



March 13, 2015

██████████
Pennzoil-Quaker State Company
700 Milam Avenue
Houston, TX 77002

Re: Sheen Evaluation
Hal H. Clark Park, Parcel #41-28-57
Centerbridge Facility
New Hope, Pennsylvania

Dear ██████████:

URS Corporation (URS), a wholly owned subsidiary of AECOM, has prepared the following Letter Report for a sheen evaluation conducted at Hal H. Clark Park, Parcel 41-28-57, located in New Hope, Pennsylvania (the "Site"). The activities were conducted to evaluate potential hydrocarbon sheen observed in a shallow stream at the Site, by Mr. Paul Jardel of the Pennsylvania Department of Environmental Protection (PADEP) and Mr. Michael Towle, U.S. Environmental Protection Agency (EPA) on July 25 and August 20, 2014, respectively. Mr. Towle indicated that sheen has been observed several times during the past approximately 20 years, with the most recent occurrence observed in September 2014.

Media samples were collected from four (4) locations on September 4, 2014 where surface water sheens were observed in discrete patches. This Letter Report summarizes the methods, results and findings of the field activities and subsequent laboratory analyses. In addition, visual observations from a public walking trail of adjacent Parcel 41-18-130 located immediately to the northwest are also noted in this Report.

1.0 BACKGROUND

The Site is currently Bucks County public park, Hal H. Clark Park (HHCP) and is located to the east of River Road and the Delaware Canal. In the vicinity of the Site, a crude oil pipeline and storage facility operated from approximately 1897 to 1960. Two (2) companies [National Transit Company (National Transit) and Tuscarora Pipeline (Tuscarora)] owned the Site over the course of its history. Tuscarora was dissolved in 1961; its liabilities are assumed by what is now ExxonMobil. National Transit is now owned by Pennzoil-Quaker State (PQS) Company, a subsidiary of Shell. The location of the Site is shown on **Figure 1**.

On July 25, 2014 and again on August 20, 2014, Mr. Paul Jardel of the PADEP collected sheen samples within the shallow stream located on the Site. Subsequently, PADEP notified URS that EPA would disseminate information regarding the samples collected. During a conference call on August 26, 2014, the EPA identified two locations in which a surface water sheen and petroleum odor were suspected in the shallow stream. The first location was less than 50 feet north of the entrance to HHCP. At this location, it was observed that a small tree had fallen over the stream and was acting like a dam with the sheen accumulating on the upstream side of the tree. The second location was approximately 100 to 150 feet north of the HHCP entrance. At the second location, the EPA noted that a paraffin-like material was primarily originating from the bank adjacent to the canal, with a minor amount of material originating

from the river-side of the bank. Mr. Towle of the EPA noted metal pipes of unknown origin in the stream. Mr. Towle noted that flow was coming into the stream from beneath the canal in the area of the pipes, and he indicated that the odors were strongest in this area.

2.0 FIELD ACTIVITIES

Based on correspondence with Mr. Paul Jardel, PADEP, and Mr. Michael Towle, EPA, URS mobilized to the Site to collect samples to evaluate the potential hydrocarbon sheen observed in a shallow stream at the Site. On September 4, 2014, URS observed approximately 1,300 linear feet (LF) of a shallow stream flowing generally north-to-south adjacent to and east of the Delaware Canal, and collected media samples from four locations (Brook-1 through Brook-3, and Seep-1C) within or adjacent to the stream. Samples Brook-1 and Brook-2 were collected in the area where the EPA identified the two locations in which surface water sheen and petroleum odor were suspected in the shallow stream. Sample location Brook-2 was also near the area where the EPA noted the paraffin-like material originating from a bank. The location of the metal pipes noted by the EPA in the stream is shown on **Figure 1** between locations Seep-1C and Seep-1B, approximately 185 LF upstream (northwest) of sample location Brook-2.

The stream is a low-gradient, perennial stream with minimal evidence of flash flooding. Based on a visual estimation, the average water depth in the center of the stream channel was approximately 4 to 6 inches.

During the evaluation, URS noted the following observations:

- sheen with a petroleum-like odor was observed in locations where flow velocities were slowed,
- two daylighted pipes, one near the stream level that had both ends buried underground and one higher than the other that is cut off at one end, approximately 700 LF upstream (north) of the entrance to HHCP,
- the stream channel divides into two channels at approximately 1100 LF upstream of the entrance to HHCP,
- the furthest upstream sheen location observed was approximately 1200 LF upstream of the entrance to HHCP and was apparent in both the eastern and western stream channels; and
- two ground surface mounds, each approximately 15 to 20 feet in length by 4 feet in width and possibly associated with remnant piping, are located approximately 1250 LF upstream of the entrance to HHCP and closest to the western stream channel. The mounds are located on the northwestern adjacent property, Parcel 41-18-130.

The four sampling locations and other observed features are shown on **Figure 1**. A photographic log is included in **Attachment 1**.

2.1 Sample Collection Methods and Laboratory Analyses

Sheens were generally observed as discrete patches. The patches often formed as a result of flow blockages (e.g. woody debris). The sheens were also observed where flow velocities were slowed, and were not visible where flow rates increased. Prior to sample collection, a stick test was performed to differentiate naturally occurring sheens from a petroleum sheens on the basis of “plating.” If a sheen broke up into discrete “plates” when disturbed, it was determined to likely be natural. If the sheen coalesced following disturbance, it was determined to likely be a potential petroleum sheen. In all areas where a stick test was conducted, the results indicated a potential petroleum sheen. Subsequently, samples were collected from these areas.

At sample locations Brook-1 and Brook-2, sheen, biomatter and sediment samples were collected. Sediment samples at both of these locations were dark brown silty loam with some organic matter (detritus and leaves). At sample location Brook-3, sheen and sediment samples were collected. Biomatter was not present at this location; therefore a sample was not collected. The sediment sample was a dark brown sandy loam with some organic matter (detritus and leaves).

Three seeps (Seep-1A, Seep-1B, and Seep-1C) were identified, all within approximately 30 LF of each other, and in an area where remnant pipe sections, approximately 8-inches to 10-inches in diameter, were observed (**Figure 2**). A water sample was collected from Seep-1C, which is located the furthest upstream (northwest) and where the greatest volume of water was observed to seep from the stream bank. Between Seep-1B and Seep-1C, a pipe laying along the east bank of the stream parallel to water flow was observed and was potentially dislodged from the location of Seep-1C.

Water quality parameters of temperature, conductivity, dissolved oxygen, pH, and oxidation reduction potential were collected at sampling locations Brook-1 and Brook-2, and are summarized on **Table 1**. Due to shallow conditions that did not allow for the complete submersion of the sonde, water quality parameters were not collected at sampling locations Brook-3 and Seep-1C.

Three sheen, one water, two biomatter, and three sediment samples were collected and submitted for laboratory analysis. The collection methods are summarized below according to sample type. All samples were collected from the west side of the stream in the vicinity of where a potential petroleum sheen was observed. All samples were placed in appropriate bottleware, placed on ice, and sent under proper chain-of-custody protocol to their respective laboratories for analysis.

Four laboratories were utilized to complete the targeted analyses. The analyses and analytical methods performed on each material type and the laboratory that completed the testing are summarized below and on **Table 2**.

2.1.1 Sheen

Sheen samples (Brook-1-SH, Brook-2-SH, and Brook-3-SH) were collected with a long-handled sampling apparatus by placing a clean sample bottle into the stream and allowing the sheen to flow into the bottle. Attention was given to collect as much of the sheen as possible, and to minimize the collection of surface water and suspended particulates such a sediment and biomatter. This approach was generally consistent with the method used to collect sheen samples by Paul Jardel of the PADEP, who sampled the sheen within the stream in July 2014 and again in August 2014. Two equipment blanks and four trip blanks were also collected. The sheen and blank samples were submitted to Accutest Laboratories (Accutest) of Dayton, New Jersey for target constituent list (TCL) volatile organic compounds (VOCs) by EPA Method 8260B; dissolved light hydrocarbons C1-C3 analysis by EPA Method RSK-175; total petroleum hydrocarbons (TPH) gasoline range organics (GRO), TPH diesel range organics (DRO), and TPH oil range organics (ORO) by EPA Method 8015C; sulfate by EPA Method 9056A; and sulfide by EPA Method SM54002S-F-11. Samples collected from the same locations were also submitted to SOPUS for fingerprint analysis.

2.1.2 Water

A water sample collected from Seep-1C was submitted to Shell Global Solutions US (SOPUS) for fingerprint analysis for comparison to the sediment and other sheen samples. It should be noted the

sample collected from Seep-1C was collected directly from the water flowing out of the bank into the stream.

2.1.3 Biomatter Tissue

Biomatter tissue samples (Brook-1-BIO and Brook-2-BIO) were collected with a transfer pipette by vacuum extraction. The pipette was placed within a floating patch of the biomatter tissue and a sample was extracted. The biomatter tissue was allowed to settle and the liquids were decanted. In addition, the water directly in contact with the biomatter was collected in a clean bottle and utilized for bacteriological culturing. The biomatter tissue samples were submitted to Alpha Analytical (Alpha) of Mansfield, Massachusetts for TCL VOCs analysis by EPA Method 8260B PIANO VOCs and EMSL Analytical Inc. (EMSL) of Cinnaminson, New Jersey for iron-related bacteria (IRB) analysis by EMSL Method M121 and sulfate-reducing bacteria (SRB) analysis by EMSL Method M122. The water in direct contact with biomatter tissue samples was submitted to EMSL for bacteriological culturing of IRB and SRB.

2.1.4 Sediment

Sediment samples (Brook-1-SED, Brook-2-SED, and Brook-3-SED) were collected from the biologically active zone from the bottom of the stream channel (sediment-water interface) to 6 inches below the bottom of the stream channel. Samples were collected with a dedicated acetate core liner using a direct push method or with an open-walled soil auger. Attention was given to minimize the collection of biomatter present on the bottom of the stream channel. The collected interval was homogenized and placed into clean sample containers. The sediment samples were submitted to SOPUS for fingerprint analysis.

3.0 LABORATORY RESULTS

The laboratory analytical results for the sheen, biomatter, and sediment samples are summarized in the following sections.

3.1 Sheen Results

Three sheen samples (Brook-1-SH, Brook-2-SH, and Brook-3-SH) were collected for analysis of VOCs, TPH GRO, TPH DRO, TPH ORO, sulfide, and sulfate. The laboratory analytical data were compared to PADEP Act 2 residential medium specific concentrations (MSCs) for groundwater. Analytes with detectable concentrations are discussed below. No analytes were detected above laboratory detection limits in the quality control samples (i.e., equipment and trip blanks).

Five VOCs (2-butanone, isopropylbenzene, methylcyclohexane, pentane, and methane) were detected in the sheen samples. The maximum VOC concentration detected was methylcyclohexane at a concentration of 87.8 micrograms per liter ($\mu\text{g/L}$) in sheen sample Brook-2-SH. All VOC detections were below PADEP Act 2 residential MSCs for groundwater or there was not an MSC developed. Surface water quality criteria (WQCs) under the provisions of Pennsylvania Code §93.8c for human health and aquatic life criteria are not available for any of the five detected VOCs. Volatile tentatively identified compounds (TICs) were detected in sheen samples Brook-1-SH and Brook-2-SH, and included alkanes, alkenes, propyl-benzene, and 1H-indene-dihydro-methyl-isomer. The maximum total TICs concentration detected was 251.6 $\mu\text{g/L}$ in sheen sample Brook-2-SH.

TPH-GRO was detected in sheen samples Brook-1-SH and Brook-2-SH. The maximum TPH-GRO concentration detected was 0.806 milligrams per liter (mg/L) in sheen sample Brook-1-SH. TPH-DRO was detected in all three sheen samples. The maximum TPH-DRO concentration detected was 0.18 mg/L in sheen sample Brook-3-SH. TPH-ORO was detected in sheen sample Brook-3-SH at a concentration of 0.131 mg/L. PADEP Act 2 MSCs have not been developed for TPH-GRO, TPH-DRO, and TPH-ORO.

Sulfate was detected in sheen sample Brook-2-SH at a concentration of 13.2 mg/L. This sulfate concentration is below the U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (SMCL) of 250 mg/L. The SMCL was established for sulfate as a guideline to assist with management of aesthetic considerations such as taste, color, and odor. SMCLs are not mandatory water quality standards, and contaminants for which a SMCLs are established are not considered to present a risk to human health if a concentration is at or above the SMCL. Sulfate was not detected in any other sheen sample.

Compounds detected in the sheen samples are shown on **Figure 2** and summarized on **Table 3**. Laboratory analytical reports for the sheen samples and equipment blanks are included in **Attachment 2**.

3.2 Biomatter Tissue Results

Two biomatter tissues samples (Brook-1 and Brook-2) were collected for analysis of VOCs. Biomatter tissue analytical results indicate no VOCs were detected in either biomatter tissue sample. The laboratory analytical report for the biomatter tissue samples is included in **Attachment 3**.

The water in direct contact with biomatter tissue samples was collected for bacteriological culturing of IRB and SRB. Results of the bacteriological culturing indicate the detection of both IRB and SRB in the samples collected. The density of IRB detected was 2,300 colony forming units per milliliter (CFU/mL) in both samples, and the maximum density SRB detected was 5,000 CFU/mL. The dominant organism of the IRB was highly aerobic iron oxidizing bacteria that could include sheath formers and genus *Gallionella*. These IRB are likely associated with iron oxidization, which likely contributed to the orangish color of the collected biomatter at both sample locations. The dominant organism of the SRB was determined to be active anaerobically within deeply set aerobic bacterial growths, such as the biomatter tissue collected. The laboratory analytical report for the water associated with the biomatter tissue samples is included in **Attachment 4**.

3.3 Fingerprint Results

Hydrocarbon fingerprint analysis was completed on sheen samples Brook-1-SH through Brook-3-SH, water sample Seep-1C, and sediment samples Brook 1-SED through Brook-3-SED. The fingerprint analysis was performed by Shell's Technology Center (STC) in Houston, Texas. STC provided AECOM with a summary of findings in emails dated September 18, 2014 and February 11, 2015. Summaries of the STC fingerprint results and associated findings are discussed below according to sample type and location, as applicable.

3.3.1 Sheen Samples

Hydrocarbons were not detected by analysis of the headspace for sheen samples Brook-1-SH through Brook-3-SH. As discussed in Section 3.1, analysis of the sheen samples by Accutest resulted in the detection of several hydrocarbons. Although low levels of hydrocarbons were detected through the analysis by Accutest, the lack of hydrocarbons observed through headspace analysis performed by STC indicates a potential lack of volatilization. Due to this potential lack of volatilization, it is unlikely that

the material in the sheen samples would cause a significant contribution to odors observed near the stream. The chromatograms from STC's fingerprint analysis of sheen samples Brook-1-SH through Brook-3-SH are provided in **Attachment 5**.

3.3.2 Seep Sample

Chromatogram spikes for the headspace of water sample Seep-1C indicate the presence of light end hydrocarbons that are primarily less than carbon chain 8; the detected hydrocarbons are branched and cyclic and resistant to biodegradation. Analysis indicated that the n-alkanes and aromatics, which are faster to biodegrade, are not present. Traces of methylpentenes, dimethylcyclopentene, and methylcyclohexene (all alkenes) were observed.

Alkenes are a product of cracking crude and can be found in gasoline. Based on the data, the light end petroleum hydrocarbons are too light to be a lubricating oil. They may be from biodegraded condensate (the light fractions of processed crude) or heavier ends of a biodegraded gasoline. Based on the results, indications of the presence of unprocessed crude oil were not observed.

The light end hydrocarbons detected in the headspace of the Seep-1C sample would have the potential to produce odor. The chromatogram from the fingerprint analysis of the headspace from sample Seep-1C is included in **Attachment 5**.

3.3.3 Sediment Samples

Hydrocarbon fingerprint analysis was also completed by STC on extracts from sediment samples Brook-1-SED through Brook-3-SED. Based on the analytical results, the same type of compounds and chromatographic profiles were identified in sediment samples as identified in water sample Seep-1C. However, Brook-1-SED and Brook-2-SED contained relatively greater amounts of hydrocarbons (as compared to Brook-3-SED), and sample Brook-3-SED contained barely detectable amounts. Sample Brook-3-SED was collected further north and upgradient of Brook-1-SED, Brook-2-SED and Seep-1C, near the northern border of the Hal H. Clark Park.

4.0 SUMMARY OF FINDINGS

Evaluation of analytical results indicate that petroleum-related compounds were detected in the surface water sheen, but the detected concentrations were below PADEP residential MSCs for groundwater. Sheen sample results were also screened against surface WQC under the provisions of Pennsylvania Code §93.8c for human health and aquatic life criteria; however, none of the five detected VOCs have listed WQC. Based on the extremely low detections, an unacceptable human health or ecological risk is not anticipated to be present.

Analysis of the sheen/water mixture performed by Accutest and STC does not support the concept that the sheen is producing the detected odor observed near the stream. However, analysis of the Seep-1C sample resulted in the detection of light end hydrocarbons that could contribute to the odors observed near the stream. It is likely that the odor observed at the stream is due to the low level presence of volatile hydrocarbons in the seep and potential degradation compounds including biogenic organic matter.

STC's analysis of the seep sample suggests that the detected compounds may originate from a biodegraded condensate of the light fractions of processed crude or the heavier ends of a biodegraded gasoline. Several alkenes were detected in the seep sample. The reported alkenes can be a product of cracking crude and can be found in gasoline.

Analysis of the three sediment samples indicates that the same type of compounds and chromatographic profiles were identified in the sediment samples as were identified in the Seep-1C sample, and that Brook-1-SED and Brook-2-SED contained relatively greater amounts of hydrocarbons (as compared to Brook-3-SED).

Analysis of Brook-3-SED collected at the upgradient portion of the stream near the Hal H. Clark Park property boundary indicated barely detectable amounts of petroleum hydrocarbons. Based on the analysis of the sediment samples and the seep sample, the source of the odors is likely downgradient of the northwestern property boundary of the Hal H. Clark Park. Observations of odors in the area have typically indicated that they are most prevalent in the area of the Hal H. Clark Park entrance and immediately upstream to the northwest. Analysis of the Seep-1C, Brook-1-SED and Brook-2-SED samples resulted in the identification of light end hydrocarbons that could contribute to the odor observed in the area.

Please contact [REDACTED] at [REDACTED] or [REDACTED] at [REDACTED] of URS should you have questions or require additional information.

Sincerely,
URS CORPORATION

[REDACTED]

[REDACTED]

[REDACTED]
Principal, Senior Project Manager

[REDACTED]
Geologist

Enclosures:

- Table 1** – Water Quality Parameters
- Table 2** – Sample Collection Matrix
- Table 3** – Sheen Analytical Results of Constituents Detected

- Figure 1** – Site Map
- Figure 2** – Sheen Analytical Results Map of Constituents Detected

- Attachment 1** – Photographic Log
- Attachment 2** – Sheen Analytical Laboratory Reports
- Attachment 3** – Biomatter Tissue Analytical Laboratory Report
- Attachment 4** – Bacteriological Analytical Laboratory Report
- Attachment 5** – Fingerprint Chromatogram

TABLES

Table 1
Sheen Evaluation
Water Quality Parameters
Centerbridge, PA, Incident No. 97611740

Sample Location	Brook-1	Brook-2
Temperature (°C)	19.82	19.96
Conductivity (mS/cm)	0.282	0.282
Dissolved Oxygen (mg/L)	32.6	32.5
Dissolved Oxygen (%)	2.98	2.95
pH (SU)	7.03	6.88
ORP (mV)	-38.9	-47.4

Notes

Readings obtained in field using handheld multi-parameter water quality meter.

°C - Degrees Celcius

mS/cm - milliSiemens per centimeter

mg/L - milligrams per Liter

% - Percent

SU - Standard Units

ORP - Oxidation Reduction Potential

mV - milliVolts

Table 2
Sheen Evaluation
Sample Collection Matrix
Centerbridge, PA, Incident No. 97611740

<i>Constituent(s)</i>	<i>Analytical Method</i>	<i>Sheen</i>	<i>Water</i>	<i>Biomatter</i>	<i>Sediment</i>
Target Constituent List Volatile Organic Compounds	EPA 8260B	X ¹			
Target Constituent List Volatile Organic Compounds	PIANO Volatiles EPA 8260B Mod			X ²	
C1-C3 Dissolved Light Hydrocarbons	EPA RSK-175	X ¹			
Total Petroleum Hydrocarbons Gasoline Range Organics	EPA 8015C	X ¹			
Total Petroleum Hydrocarbons Diesel Range Organics	EPA 8015C	X ¹			
Total Petroleum Hydrocarbons Oil Range Organics	EPA 8015C	X ¹			
Sulfate	EPA 9056A	X ¹			
Sulfide	EPA SM54002S-F-11	X ¹			
Iron-Related Bacteria	EMSL M121			X ³	
Sulfate-Reducing Bacteria	EMSL M122			X ³	
Fingerprint	MS	X ⁴	X ⁴		X ⁴

Notes

¹ Analysis performed by Accutest Laboratories of Dayton, New Jersey

² Analysis of biomatter tissue performed by Alpha Analytical of Mansfield, Massachusetts

³ Analysis of surface water directly in contact with biomatter performed by EMSL Analytical, Inc. of Cinnaminson, New Jersey

⁴ Analysis performed by Shell Global Solutions, US of Houston, Texas

Table 3
Sheen Evaluation
Sheen Analytical Results of Constituents Detected
Centerbridge, PA, Incident No. 97611740

Sample ID:	CAS #	Units	Residential Used Aquifer Groundwater MSCs (TDS ≤ 2,500)¹	BROOK-1	BROOK-2	BROOK-3
Date Sampled:				9/4/2014	9/4/2014	9/4/2014
Volatile Organic Compounds (SW846 8260B)						
2-Butanone (MEK)	78-93-3	µg/L	4,000	10.3	11.1	ND(10)
Isopropylbenzene	98-82-8	µg/L	840	5.2	7.1	ND(1.0)
Methylcyclohexane	108-87-2	µg/L	NE	83	87.8	ND(5.0)
Pentane	109-66-0	µg/L	NE	13.3	13.3	ND(5.0)
GC Volatile Organic Compounds (RSK-175)						
Methane	74-82-8	µg/L	NE	76.3	49.5	43.4
GC Volatile Organic Compounds (SW846 8015C)						
TPH-GRO (C6-C10)	8006-61-9	mg/L	NE	0.806	0.781	ND (0.20)
GC Semi-Volatile Organic Compounds (SW846 8015C)						
TPH-DRO (C10-C28)	68334-30-5	mg/L	NE	0.114	0.15	0.18
TPH-ORO (>C28-C40)	NE	mg/L	NE	ND (0.028)	ND (0.026)	0.131
General Chemistry						
Sulfate	14808-79-8	mg/L	250²	ND(10)	13.2	ND(10)

Notes

Only analytes detected above the laboratory reporting limits are included on this table.

¹ Pennsylvania Department of Environmental Protection medium specific concentrations (MSCs) organic regulated substances in groundwater [PADEP Act 2 Appendix A, Table 1 (organic)]

² U.S. Environmental Protection Agency. Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals. <http://water.epa.gov/drink/contaminants/secondarystandards.cfm>

µg/L - micrograms per liter

mg/L- milligrams per liter

NE- not established

ND (10)- not detected (reporting limit)

FIGURES

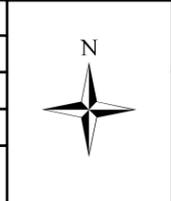


Legend

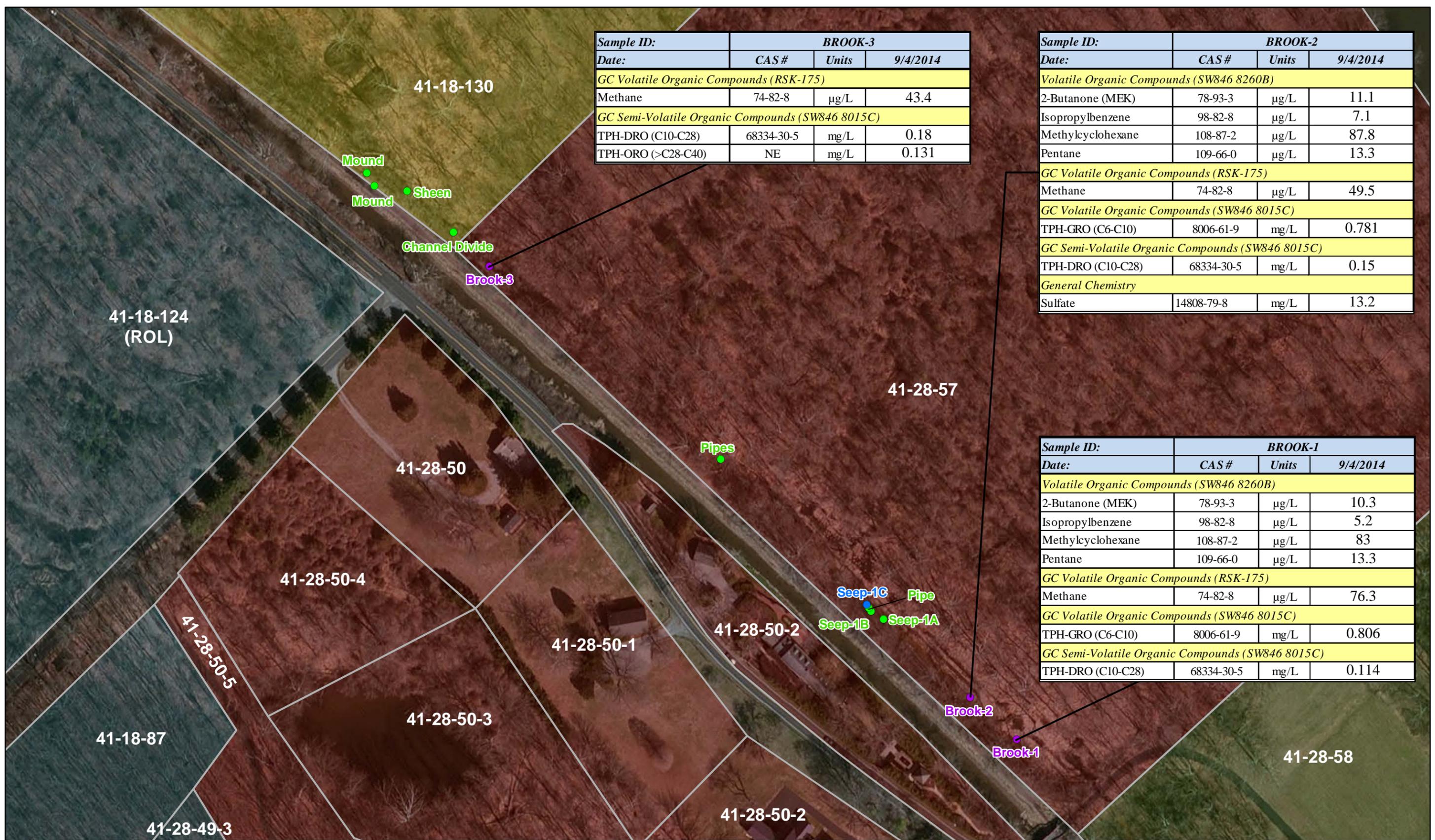
Tax Parcel Boundary	Shell, Exxon, & Standard Oil owned	Sheen Sampling Location
Shell Owned	41-28-57 Parcel Tax ID Number	Seep Sampling Location
Neither Shell nor Exxon	(ROL) Release of Liability Received	Observed Feature
Shell & Standard Oil owned; Exxon - Right of Way (ROW)		

Note: Sheen Investigation conducted on September 4, 2014.

CLIENT	Pennzoil-Quaker State Company		
PROJ	SOPUS Site #97611740, New Hope, PA		
SCALE	1:1,440	DES BY	AB 11/13/2014
0 60 120 240 Feet		CHK BY	CL 11/13/2014
Q:\Projects\TechSol\GIS\Projects\Shell\Centerbridge_PA\Projects\SheenInvestigationMap.mxd			



TITLE Sheen Investigation Map	
	12420 Milestone Center Drive Germantown, MD 20876
FIGURE 1	



Sample ID:	BROOK-3		
Date:	CAS#	Units	9/4/2014
GC Volatile Organic Compounds (RSK-175)			
Methane	74-82-8	µg/L	43.4
GC Semi-Volatile Organic Compounds (SW846 8015C)			
TPH-DRO (C10-C28)	68334-30-5	mg/L	0.18
TPH-ORO (>C28-C40)	NE	mg/L	0.131

Sample ID:	BROOK-2		
Date:	CAS#	Units	9/4/2014
Volatile Organic Compounds (SW846 8260B)			
2-Butanone (MEK)	78-93-3	µg/L	11.1
Isopropylbenzene	98-82-8	µg/L	7.1
Methylcyclohexane	108-87-2	µg/L	87.8
Pentane	109-66-0	µg/L	13.3
GC Volatile Organic Compounds (RSK-175)			
Methane	74-82-8	µg/L	49.5
GC Volatile Organic Compounds (SW846 8015C)			
TPH-GRO (C6-C10)	8006-61-9	mg/L	0.781
GC Semi-Volatile Organic Compounds (SW846 8015C)			
TPH-DRO (C10-C28)	68334-30-5	mg/L	0.15
General Chemistry			
Sulfate	14808-79-8	mg/L	13.2

Sample ID:	BROOK-1		
Date:	CAS#	Units	9/4/2014
Volatile Organic Compounds (SW846 8260B)			
2-Butanone (MEK)	78-93-3	µg/L	10.3
Isopropylbenzene	98-82-8	µg/L	5.2
Methylcyclohexane	108-87-2	µg/L	83
Pentane	109-66-0	µg/L	13.3
GC Volatile Organic Compounds (RSK-175)			
Methane	74-82-8	µg/L	76.3
GC Volatile Organic Compounds (SW846 8015C)			
TPH-GRO (C6-C10)	8006-61-9	mg/L	0.806
GC Semi-Volatile Organic Compounds (SW846 8015C)			
TPH-DRO (C10-C28)	68334-30-5	mg/L	0.114

Legend

- Tax Parcel Boundary
- Shell Owned
- Neither Shell nor Exxon
- Shell & Standard Oil owned; Exxon - Right of Way (ROW)

- Shell, Exxon, & Standard Oil owned
- 41-28-57 Parcel Tax ID Number
- (ROL) Release of Liability Received

- Sheen Sampling Location
- Seep Sampling Location
- Observed Feature

Key:
 µg/L - micrograms per liter
 mg/L - milligrams per liter

Note: Only analytes detected above the laboratory reporting limits are included on this figure.

The sheen sample collected from Seep-1 (Seep-1C) was submitted for fingerprint analysis only, and no other chemical testing.

CLIENT	Pennzoil-Quaker State Company		
PROJ	SOPUS Site #97611740, New Hope, PA		
SCALE	1:1,440	DES BY	AB 11/13/2014
	0 60 120 240 Feet	CHK BY	CL 11/13/2014
Q:\Projects\TechSol\GIS\Projects\Shell\Centerbridge_PA\Projects\SheenAnalyticalResults.mxd			



TITLE	Sheen Analytical Results Map	
	12420 Milestone Center Drive	FIGURE 2
	Germantown, MD 20876	

Attachment 1

Photographic Log



PHOTOGRAPHIC LOG

Client Name:
Pennzoil-Quaker State Company

Site Location:
Parcel #41-28-57 and #41-18-130, New Hope, PA

Project
Site #976111740

Photo No.
1

Date:
9/4/14

Direction Photo Taken:

Northwest

Description:

Sampling Location
Brook-1



Photo No.
2

Date:
9/4/14

Direction Photo Taken:

Southwest

Description:

Sampling Location
Brook-1





PHOTOGRAPHIC LOG

Client Name:
Pennzoil-Quaker State Company

Site Location:
Parcel #41-28-57 and #41-18-130, New Hope, PA

Project
Site #976111740

Photo No.
3

Date:
9/4/14

Direction Photo Taken:

Southwest

Description:

Sampling Location
Brook-2



Photo No.
4

Date:
9/4/14

Direction Photo Taken:

Northwest

Description:

Sampling Location
Brook-2



Client Name: Pennzoil-Quaker State Company		Site Location: Parcel #41-28-57 and #41-18-130, New Hope, PA	Project Site #976111740
Photo No. 5	Date: 9/4/14		
Direction Photo Taken: Southwest			
Description: Sampling Location Seep-1			
Photo No. 6	Date: 9/4/14		
Direction Photo Taken: Southwest			
Description: Sampling Location Seep-1			



PHOTOGRAPHIC LOG

Client Name: Pennzoil-Quaker State Company	Site Location: Parcel #41-28-57 and #41-18-130, New Hope, PA	Project Site #976111740
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Photo No. 7	Date: 9/4/14
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Direction Photo Taken:
Northwest

Description:
Pipe Crossing Brook



Photo No. 8	Date: 9/4/14
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Direction Photo Taken:
Southwest

Description:
Sampling Location
Brook-3



Client Name: Pennzoil-Quaker State Company		Site Location: Parcel #41-28-57 and #41-18-130, New Hope, PA	Project Site #976111740
Photo No. 9	Date: 9/4/14		
Direction Photo Taken: Southwest			
Description: Furthest Upstream Sheen Observed			
Photo No. 10	Date: 9/4/14		
Direction Photo Taken: Northwest			
Description: Location of Mounds			