in the accompanying Tables F3, F4, and F5. Because the Scheffe test looks for differences between the mean values and the K-W MC looks for differences between the median ranks of the values, one dataset may have a higher mean value but a lower median rank than another, especially if the distribution of values in one dataset is more skewed toward higher values or has more high outliers than the other. Therefore, which dataset appears to be "higher" or "greater" than another may differ between the Scheffe and K-W MC tests.

F.2.3. Barium and Strontium Evaluation by Water Type

Since Na-Cl and Na-HCO_3 water types in this study were observed to generally exhibit the higher barium and strontium concentrations relative to the other water types, and since there was a larger proportion of Na-Cl and Na-HCO_3 water types in this study (10/38) than in the NWIS dataset (12/62), it was possible that uneven representation of these water types in the two datasets could account for any differences observed. To test this possibility, barium and strontium concentrations in only the Na-Cl and Na-HCO_3 water types for the two datasets were compared. Goodness of fit testing at the 0.05 significance level and analysis of variance for the parametric test and nonparametric Kruskal-Wallis test are provided in Tables F6 and F7.

F.3 References

StatSoft, Inc. (2012). STATISTICA (data analysis software system), version 12. www.statsoft.com.

United States Environmental Protection Agency (US EPA). 2013a. ProUCL Version 5.0.00, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations, EPA Technical Support Center, Las Vegas, Nevada, September 30, 2011.

United States Environmental Protection Agency (US EPA). 2013b. ProUCL Version 5.0.00 Technical Guide, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations, EPA/600/R-07/041, EPA Technical Support Center, Las Vegas, Nevada, September, 2013.

Table F2

Summary of Analysis of Variance and Kruskal-Wallis Results for Bradford County, Pennsylvania Groundwater

	Number of Observations			Degrees of Freedom	Parametric ANOVA				Nonparametric ANOVA		
	NURE	NWIS	This Study		Original Values		Log Transformed		(Kruskal-Wallis)		
Parameter	N	N	N	(Between/Within)	F Stat	P	F Stat	P	DoF	K-W (H-Stat)	P
Alkalinity	164	122	38	2 / 321	0.457	0.634	1.098	0.335	2	0.562	0.755
Barium,total	--	62	38	1 / 98	0.497	0.483	7.886	**0.00601**	1	11.93	**5.53E-04**
Bromide, dissolved	112	--	38	1 / 148	53.97	**1.267E-11**	198.1	**0**	1	73.2	**0**
Bromide, dissolved - outliers	110	--	36	1 / 144	142.4	**0**	269.5	**0**	1	76.5	**0**
Calcium, dissolved	--	60	38	1 / 96	0.371	0.544	0.999	0.32	1	2.55	0.11
Calcium, dissolved - outliers	--	60	37	1 / 95	4.604	**0.0344**	2.289	0.134	1	3.42	**0.0644**
Calcium, total	--	64	38	1 / 100	0.172	0.679	0.112	0.739	1	1.265	0.261
Calcium, total - outliers	--	63	37	1 / 98	2.235	0.138	0.301	0.584	1	1.579	0.209
Chloride, dissolved	164	116	38	2 / 315	2.958	0.0534	2.132	0.12	2	0.217	0.897
Chloride, dissolved - outliers	161	115	38	2 / 311	6.55	**0.00164**	1.352	0.26	2	0.0648	0.968
Inorganic Nitrogen	--	72	38	1 / 108	2.126	0.148	0.219	0.641	1	0.0574	0.811
Iron, dissolved	--	50	38	1 / 86	4.61	**0.0346**	19.7	**2.67E-05**	1	20.26	**6.75E-06**
Iron, total	--	72	38	1 / 108	0.566	0.454	2.461	0.12	1	2.52	0.112
Magnesium, dissolved	--	60	38	1 / 96	0.411	0.523	4.193	**0.0433**	1	6.949	**0.00839**
Magnesium, total	--	63	38	1 / 99	0.0772	0.782	0.481	0.489	1	2.075	0.15
Manganese, dissolved	161	37	38	2 / 233	2.925	**0.0556**	19.25	**1.83E-08**	2	14.17	**8.39E-04**
Manganese, total	--	71	38	1 / 107	0.0679	0.795	0.891	0.347	1	1.025	0.311
pH	164	44	38	2 / 243	1.33	0.266	1.246	0.29	2	3.298	0.192
Potassium, dissolved	--	45	38	1 / 81	7.444	**7.81E-03**	25.8	**2.38E-06**	1	22.3	**2.33E-06**
Potassium, dissolved - outliers	--	44	38	1 / 80	21.56	**1.33E-05**	27.27	**1.37E-06**	1	21.42	**3.70E-06**
Potassium, total	--	72	38	1 / 108	0.252	0.617	6.304	**0.0135**	1	10.93	**9.47E-04**
Potassium, total - outliers	--	70	38	1 / 106	8.254	**4.91E-03**	12.66	**5.61E-04**	1	13.16	**2.86E-04**
Sodium, dissolved	163	45	38	2 / 243	5.429	**4.94E-03**	15.48	**4.70E-07**	2	26.52	**1.75E-06**
Sodium, dissolved - outliers	163	44	38	2 / 242	11.78	**1.31E-05**	14.14	**1.55E-06**	2	25.32	**3.17E-06**
Sodium, total	--	72	38	1 / 108	0.386	0.535	0.125	0.724	1	0.423	0.515
Sodium, total - outliers	--	71	38	1 / 107	0.0407	0.841	0.416	0.52	1	0.607	0.436
Specific Conductance	164	58	38	2 / 257	8.094	**3.90E-04**	11.27	**2.03E-05**	2	36.35	**1.28E-08**
Specific Conductance - outliers	163	55	38	2 / 253	11.66	**1.43E-05**	16.4	**2.01E-07**	2	35.58	**1.87E-08**
Strontium, total	--	62	38	1 / 96	0.0118	0.914	22.44	**7.32E-06**	1	23.43	**1.29E-06**
Strontium, total - outliers	--	61	38	1 / 95	7.18	**8.66E-03**	31.14	**2.17E-07**	1	25.41	**4.63E-07**
Sulfate, dissolved	--	121	38	1/ 157	0.838	0.361	17.94	**3.88E-05**	1	18.92	**1.36E-05**
Sulfate, dissolved - outliers		121	37	1 / 156	7.864	**5.68E-03**	28.09	**3.88E-07**	1	21.82	**3.00E-06**
Temperature	164	--	38	1 / 200	50.39	**2.15E-11**	47.09	**8.32E-11**	1	61.88	**3.664E-15**
Total Dissolved Solids	--	120	38	1 / 156	0.0289	0.865	0.0145	0.904	1	0.0448	0.832

Table F3
Scheffe Parametric Multiple Comparison Tests

Cell No.	Scheffe test; variable Chloride, Dissolved mg/l Probabilities for Post Hoc Tests Error: Between MS 65170., df 315.00				Scheffe test; variable Log Chloride, Dissolved mg/l Probabilities for Post Hoc Tests Error: Between MS 1.7839, df 315.00			
	Study	{1} (14.129)	{2} (89.440)	{3} (47.553)	Study	{1} (2.1707)	{2} (2.5050)	{3} (2.2883)
1	NURE 1977		0.053444	0.767802	NURE 1977		0.120781	0.887415
2	NWIS < 2007	0.053444		0.680577	NWIS < 2007	0.120781		0.686323
3	This Study	0.767802	0.680577		This Study	0.887415	0.686323	

Cell No.	Scheffe test; variable Chloride, Dissolved - outliers mg/l Probabilities for Post Hoc Tests Error: Between MS 9038.2, df 311.00				Scheffe test; variable Log Chloride, Dissolved - outliers mg/l Probabilities for Post Hoc Tests Error: Between MS 1.5322, df 311.00			
	Study	{1} (12.972)	{2} (53.043)	{3} (47.553)	Study	{1} (2.2061)	{2} (2.4541)	{3} (2.2883)
1	NURE 1977		0.002887	0.132559	NURE 1977		0.261534	0.934420
2	NWIS < 2007	0.002887		0.953499	NWIS < 2007	0.261534		0.774084
3	This Study	0.132559	0.953499		This Study	0.934420	0.774084	

Cell No.	Scheffe test; variable Manganese, Dissolved ug/l Probabilities for Post Hoc Tests Error: Between MS 97849., df 233.00				Scheffe test; variable Log Manganese, Dissolved ug/l Probabilities for Post Hoc Tests Error: Between MS 1.2578, df 233.00			
	Study	{1} (149.33)	{2} (273.92)	{3} (230.13)	Study	{1} (4.8175)	{2} (4.5799)	{3} (3.5624)
1	NURE 1977		0.094194	0.360170	NURE 1977		0.510026	0.000000
2	NWIS < 2007	0.094194		0.832302	NWIS < 2007	0.510026		0.000570
3	This Study	0.360170	0.832302		This Study	0.000000	0.000570	

Cell No.	Scheffe test; variable Sodium, Dissolved mg/l Probabilities for Post Hoc Tests Error: Between MS 17354., df 243.00				Scheffe test; variable Log Sodium, Dissolved mg/l Probabilities for Post Hoc Tests Error: Between MS .97339, df 243.00			
	Study	{1} (17.475)	{2} (89.143)	{3} (48.044)	Study	{1} (2.4566)	{2} (3.2547)	{3} (3.1181)
1	NURE 1977		0.006038	0.437415	NURE 1977		0.000016	0.001187
2	NWIS < 2007	0.006038		0.368417	NWIS < 2007	0.000016		0.820969
3	This Study	0.437415	0.368417		This Study	0.001187	0.820969	

Cell No.	Scheffe test; variable Sodium, Dissolved - outliers mg/l Probabilities for Post Hoc Tests Error: Between MS 1994.6, df 242.00				Scheffe test; variable Log Sodium, Dissolved - outliers mg/l Probabilities for Post Hoc Tests Error: Between MS .89758, df 242.00			
	Study	{1} (17.475)	{2} (45.715)	{3} (48.044)	Study	{1} (2.4566)	{2} (3.1559)	{3} (3.1181)
1	NURE 1977		0.001188	0.000901	NURE 1977		0.000113	0.000684
2	NWIS < 2007	0.001188		0.972649	NWIS < 2007	0.000113		0.983896
3	This Study	0.000901	0.972649		This Study	0.000684	0.983896	

Cell No.	Scheffe test; variable Specific Conductance µS/cm Probabilities for Post Hoc Tests Error: Between MS 2969E2, df 257.00				Scheffe test; variable Log Specific Conductance µS/cm Probabilities for Post Hoc Tests Error: Between MS .50366, df 257.00			
	Study	{1} (317.80)	{2} (634.31)	{3} (526.32)	Study	{1} (5.5913)	{2} (6.0406)	{3} (5.9973)
1	NURE 1977		0.000883	0.106524	NURE 1977		0.000245	0.007073
2	NWIS < 2007	0.000883		0.637535	NWIS < 2007	0.000245		0.958076
3	This Study	0.106524	0.637535		This Study	0.007073	0.958076	

Cell No.	Scheffe test; variable Specific Conductance - outliers µS/cm Probabilities for Post Hoc Tests Error: Between MS 73300., df 253.00				Scheffe test; variable Log Specific Conductance - outliers µS/cm Probabilities for Post Hoc Tests Error: Between MS .29552, df 253.00			
	Study	{1} (319.72)	{2} (454.31)	{3} (526.32)	Study	{1} (5.6157)	{2} (6.0350)	{3} (5.9973)
1	NURE 1977		0.006863	0.000172	NURE 1977		0.000008	0.000629
2	NWIS < 2007	0.006863		0.452782	NWIS < 2007	0.000008		0.947260

Table F4

Kruskal-Wallis Nonparametric Multiple Comparison Tests

Depend.: Chloride Dissolved mg/l	Multiple Comparisons z' values; Chloride, Dissolved mg/l Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 318) =.2174655 p =.8970			Multiple Comparisons p values (2-tailed); Chloride, Dissolved mg/l Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 318) =.2174655 p =.8970		
	NURE 1977 (R:157.42)	NWIS < 2007 (R:162.61)	This Study (R:158.97)	NURE 1977 (R:157.42)	NWIS < 2007 (R:162.61)	This Study (R:158.97)
NURE 1977		0.464747	0.093632		1.000000	1.000000
NWIS < 2007	0.464747		0.211464	1.000000		1.000000
This Study	0.093632	0.211464		1.000000	1.000000	

Depend.: Chloride Dissolved mg/l	Multiple Comparisons z' values; Chloride, Dissolved - outliers mg/l Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 314) =.0647891 p =.9681			Multiple Comparisons p values (2-tailed); Chloride, Dissolved - outliers mg/l Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 314) =.0647891 p =.9681		
	NURE 1977 (R:156.43)	NWIS < 2007 (R:159.20)	This Study (R:156.89)	NURE 1977 (R:156.43)	NWIS < 2007 (R:159.20)	This Study (R:156.89)
NURE 1977		0.250696	0.028660		1.000000	1.000000
NWIS < 2007	0.250696		0.135958	1.000000		1.000000
This Study	0.028660	0.135958		1.000000	1.000000	

Depend.: Manganese Dissolved ug/l	Multiple Comparisons z' values; Manganese, Dissolved ug/l Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 236) =14.16710 p =.0008			Multiple Comparisons p values (2-tailed); Manganese, Dissolved ug/l Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 236) =14.16710 p =.0008		
	NURE 1977 (R:128.52)	NWIS < 2007 (R:111.43)	This Study (R:82.947)	NURE 1977 (R:128.52)	NWIS < 2007 (R:111.43)	This Study (R:82.947)
NURE 1977		1.372487	3.700839		0.509736	0.000645
NWIS < 2007	1.372487		1.806507	0.509736		0.212517
This Study	3.700839	1.806507		0.000645	0.212517	

Depend.: Sodium Dissolved mg/l	Multiple Comparisons z' values; Sodium, Dissolved mg/l Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 246) =26.51509 p =.0000			Multiple Comparisons p values (2-tailed); Sodium, Dissolved mg/l Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 246) =26.51509 p =.0000		
	NURE 1977 (R:106.84)	NWIS < 2007 (R:157.56)	This Study (R:154.63)	NURE 1977 (R:106.84)	NWIS < 2007 (R:157.56)	This Study (R:154.63)
NURE 1977		4.232334	3.728285		0.000069	0.000578
NWIS < 2007	4.232334		0.186512	0.000069		1.000000
This Study	3.728285	0.186512		0.000578	1.000000	

Depend.: Sodium Dissolved mg/l	Multiple Comparisons z' values; Sodium, Dissolved - outliers mg/l Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 245) =25.32440 p =.0000			Multiple Comparisons p values (2-tailed); Sodium, Dissolved - outliers mg/l Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 245) =25.32440 p =.0000		
	NURE 1977 (R:106.84)	NWIS < 2007 (R:155.55)	This Study (R:154.63)	NURE 1977 (R:106.84)	NWIS < 2007 (R:155.55)	This Study (R:154.63)
NURE 1977		4.045277	3.743471		0.000157	0.000544
NWIS < 2007	4.045277		0.058229	0.000157		1.000000
This Study	3.743471	0.058229		0.000544	1.000000	

Depend.: Specific Conductance µS/cm	Multiple Comparisons z' values; Specific Conductance µS/cm Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 260) =36.34579 p =.0000			Multiple Comparisons p values (2-tailed); Specific Conductance µS/cm Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 260) =36.34579 p =.0000		
	NURE 1977 (R:109.28)	NWIS < 2007 (R:172.86)	This Study (R:157.43)	NURE 1977 (R:109.28)	NWIS < 2007 (R:172.86)	This Study (R:157.43)
NURE 1977		5.534715	3.556961		0.000000	0.001126
NWIS < 2007	5.534715		0.983014	0.000000		0.976802
This Study	3.556961	0.983014		0.001126	0.976802	

Depend.: Specific Conductance - outliers µS/cm	Multiple Comparisons z' values; Specific Conductance - outliers µS/cm Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 256) =35.58465 p =.0000			Multiple Comparisons p values (2-tailed); Specific Conductance - outliers µS/cm Independent (grouping) variable: Study Kruskal-Wallis test: H (2, N= 256) =35.58465 p =.0000		
	NURE 1977 (R:107.94)	NWIS < 2007 (R:170.84)	This Study (R:155.43)	NURE 1977 (R:107.94)	NWIS < 2007 (R:170.84)	This Study (R:155.43)
NURE 1977		5.447623	3.561006		0.000000	0.001108
NWIS < 2007	5.447623		0.986091	0.000000		0.972265
This Study	3.561006	0.986091		0.001108	0.972265	

Table F5

Summary of Multiple Comparison Test Results

Parameter	Test	Values Tested	Significant Differences (P < 0.05)
Chloride	Scheffe	Cl	None
		LnCl	None
	K-W MCT	Cl	None
Chloride - outliers	Scheffe	Cl	None
		LnCl	None
	K-W MCT	Cl	None
Manganese	Scheffe	Mn	None
		Ln Mn	(NURE & NWIS) > This Study
	K-W MCT	Mn	NURE > This Study
Sodium	Scheffe	Na	NWIS > NURE
		Ln Na	(NWIS & This Study) > NURE
	K-W MCT	Na	(NWIS & This Study) > NURE
Sodium - outliers	Scheffe	Na	(NWIS & This Study) > NURE
		Ln Na	(NWIS & This Study) > NURE
	K-W MCT	Na	(NWIS & This Study) > NURE
Specific Conductance	Scheffe	SpC	NWIS > NURE
		Ln SpC	(NWIS & This Study) > NURE
	K-W MCT	Spc	(NWIS & This Study) > NURE
Specific Conductance - outliers	Scheffe	SpC	(NWIS & This Study) > NURE
		Ln SpC	(NWIS & This Study) > NURE
	K-W MCT	Spc	(NWIS & This Study) > NURE

Table F6

Goodness of Fit Tests for Ba and Sr in Na-Cl and Na-HCO_3 Type Waters Only - 95% Confidence

Parameter	Study	Fraction	Normal	Gamma	Log Normal
Barium	NWIS	Recoverable	No	No	Yes
	This Study	Total	No	Yes	Yes
Strontium	NWIS	Recoverable	No	No	Yes
	This Study	Total	No	Yes	Yes

Table F7

Summary of Analysis of Variance and Kruskal-Wallis Results for Na-Cl and Na-HCO_3 Water Types Only

Parameter	NWIS			This Study			Degrees of Freedom (Between/ Within)	Parametric ANOVA Original Values		Log Transformed		Nonparametric ANOVA (Kruskal Wallis)		
	N	Mean	SD	N	Mean	SD		F Stat	P	F Stat	P	DoF	K W (H Stat)	P
Barium	12	10,391	28,005	10	1,876	1,805	1/20	0.914	0.351	0.884	0.358	1	0.436	0.509
Strontium	12	8,245	22,935	10	3,059	2,400	1/20	0.503	0.487	3.87	0.0632	1	5.326	0.021

Highlighting Key: **P < 0.05**; **0.05 < P < 0.1**.

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