Mr. Matthew King
Geologist Trainee, Remedial Bureau C
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Albany, New York 12233

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ENVIRONMENT

Subject:
Bedrock Monitoring Well Results
Dunkirk Former MGP Site
National Fuel

Date:
May 22, 2020

Contact:
Scott A. Powlin

Phone:
315 671 9456

Email:
Scott.Powlin@arcadis.com

Our ref:
30003783

Dear Mr. King:

On behalf of National Fuel Gas Distribution Corporation (NFG), this letter presents the results of recent bedrock investigation activities completed in connection with the former manufactured gas plant (MGP) site located at 31 West 2nd Street in Dunkirk, New York. This letter supersedes the April 23, 2020 letter and includes additional recommendations for next steps based on:

- Discussions held during an April 30, 2020 conference call between NFG, New York State Department of Environmental Conservation (NYSDEC), NYS Department of Health (NYSDOH), and Arcadis.
- May 14, 2020 e-mail from Arcadis presenting responses to comments from the NYSDEC and NYSDOH discussed during the April 30, 2020 conference call, and NYSDEC's May 20, 2020 e-mail identifying that NYSDEC concurs with the responses.

The field activities consisted of installing three bedrock monitoring wells (MW-1R, MW-4R, and MW-16R) and collecting groundwater samples from the wells in accordance with the *Work Plan for Bedrock Monitoring Wells* submitted to and approved by the New York State Department of Environmental Conservation (NYSDEC) on December 6, 2019 and February 4, 2020, respectively. The three bedrock monitoring wells were installed to investigate potential volatile organic compound (VOC) impacts in bedrock in the areas of the site exhibiting the highest concentrations of dissolved-phase benzene in the overburden and collect information to evaluate groundwater flow direction in the bedrock and the vertical hydraulic connection between the overburden and bedrock.

FIELD ACTIVITIES

Field activities were conducted in accordance with the Work Plan and the procedures detailed in the existing NYSDEC-approved Field Sampling Plan (FSP) and Quality Assurance Sampling and Analysis Project Plan (QA/SAPP) developed for the site (Arcadis 2009). Health and safety procedures were conducted in accordance with a site-specific Health and Safety Plan (HASP).

Monitoring wells MW-1R, MW-4R, and MW-16R were installed from March 3 to 10, 2020 at the locations shown on Figure 1. Prior to monitoring well installation, underground utilities were located by contacting Dig Safely New York and creating a ticket for public utilities to mark the location of buried utilities at the site. In addition, private utility locating was used in the areas of the three bedrock wells using Ground Penetrating Radar (GPR) and/or EM-31 geophysical surveying techniques as well as a line locator. A vacuum-excavation truck and hand tools were used to clear each new monitoring well location to approximately 5 feet below ground surface (bgs). Upon clearing of each location, the overburden was drilled using 4.25-inch hollow stem augers (HSA) and continuous split-spoon sampling was performed until bedrock refusal was encountered. Soil samples were collected continuously from the borings for visual characterization and headspace screening with a photoionization detector (PID). Once bedrock was encountered the upper approximately 5 feet of bedrock was cored, and a nominal 6-inch diameter, 5-foot rock socket was reamed, at which point a 4-inch diameter steel casing was grouted into place from grade to approximately 5 feet into rock at each location and allowed to cure for a minimum of 24 hours before additional bedrock coring. Once the grout was allowed to cure, HQ-sized tooling was used to core bedrock to a depth of approximately 12 feet below the bottom of the steel casing to a total depth of approximately 17 feet into bedrock at each location. Bedrock cores were retrieved, screened with a PID, and logged in terms of lithology, texture, color, fracture orientation, and observed for the presence or absence of sheen or non-aqueous phase liquid (NAPL).

The bedrock monitoring wells were installed as open-hole construction, as follows:

- **MW-1R:** 24.5 to 36.5 feet bgs
- **MW-4R:** 25.7 to 37.8 feet bgs
- **MW-16R:** 22.5 to 34.2 feet bgs

Please refer to the monitoring well logs in Attachment 1 for detail regarding the well construction and the characteristics of the soil and bedrock encountered during installation.

Each well was secured at the surface with an 8-inch dimeter flush-mounted curb box. Approximately 24 hours after installation, the monitoring wells were developed using surge and purge techniques until purge water readings reached less than 50 nephelometric turbidity units (NTUs) or until the purge water was reasonably free of sediment. Well development resulted in the removal of approximately 10 well volumes at well MW-1R, 9 well volumes at well MW-4R, and 5 well volumes at well MW-16R. Impacts were not observed during well development.

The location, ground surface elevation, and measuring point elevation of each new monitoring well were surveyed by CT Male Associates of Syracuse, New York on March 12, 2020. Horizontal coordinates were tied to the New York State Plane Central (3102) coordinate system (NAD 83), and all elevations were established with respect to NAVD 1988.

Groundwater samples were collected from the three new bedrock monitoring wells on March 20, 2020. A round of water levels and total well depths were measured at all site monitoring wells (bedrock and overburden) prior to sampling. With the exception of MW-16R (discussed below), NAPL was not observed in any site wells. Groundwater samples were collected using low-flow sampling techniques at wells MW-1R and MW-4R; however, due to the presence of NAPL blebs suspended in the water column at well MW-16R, a polyethylene disposable bailer was used to sample groundwater at this location. Groundwater was sampled from this well using a bailer to avoid damaging down-hole instruments due to the presence of NAPL. All bedrock wells were sampled and submitted for analysis for Target Compound List (TCL) VOCs by Eurofins TestAmerica of Buffalo, New York. Samples were analyzed in accordance with NYSDEC Analytical Services Protocol (ASP). The laboratory provided Category B Deliverables. Laboratory data packages were validated, and a Data Usability Summary Report (DUSR) was prepared to assess the usability of the data. A copy of the DUSR can be provided upon request.

SOIL AND BEDROCK CHARACTERIZATION

The overburden stratigraphy observed at the three new bedrock monitoring wells is similar to the overburden previously observed while drilling soil borings to support the Remedial Investigation. Fill materials were observed with thicknesses ranging between approximately 4 to 9 feet. The fill is underlain by approximately 8 to 16 feet of native interbedded silt and clay which lies on the bedrock surface. An increased amount of sand and sometimes gravel was observed in the lower portion of the overburden. Bedrock was encountered at the following depths: MW-1R – 18.4 feet bgs; MW-4R – 20.7 feet bgs; and MW-16R – 17.5 feet bgs. The bedrock is consistent with the Dunkirk Shale and typically ranges from black to very dark gray in color. The shale has fine laminations and has minimal horizontal fracturing along bedding planes. The shale is relatively competent without a high degree of weathering as evidenced by its high rock quality designation (RQD), which typically ranges from 85 to 100 percent. Water loss was observed at MW-1R while coring through the 19.5 to 24-feet bgs interval as well as at approximately 26-feet bgs.

As noted in the boring logs contained in Attachment 1, visual impacts were observed in the fill materials while hand clearing at MW-1R. A faint odor and slight sheen was observed in the 3 to 5-foot bgs interval, though no PID readings were detected. There were no visual impacts (i.e., staining, sheen, NAPL) observed in the overburden at the other two bedrock monitoring wells locations (MW-4R and MW-16R). Sheen was observed at MW-16R while drilling the initial core run from 17.5 to 22.5-feet bgs, though no PID readings were detected. NAPL blebs were also observed suspended in the water column while sampling at this location. Visual impacts were not observed in the bedrock at MW-1R and MW-4R.

The hydraulic connection between the overburden and bedrock was evaluated by comparing groundwater elevations measured in the bedrock wells to elevations measured in nearby overburden monitoring wells. A summary of groundwater elevations is presented in the table, below.

Well ID	Groundwater Elevation (ft AMSL)	Difference (ft)
MW-14D	581.75	1.96
MW-1R	579.79	
MW-4	583.01	0.50
MW-4R	582.51	

Well ID	Groundwater Elevation (ft AMSL)	Difference (ft)
MW-16	579.75	0.43
MW-16R	579.32	

Notes:
Ft = feet; AMSL = Above Mean Sea Level

As demonstrated in the table above, the hydraulic head in the overburden is higher than that of the bedrock at all three bedrock well locations. This suggests that there is a downward component of groundwater flow from the overburden to the bedrock. Note that a groundwater elevation could not be measured at the overburden monitoring well (MW-1) nearest MW-1R because the bolts securing the flush-mount cover were bent. A groundwater elevation measurement at MW-1 would provide a more accurate measurement of the magnitude off vertical hydraulic gradient in this area.

Figure 2 presents a potentiometric surface map for the bedrock based on the levels measured at the three new bedrock wells on March 20, 2020. As shown on Figure 2, groundwater in the bedrock flows generally north-northeast. This flow direction is similar to that of the overburden; however, flow in the bedrock is more complicated than flow through the overburden. Groundwater in bedrock is primarily through an interconnected network of fracture rather than flow through porous media comprising the overburden.

GROUNDWATER ANALYTICAL RESULTS

Groundwater analytical results are presented on Figure 3 and in Table 1 in comparison to the NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1 (TOGS) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitation (NYSDEC, reissued June 1998 and revised April 2000 and June 2004). As shown in Table 1, benzene, ethylbenzene, toluene, and xylene (BTEX) were detected above their respective Standards in groundwater collected from all three of the bedrock monitoring wells. Total BTEX concentrations were as follows: MW-1R: 300 micrograms per liter (ug/L); MW-4R: 93 ug/L; and MW-16R: 11,000 ug/L. Additionally, styrene was detected above its Standard at MW-16R and methylene chloride was detected above its Standard at MW-1R.

RECOMMENDATIONS FOR NEXT STEPS

NFG proposes additional work activities to:

- Confirm the level of concentrations detected in the previous bedrock groundwater samples;
- Evaluate whether NAPL is present at appreciable quantities; and
- Further evaluate the hydraulic characteristics of the bedrock and hydraulic connection between the overburden and bedrock.

NFG proposes the following additional activities at the site:

- **Sump Installation:** Install 2-foot-long collection sumps at the bottom of each bedrock monitoring well. The sumps will be installed to collect NAPL that may enter the bedrock well. Sumps will be

installed by inserting steel sumps into the bottom of the coreholes and sumps would be fitted with a tight-fitting collar at the top of each sump to form a seal with the corehole wall.

- **NAPL Monitoring:** Conduct a 6-month NAPL monitoring program to further evaluate hydraulic gradients[1] and NAPL absence/presence in the bedrock monitoring wells. NAPL monitoring will be conducted on a monthly basis and NAPL quantities (if any) greater than one foot will be removed from the monitoring well to the extent practicable by manually bailing or periodically pumping (with portable pump) NAPL from the well. Recovered NAPL (if any) will then be containerized and transported off-site for treatment/disposal. Additionally, if sufficient NAPL is present in a bedrock monitoring well(s) a NAPL sample will be collected for physical characterization testing (i.e., interfacial tension, viscosity, and density). The frequency of the NAPL monitoring events or the NAPL monitoring duration may be modified based on the quantity of NAPL (if any) observed at the monitoring wells.
- **Well Pair Water-Level Measurement**: Measure water levels at monitoring wells MW-1, MW-1R, MW-4, MW-4R, MW-16, and MW-16R during each monthly NAPL monitoring event to evaluate the temporal variations of the vertical hydraulic gradient between the overburden and bedrock.
- **Groundwater Sampling and Site-Wide Water-Level Measurement**: Collect a round of groundwater samples from overburden monitoring wells MW-1, MW-4, and MW-16 and bedrock monitoring wells MW-1R, MW-4R, MW-16R and for analysis of TCL VOCs, TCL, semi-volatile organic compounds (SVOCs), and total cyanide. Measure a complete round of water-levels and total wells depths from all site wells. Groundwater samples and water levels/well depth measurements will be collected during the final NAPL monitoring event. Samples will be analyzed in accordance with the most recent version of the NYSDEC Analytical Services Protocol (ASP) with Category B deliverables. A DUSR report of the laboratory data packages will be prepared.
- **Mini-Pumping Tests**: Conduct mini-pumping tests at bedrock monitoring wells to evaluate the degree of hydraulic connection between the overburden and bedrock and bulk hydraulic conductivity of the bedrock. These tests would entail pumping groundwater from the bedrock wells for a period of 2 hours and measuring water levels in the bedrock wells and nearby overburden wells during pumping. The goal would be to achieve a minimum of 5 feet of drawdown in the bedrock wells during the tests. The mini-pumping tests would be performed following the groundwater sampling event and site-wide water-level measurement round proposed for the last month of the six-month NAPL monitoring period.
- **Reporting**: Submit monthly emails to the NYSDEC to summarize NAPL monitoring and well pair water-level measurements and submit a summary report of the collected data and propose a path forward for additional bedrock investigation activities, if deemed warranted, at the conclusion of the six-month monitoring program. The summary report will be submitted to the NYSDEC approximately one month after validation of the groundwater sampling analytical results.

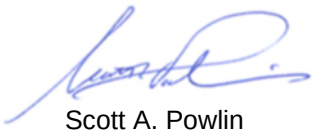
Please let us know if you have any questions regarding the information contained in this report and if you approve the recommended next steps. Please contact via phone at 315.671.9456 or e-mail at

[1] The surface completion at monitoring well MW-1 will be repaired prior to the first NAPL monitoring event to enable access to this well for measuring NAPL and water levels.

scott.powlin@arcadis.com or Tanya Alexander of NFG via phone at 716.857.7410 or email at AlexanderT@natfuel.com at your earliest convenience if you have any additional questions. We look forward to your review and approval of this report.

Sincerely,

Arcadis of New York, Inc.



Scott A. Powlin
Project Manager

Copies:
Tanya Alexander, CHMM, REM, National Fuel
Katie Hoelscher, National Fuel
Daniel Eaton, NYSDEC
Anthony Perretta, NYSDOH
Terry Young, Arcadis

Attachments:
Table 1 – Bedrock Groundwater Sampling Results
Figure 1 – Monitoring Well Locations
Figure 2 – Bedrock Potentiometric Surface Contours – 3/20/20
Figure 3 – Monitoring Well Groundwater Sampling Results
Attachment 1 – Monitoring Well Construction Logs

TABLE

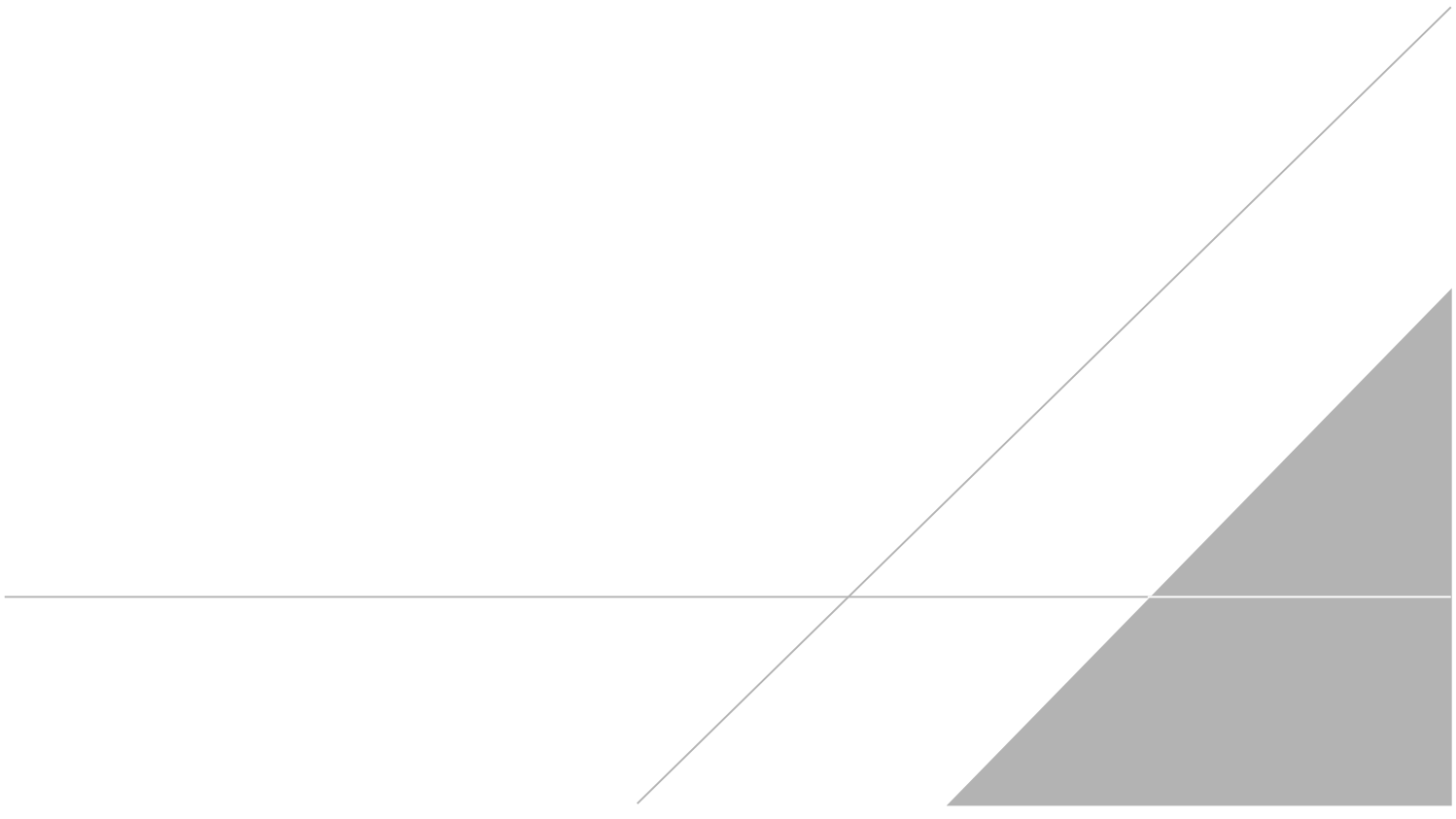


Table 1
Bedrock Groundwater Sampling Results

Bedrock Investigation
National Fuel
Dunkirk Former MGP Site, Dunkirk, New York

Location ID: / Date Collected:	TOGS 1.1.1 Standards & Guidance Values	Units	MW-1R 03/20/20	MW-4R 03/20/20	MW-16R 03/20/20
Volatile Organics					
1,1,1-Trichloroethane	5	ug/L	4.1 U [4.1 U]	0.82 U	82 U
1,1,2,2-Tetrachloroethane	5	ug/L	1.1 U [1.1 U]	0.21 U	21 U
1,1,2-trichloro-1,2,2-trifluoroethane	5	ug/L	1.6 U [1.6 U]	0.31 U	31 U
1,1,2-Trichloroethane	1	ug/L	1.2 U [1.2 U]	0.23 U	23 U
1,1-Dichloroethane	5	ug/L	1.9 U [1.9 U]	0.38 U	38 U
1,1-Dichloroethene	5	ug/L	1.5 U [1.5 U]	0.29 U	29 U
1,2,4-Trichlorobenzene	5	ug/L	2.1 U [2.1 U]	0.41 U	41 U
1,2-Dibromo-3-chloropropane	0.04	ug/L	2.0 U [2.0 U]	0.39 U	39 U
1,2-Dibromoethane	- -	ug/L	3.7 U [3.7 U]	0.73 U	73 U
1,2-Dichlorobenzene	3	ug/L	4.0 U [4.0 U]	0.79 U	79 U
1,2-Dichloroethane	0.6	ug/L	1.1 U [1.1 U]	0.21 U	21 U
1,2-Dichloropropane	1	ug/L	3.6 U [3.6 U]	0.72 U	72 U
1,3-Dichlorobenzene	3	ug/L	3.9 U [3.9 U]	0.78 U	78 U
1,4-Dichlorobenzene	3	ug/L	4.2 U [4.2 U]	0.84 U	84 U
2-Butanone	- -	ug/L	6.6 U [6.6 U]	1.3 U	130 U
2-Hexanone	50	ug/L	6.2 U [6.2 U]	1.2 U	120 U
4-Methyl-2-pentanone	- -	ug/L	11 U [11 U]	2.1 U	210 U
Acetone	50	ug/L	15 U [15 U]	3.0 U	300 U
Benzene	1	ug/L	**250 [240]**	**16**	**4,800**
Bromodichloromethane	50	ug/L	2.0 U [2.0 U]	0.39 U	39 U
Bromoform	50	ug/L	1.3 U [1.3 U]	0.26 U	26 U
Bromomethane	5	ug/L	3.5 U [3.5 U]	0.69 U	69 U
Carbon Disulfide	- -	ug/L	0.95 U [0.95 U]	1.5	19 U
Carbon Tetrachloride	5	ug/L	1.4 U [1.4 U]	0.27 U	27 U
Chlorobenzene	5	ug/L	3.8 U [3.8 U]	0.75 U	75 U
Chloroethane	5	ug/L	1.6 U [1.6 U]	0.32 UJ	32 UJ
Chloroform	7	ug/L	1.7 U [1.7 U]	0.34 U	34 U
Chloromethane	- -	ug/L	1.8 U [1.8 U]	0.35 U	35 U
Cis-1,2-dichloroethene	5	ug/L	4.1 U [4.1 U]	0.81 U	81 U
Cis-1,3-dichloropropene	0.4	ug/L	1.8 U [1.8 U]	0.36 U	36 U
Cyclohexane	- -	ug/L	31 [26]	43	56 J
Dibromochloromethane	50	ug/L	1.6 U [1.6 U]	0.32 U	32 U
Dichlorodifluoromethane	5	ug/L	3.4 U [3.4 U]	0.68 U	68 U
Ethylbenzene	5	ug/L	**5.7 [5.3]**	**7.3**	**270**
Isopropylbenzene	5	ug/L	4.0 U [4.0 U]	1.2	79 U
Methyl Acetate	- -	ug/L	6.5 U [6.5 U]	1.3 U	130 U
Methyl Tert-butyl Ether	- -	ug/L	0.80 U [0.80 U]	0.16 U	16 U
Methylcyclohexane	- -	ug/L	29 [24]	32	51 J
Methylene Chloride	5	ug/L	**7.2 [6.8]**	0.44 U	44 U
Styrene	5	ug/L	3.7 U [3.7 U]	0.73 U	**620**
Tetrachloroethene	5	ug/L	1.8 U [1.8 U]	0.36 U	36 U
Toluene	5	ug/L	**13 [12]**	**32**	**3,800**
Trans-1,2-dichloroethene	5	ug/L	4.5 U [4.5 U]	0.90 U	90 U
Trans-1,3-dichloropropene	0.4	ug/L	1.9 U [1.9 U]	0.37 U	37 U
Trichloroethene	5	ug/L	2.3 U [2.3 U]	0.46 U	46 U
Trichlorofluoromethane	5	ug/L	4.4 U [4.4 U]	0.88 U	88 U
Vinyl Chloride	2	ug/L	4.5 U [4.5 U]	0.90 U	90 U
Xylenes (total)	5	ug/L	**27 [25]**	**38**	**2,100**
Total BTEX	- -	ug/L	300 [280]	93	11,000

See Notes on Page 2.

Table 1
Bedrock Groundwater Sampling Results

Bedrock Investigation
National Fuel
Dunkirk Former MGP Site, Dunkirk, New York

Notes:

- - = Not available.
U = The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
J = Indicates estimated value.
NYSDEC = New York State Department of Environmental Conservation.
TOGS = Division of Water Technical and Operational Guidance Series.
ug/L = micrograms per liter.
Duplicate samples are in brackets [ ].
Exceedances of the NYSDEC TOGS 1.1.1 Protection of Drinking Water are bold and shaded.
NYSDEC TOGS 1.1.1 Water Guidance Values are the Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (1998).

FIGURES

LEGEND:

MONITORING WELL

NOTES:

1. ALL LOCATIONS APPROXIMATE.
2. LOCATIONS OF FORMER USTs, PUMP ISLAND, AND ASSOCIATED DISTRIBUTION LINES FROM MESCH ENGINEERING, P.C. DRAWING ENTITLED "SITE PLAN", ORIGINAL DRAWING DATED 9/17/87.
3. MONITORING WELLS MW-5 AND MW-6 FROM SURVEY FILE DATED 10/7/11. MONITORING WELLS MW-10, M-11, AND MW-14S/D THROUGH MW-16 FROM SURVEY FILE DATED 7/1/14. ALL SURVEY FILES PROVIDED BY C.T. MALE ASSOCIATES.
4. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO OBTAINED ON MARCH 24, 2020 DATED APRIL 14, 2016.

0 80' 160'

GRAPHIC SCALE

NATIONAL FUEL
DUNKIRK FORMER MGP SITE
DUNKIRK, NEW YORK
BEDROCK INVESTIGATION

MONITORING WELL LOCATIONS

ARCADIS Design & Consultancy for natural and built assets

FIGURE 1

XREFS:
NF-DNKRK_XBASE
IMAGES:
GEP_IMAGE_2016.jpg

CITY: SYRACUSE, NY DIV/GROUP: EBC-IM/DV DB: L.POSENAUER PM/TM: S.POWLIN LYR: ON=*;OFF=*REF*
C:\Users\lposenauer\BIM 360\Arcadis\ANA - NATIONAL FUEL\Project Files\DUNKIRK FORMER MGP\2020\30003783\01-DWG\NF-DNKRK_BR INV_01_MW LOCS.dwg LAYOUT: 1 SAVED: 4/20/2020 1:33 PM ACADVER: 23.1S (LMS TECH) PAGESETUP: C-LB-PDF PLOTSTYLETABLE: PLTFULL.CTB
PLOTTED: 4/22/2020 10:12 AM BY: POSENAUER, LISA

LEGEND:

- MONITORING WELL
- (580) GROUNDWATER ELEVATION
- GENERAL GROUNDWATER FLOW DIRECTION

NOTES:

1. ALL LOCATIONS APPROXIMATE.
2. LOCATIONS OF FORMER USTs, PUMP ISLAND, AND ASSOCIATED DISTRIBUTION LINES FROM MESCH ENGINEERING, P.C. DRAWING ENTITLED "SITE PLAN", ORIGINAL DRAWING DATED 9/17/87.
3. MONITORING WELLS MW-5 AND MW-6 FROM SURVEY FILE DATED 10/7/11. MONITORING WELLS MW-10, M-11, AND MW-14S/D THROUGH MW-16 FROM SURVEY FILE DATED 7/1/14. ALL SURVEY FILES PROVIDED BY C.T. MALE ASSOCIATES.
4. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO OBTAINED ON MARCH 24, 2020 DATED APRIL 14, 2016.

0 80' 160'

GRAPHIC SCALE

NATIONAL FUEL
DUNKIRK FORMER MGP SITE
DUNKIRK, NEW YORK
BEDROCK INVESTIGATION

BEDROCK POTENTIOMETRIC SURFACE CONTOURS - 3/20/20

ARCADIS Design & Consultancy for natural and built assets

FIGURE 2

CITY: SYRACUSE, NY DIV/GROUP: EBC-IM/DV DB: L.POSENAUER PM/TM: S.POWLIN LYR: ON=*;OFF=*REF*
C:\Users\lposenauer\BIM 360\Arcadis\ANA - NATIONAL FUEL\Project Files\DUNKIRK FORMER MGP\20200300378310 1-DWG\NF-DNKRK_BR INV_02_POT SRF CONT.dwg LAYOUT: 2 SAVED: 4/22/2020 10:10 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: C-LB-PDF PLOTSTYLETABLE: PLTFULL.CTB
PLOTTED: 4/22/2020 10:13 AM BY: POSENAUER, LISA
XREFS: IMAGES:
NF-DNKRK_XBASE GEP_IMAGE_2016.jpg

MW-9		
Date	7/2/2014	10/29/2014
Total BTEX	ND	ND
Total PAHs	ND	0.95 J
Cyanide	10.0 U	5.60 J

MW-10		
Date	7/2/2014	10/28/2014
Total BTEX	ND	ND
Total PAHs	ND	2.3 J
Cyanide	10.0 U	2.00 U

MW-11		
Date	7/2/2014	10/28/2014
Total BTEX	ND	ND
Total PAHs	ND	ND
Cyanide	6.00 J	2.00 U

MW-8		
Date	8/28/2012	7/1/2014
Total BTEX	390 J	79 [110]
Total PAHs	ND	0.89 J [ND]
Cyanide	8.70 J	7.80 J [8.10 J]

MW-16		
Date	7/3/2014	10/28/2014
Total BTEX	3,600	5,400
Total PAHs	290 J	850 J
Cyanide	42	79

MW-12		
Date	7/2/2014	10/28/2014
Total BTEX	44	14
Total PAHs	ND	ND
Cyanide	10.0 U	5.00 U

MW-16R	
Date	3/20/2020
Total BTEX	11,000
Total PAHs	NA
Cyanide	NA

MW-2		
Date	9/9/2010	6/20/2011
Total BTEX	ND	ND
Total PAHs	0.45 J	ND
Cyanide	719 J	560 J

MW-7		
Date	8/28/2012	7/2/2014
Total BTEX	7,800 [6800]	7,900
Total PAHs	ND [ND]	ND
Cyanide	6.70 J [9.70 J]	25

MW-13		
Date	7/2/2014	10/28/2014
Total BTEX	ND	ND
Total PAHs	ND	ND
Cyanide	10.0 U	2.00 U

MW-6		
Date	9/13/2011	7/2/2014
Total BTEX	ND [ND]	ND
Total PAHs	ND [ND]	ND
Cyanide	5.00 U [5.00 U]	5.20 J

MW-3		
Date	9/9/2010	6/20/2011
Total BTEX	110	140 [140]
Total PAHs	5.2 J	2.0 J [1.2 J]
Cyanide	324 J	400 J [160 J]

MW-1R	
Date	3/20/2020
Total BTEX	300 [280]
Total PAHs	NA
Cyanide	NA

MW-15		
Date	7/3/2014	10/29/2014
Total BTEX	ND	ND
Total PAHs	ND	ND
Cyanide	10.0 U	5.00 U

MW-1		
Date	9/9/2010	6/20/2011
Total BTEX	28,000 J [25,000]	17,000 J
Total PAHs	0.58 J [0.98 J]	2.0 J
Cyanide	23.0 J [25.2 J]	14.0 J

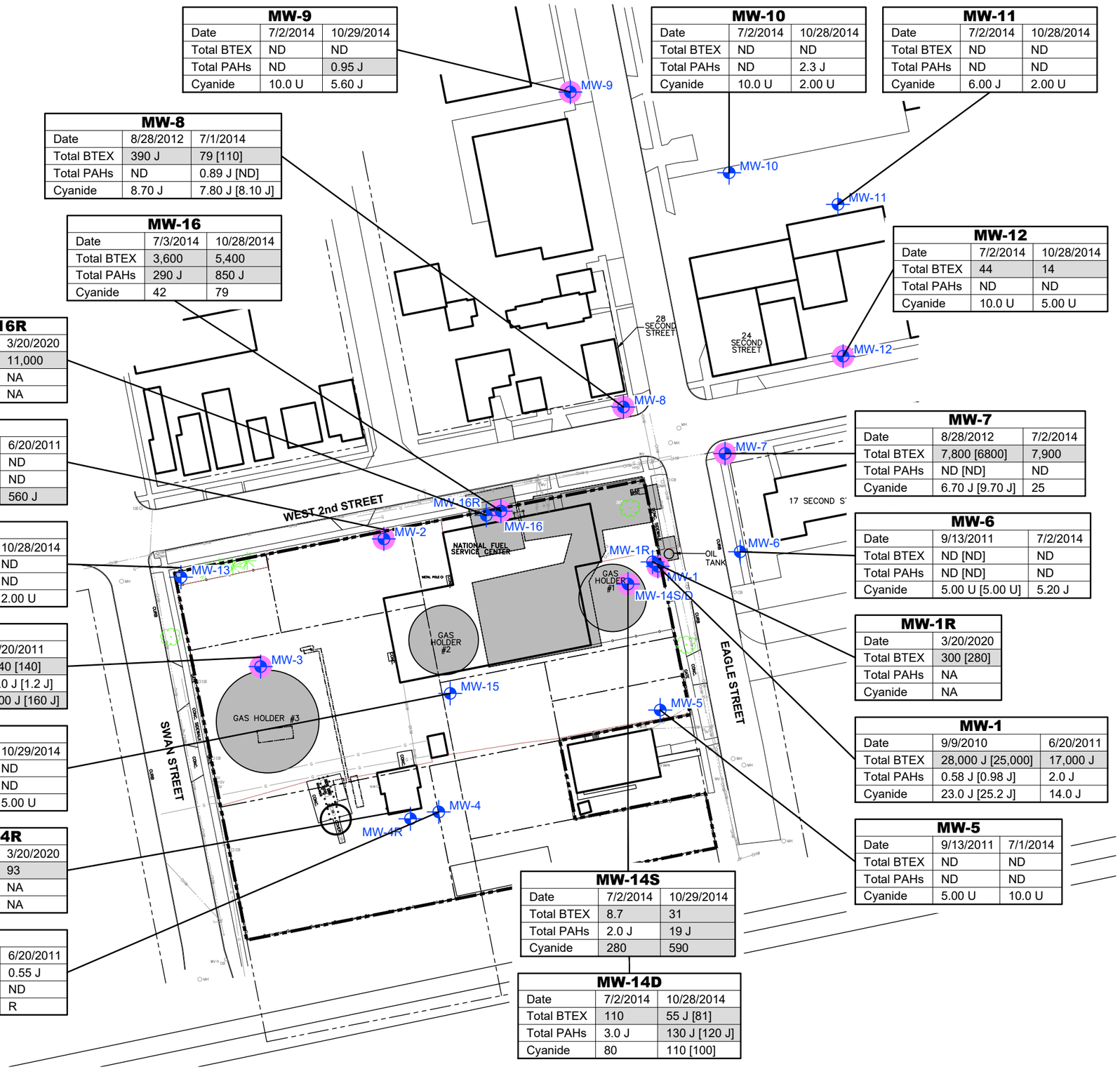
MW-4R	
Date	3/20/2020
Total BTEX	93
Total PAHs	NA
Cyanide	NA

MW-5		
Date	9/13/2011	7/1/2014
Total BTEX	ND	ND
Total PAHs	ND	ND
Cyanide	5.00 U	10.0 U

MW-4		
Date	9/9/2010	6/20/2011
Total BTEX	7.1 J	0.55 J
Total PAHs	ND	ND
Cyanide	20.0 UJ	R

MW-14S		
Date	7/2/2014	10/29/2014
Total BTEX	8.7	31
Total PAHs	2.0 J	19 J
Cyanide	280	590

MW-14D		
Date	7/2/2014	10/28/2014
Total BTEX	110	55 J [81]
Total PAHs	3.0 J	130 J [120 J]
Cyanide	80	110 [100]



LEGEND:

- MONITORING WELL
- GROUNDWATER SAMPLE FROM THIS LOCATION CONTAINED AT LEAST ONE CONSTITUENT AT A CONCENTRATION EXCEEDING THE NYSDEC CLASS GA DRINKING WATER STANDARD
- FORMER MGP STRUCTURE
- FORMER PETROLEUM DISTRIBUTION STRUCTURES
- APPROXIMATE EXTENT OF PETROLEUM REMEDIATION AREA
- APPROXIMATE PROPERTY LINE
- RAILROAD
- EXISTING BUILDING
- CHAIN LINK FENCE

NOTES:

1. ALL LOCATIONS APPROXIMATE.
2. LOCATIONS OF FORMER USTs, PUMP ISLAND, AND ASSOCIATED DISTRIBUTION LINES FROM MESCH ENGINEERING, P.C. DRAWING ENTITLED "SITE PLAN", ORIGINAL DRAWING DATED 9/17/87.
3. MONITORING WELLS MW-5 AND MW-6 FROM SURVEY FILE DATED 10/7/11. MONITORING WELLS MW-10, M-11, AND MW-14S/D THROUGH MW-16 FROM SURVEY FILE DATED 7/1/14. ALL SURVEY FILES PROVIDED BY C.T. MALE ASSOCIATES.
4. ALL CONCENTRATIONS ARE SHOWN IN MICROGRAMS PER LITER (ug/L).
5. SHADED VALUES EXCEED ONE OR MORE OF THE NYSDEC TOGS STANDARDS OR GUIDANCE VALUES.
6. ABBREVIATIONS:
   - J = APPROXIMATE VALUE
   - U = ANALYTE WAS NOT DETECTED ABOVE GIVEN DETECTION LIMIT
   - ND = INDIVIDUAL CONSTITUENT WAS NOT DETECTED
   - R = REJECTED
   - B = ANALYTE WAS ALSO DETECTED IN THE ASSOCIATED METHOD BLANK
   - NA = NOT ANALYZED
   - [ ] = DUPLICATE SAMPLE

0 80' 160'

GRAPHIC SCALE

NATIONAL FUEL
DUNKIRK FORMER MGP SITE
DUNKIRK, NEW YORK
BEDROCK INVESTIGATION

MONITORING WELL GROUNDWATER SAMPLING RESULTS

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FIGURE 3

CITY: SYRACUSE_NY DIV/GROUP: EBC-IM/DV DB: L.POSENAUER PM/TM: S.POWLIN LYR: ON=*;OFF=*REF*
C:\Users\lposenauer\BIM 360\Arcadis\ANA – NATIONAL FUEL\Project Files\DUNKIRK FORMER MGP\2020\30003783\01-DWG\NF-DNKRK_BR INV_03_MW LOCS RESULTS.dwg LAYOUT: 3 SAVED: 4/22/2020 10:11 AM ACADVER: 23.1S (LMS TECH) PAGESETUP: C-LB-PDF PLOTSTYLETABLE:
PLTFULL.CTB PLOTTED: 4/22/2020 10:13 AM BY: POSENAUER, LISA
XREFS:
NF-DNKRK_XBASE

ATTACHMENT 1

Monitoring Well Construction Logs

Date Start/Finish:	3/3/2020 - 3/10/2020	**Northing:**	906493.8840	**Well/Boring ID:**	**MW-1R**
Drilling Company:	Parratt-Wolff	**Easting:**	945038.6120	**Client:**	National Fuel
Driller's Name:	Glen Lansing	**Casing Elevation:**	583.35' AMSL		
Drilling Method:	6.25" HSA	**Surface Elevation:**	583.67' AMSL	**Location:**	
Sampling Method:	2"x2' SS / HQ Core barrel	**Borehole Depth:**	36.5' bgs		31West 2nd Street Dunkirk, New York
Rig Type:	Truck mounted CME 55	**Descriptions By:**	Dan Meandro		

Depth (feet bgs) / Elevation (ft AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Blow Count / RQD (%)	N-Value	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
585										
0									ASPHALT. [FILL]	Flush mount concrete surface pad with 8 inch diameter curb box and locking J-plug.
									Brown to dark brown SILT and SAND, some fine to medium subangular Gravel,moist, loose. [FILL]	
									ASPHALT. [FILL]	Sand drain (0.5-1.0' bgs)
	NA	0-5	NA	0.0	NA	NA			Dark brown to black Clayey SILT, some fine subangular Gravel,moist to wet, slightly plastic. [FILL]	
580									Grey to light grey CLAY, trace fine subangular Gravel, wet, high plasticity. Faint odor and slight sheen observed.	
5	1	5-6	0.8	0.0	1 1	2			Dark grey CLAY, trace Silt, moist, soft, slight plasticity.	4" steel casing (0.3-24.5' bgs)
	2	6-8	1.9	0.0	2 5 5 5	10			Mottled dark grey and brown CLAY, trace Silt, moist, very stiff, high plasticity.	
575	3	8-10	2.0	0.0	5 6 6 6	12			Dark grey CLAY, trace Silt, moist, stiff, high plasticity.	
10	4	10-12	1.3	0.0	2 2 3 5	5			Mottled dark grey and brown CLAY, trace Silt, moist, moderate stiff, high plasticity.	Cement-bentonite grout (1.0-19.5' bgs)
									Dark grey Silty CLAY, some fine to medium Sand, trace medium sub rounded Gravel, moist, firm, slightly plastic.	

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Remarks: ags = above ground surface; bgs = below ground surface; NA = Not Applicable/Available; AMSL= Above Mean Sea Level; PID = photoionization detector; ppm = parts per million.

Boring hand cleared from 0 to 5 feet bgs, via air knife and vac truck.
Soils screened using 10.6eV lamp photoionization detector.

Client: National Fuel

Well/Boring ID: MW-1R

Site Location:

31West 2nd Street
Dunkirk, New York

Borehole Depth: 36.5' bgs

Depth (feet bgs) / Elevation (ft AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Blow Count / RQD (%)	N-Value	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	5	12-14	2.0	0.0	7 10 16 18	26			Dark grey CLAY, trace Silt, fine subangular Gravel, moist, moderate stiff, high plasticity.	4" steel casing (0.3-24.5' bgs)
570									Dark grey SILT and CLAY, some fine to medium Sand, little medium to coarse angular Gravel, moist to dry, stiff.	
	6	14-16	1.8	0.0	3 10 15 14	25			Mottled dark grey and brown CLAY, trace Silt, moist, medium stiff, high plasticity.	
15									Dark grey CLAY, little Silt, trace fine Sand, moist, medium stiff, high plasticity.	
									Dark grey very fine SAND, trace Silt, trace coarse subangular Gravel, moist to dry, firm.	
	7	16-18	1.9	0.0	16 20 18 25	38			Grey CLAY, trace Silt, subrounded Gravel, moist, soft, high plasticity.	Cement-bentonite grout (1.0-19.5' bgs)
									Grey very fine SAND, some Silt, trace medium subrounded to subangular Gravel, moist, firm	
									Dark grey CLAY, trace Silt, very fine Sand, moist, firm, high plasticity	
565	8	18-19.5	0.4	0.0	50/4	NA			Black SHALE fragments lodged in sample shoe. Refusal Blind drilled from 18.4' to 19.5' bgs.	
20	9	19.5-24	53"	0.0	83	NA			Black SHALE, very finely laminated, iron staining along laminations, hard. Horizontal fractures at 20.1', 20.7', 21.9', 22.6', and 22.9' bgs. Mechanical fractures at 20.9', 22.3', and 23.1' bgs. Approximately 100 gallons of water loss during run.	
560										
25	10	24-29	54"	0.0	94	NA			Black SHALE, very finely laminated with iron staining along laminations, hard. Horizontal fractures at 25.3', 26.1', 26.9', 27.1', 27.5', and 28.4' bgs. 70 degree angle fracture at 27.0' bgs Mechanical breaks at 28.6' and 27.3' bgs. Approximately 20 gallons of water loss at 26 feet bgs	3.8 inch HQ Core hole (19.5-36.5' bgs)

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Boring hand cleared from 0 to 5 feet bgs, via air knife and vac truck.
Soils screened using 10.6eV lamp photoionization detector.

Client: National Fuel

Well/Boring ID: MW-1R

Borehole Depth: 36.5' bgs

Site Location:

31West 2nd Street
Dunkirk, New York

Depth (feet bgs) / Elevation (ft AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Blow Count / RQD (%)	N-Value	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
555									Black SHALE, very finely laminated with iron staining along laminations, hard. Horizontal fractures at 25.3', 26.1', 26.9', 27.1', 27.5', and 28.4' bgs. 70 degree angle fracture at 27.0' bgs. Mechanical breaks at 28.6' and 27.3' bgs. Approximately 20 gallons of water loss at 26 feet bgs.	
30	11	29-34	60"	0.0	92	NA			Black to very dark grey SHALE, very finely laminated with iron staining along laminations, hard. Horizontal fractures at 29.3', 30.2', 31.7', and 31.9' bgs. Mechanical breaks at 30.6', 31.6', 32.0', 33.1', and 32.9' bgs.	3.8 inch HQ Core hole (19.5-36.5' bgs)
550										
35	12	34-36.5	30"	0.0	100	NA			Grey SHALE, finely laminated, hard. Horizontal fracture at 34.5' bgs.	
									End of boring 36.5 feet bgs.	
545										
40										

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Remarks: ags = above ground surface; bgs = below ground surface; NA = Not Applicable/Available; AMSL= Above Mean Sea Level; PID = photoionization detector; ppm = parts per million.

Boring hand cleared from 0 to 5 feet bgs, via air knife and vac truck.
Soils screened using 10.6eV lamp photoionization detector.

Date Start/Finish:	3/3/2020 - 3/4/2020	**Northing:**	906300.6000	**Well/Boring ID:**	**MW-4R**
Drilling Company:	Parratt-Wolff	**Easting:**	944856.4830	**Client:**	National Fuel
Driller's Name:	Glen Lansing	**Casing Elevation:**	585.48' AMSL		
Drilling Method:	6.25" HSA	**Surface Elevation:**	585.49' AMSL	**Location:**	
Sampling Method:	2"x2' SS / HQ Core barrel	**Borehole Depth:**	37.8' bgs		31West 2nd Street Dunkirk, New York
Rig Type:	Truck mounted CME 55	**Descriptions By:**	Dan Meandro		

Depth (feet bgs)	Elevation (ft AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Blow Count / RQD (%)	N-Value	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	585	NA	NA	NM	0.0	NA	NA			Brown to dark brown SILT and medium to coarse SAND, some fine to medium angular to subangular Gravel, trace Organics (Roots), moist. [FILL]	Flush mount concrete surface pad with 8 inch diameter curb box and locking J-plug.
										Brown to grey coarse SAND and coarse angular to subangular GRAVEL, moist. [FILL]	Sand drain (0.5-1.0' bgs)
										ASPHALT. [FILL]	
										BRICK fragments. [FILL]	
										Dark brown fine SAND and red BRICK fragments. [FILL]	
5	580	1	4-6	0.8	0.0	2 3 4 6	7			Tan Silty CLAY, trace fine Sand, moist, firm, slightly plastic. [FILL]	
										Red fine subangular GRAVEL and BRICK fragments. [FILL]	4" steel casing (0.2-25.7' bgs)
		2	6-8	1.7	0.0	5 7 12 10	19			Light brown CLAY, trace Silt, moist, stiff, mostly plastic.	
		3	8-10	1.3	0.0	3 3 3 4	6			Grey becoming light brown CLAY, trace Silt, moist, medium stiff becoming stiff, mostly plastic.	
10	575	4	10-12	1.0	0.0	2 3 5 5	8			Grey CLAY, trace Silt, fine subangular to subrounded Gravel, moist, medium stiff, mostly plastic.	Cement-bentonite grout (1.0-20.7' bgs)

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Remarks: ags = above ground surface; bgs = below ground surface; NA = Not Applicable/Available; AMSL= Above Mean Sea Level; PID = photoionization detector; ppm = parts per million.

Boring hand cleared from 0 to 4 feet bgs, via air knife and vac truck.
Soils screened using 10.6eV lamp photoionization detector.

Client: National Fuel

Site Location:

31West 2nd Street
Dunkirk, New York

Well/Boring ID: **MW-4R**

Borehole Depth: 37 8' bgs

Depth (feet bgs) / Elevation (ft AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Blow Count / RQD (%)	N-Value	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	5	12-14	1.2	0.0	4 6 6 5	12			Grey CLAY, trace Silt, fine subangular to subrounded Gravel, moist, medium stiff, mostly plastic.	4" steel casing (0.2-25.7' bgs)
15 570	6	14-16	1.2	0.0	5 4 6 8	10			Grey SILT, little Clay, trace fine subangular Gravel, fine to medium Sand, moist, stiff, mostly plastic.	
	7	16-18	1.9	0.0	12 16 18 26	34			Grey SILT and CLAY, trace fine subangular Gravel, moist, stiff. Grey SILT, little Clay, trace fine Sand, fine subangular Gravel, moist to dry, stiff. Grey SAND and SILT, little Clay, trace fine to medium subangular Gravel, dry, firm, not plastic.	Cement-bentonite grout (1.0-20.7' bgs)
	8	18-20	1.8	0.0	24 26 29 26	55			Grey SILT, some fine Sand, little medium to coarse subangular Gravel, trace Clay, dry to moist, stiff, not plastic.	
20 565	9	20-20.7	0.7	0.0	21 50/2	NA			Grey SILT, some fine Sand, medium to coarse subangular Gravel, trace Clay, moist to dry, medium stiff, not plastic. Rock fragments lodged in split spoon shoe. Refusal.	
	10	20.7-25.7	55"	0.0	86	NA			Black to very dark grey SHALE, very finely laminated with iron staining along laminations,trace pyrite mineralization, hard. Horizontal fractures at 20.1, 23.3, 24.5. Mechanical breaks at 21.1, 21.7, 23.9.	
25 560									Black SHALE, very finely laminated with iron staining along laminations, hard. Horizontal fractures at 26.3, 26.8, 28.1, 28.9.	3.8 inch HQ Core hole (20.7-37.8' bgs)

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Remarks: ags = above ground surface; bgs = below ground surface; NA = Not Applicable/Available; AMSL= Above Mean Sea Level; PID = photoionization detector; ppm = parts per million.

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Boring hand cleared from 0 to 4 feet bgs, via air knife and vac truck.
Soils screened using 10.6eV lamp photoionization detector.

Client: National Fuel

Well/Boring ID: MW-4R

Borehole Depth: 37 8' bgs

Site Location:

31West 2nd Street
Dunkirk, New York

Depth (feet bgs) / Elevation (ft AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Blow Count / RQD (%)	N-Value	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	11	25.7-29.2	42"	1.4	100	NA			Black SHALE, very finely laminated with iron staining along laminations, hard Horizontal fractures at 26 3, 26 8, 28 1, 28.9.	
30 / 555	12	29 2-34.2	58"	0 0	84	NA			Black to very dark grey SHALE, very finely laminated with iron staining alon laminations, hard Horizontal fractures at 31.0', 31.2', 32.9', 33.2', and 33 4' Vertical fractures from 33.0' to 33 1' and from 33 4' to 34 2'. Mechnical breaks at 29.7', 30.4', 31.8', 32.1', and 33.0' bgs. Rock noticebly softer beginning at 33 1 feet bgs.	3 8 inch HQ Core hole (20 7-37 8' bgs)
35 / 550	13	34 2-37.8	0"	0 0	0	NA			No recovery Confirmed presence of rock core with weighted tape, yet unable to retrieve with core barrel. 3.8 inch tricone bit used drill to depth. Shale chips observerd in wash water while drilling	
40									End of boring 37.8 feet bgs.	

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Boring hand cleared from 0 to 4 feet bgs, via air knife and vac truck.
Soils screened using 10.6eV lamp photoionization detector.

Date Start/Finish:	3/3/2020 - 3/6/2020	**Northing:**	906528.9360	**Well/Boring ID:**	MW-16R
Drilling Company:	Parratt-Wolff	**Easting:**	944913.5540	**Client:**	National Fuel
Driller's Name:	Glen Lansing	**Casing Elevation:**	582.70' AMSL		
Drilling Method:	6.25" HSA	**Surface Elevation:**	583.33' AMSL	**Location:**	
Sampling Method:	2"x2' SS / HQ Core barrel	**Borehole Depth:**	34.2' bgs		31West 2nd Street Dunkirk, New York
Rig Type:	Truck mounted CME 55	**Descriptions By:**	Dan Meandro		

Depth (feet bgs)	Elevation (ft AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Blow Count / RQD (%)	N-Value	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	0									Brown to dark brown coarse SAND and SILT, some medium subangular Gravel, trace Organics, moist [FILL]	Flush mount concrete surface pad with 8 inch diameter curb box and locking J-plug.
										Dark brown medium to coarse SAND, some dark brown Silt, little fine subangular Gravel, moist. [FILL]	Sand drain (0.5-1.0' bgs)
		NA	0-4	NA	NA		NA			Red BRICK, some medium to coarse Sand, little fine subangular Gravel, moist. [FILL]	
										Dark grey to black Clayey SILT, little fine subangular Gravel, wet, slightly plastic. [FILL]	
										Grey to light grey CLAY, little Silt, wet, mostly plastic. [FILL]	
										Red BRICK, trace Silt, fine subangular Gravel, loose, moist. [FILL]	
-5	-5	1	4-6	1.2	0.0	2 3 4 6	7			Mottled dark grey and brown CLAY, trace Silt, fine subangular Gravel,moist, stiff, slighly plastic Red BRICK at 6 6 feet bgs [FILL]	
		2	6-8	1.6	0.0	2 6 6 13	12				4" steel casing (0.2-22.5' bgs)
		3	8-10	1.9	0.0	3 3 4 5	7			Brown Silty CLAY, little red Brick at 8.2 feet bgs, trace fine subangular Gravel, moist, stiff, slightly plastic. [FILL]	
										Dark grey CLAY, trace Silt, moist, stiff, mostly plastic.	Cement-bentonite grout (1.0-17.5' bgs)
-10	-10									Brown CLAY, trace Silt, moist, firm, slightly plastic.	
		4	10-12	1 7	0 0	3 2 3 4	5			Dark grey CLAY, trace Silt, moist, moderately stiff, mostly plastic	

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Boring hand cleared from 0 to 4 feet bgs, via air knife and vac truck.
Soils screened using 10.6eV lamp photoionization detector.

Client: National Fuel

Site Location:

31West 2nd Street
Dunkirk, New York

Well/Boring ID: MW-16R

Borehole Depth: 34.2' bgs

Depth (feet bgs) / Elevation (ft AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Blow Count / RQD (%)	N-Value	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	5	12-4	1.8	0.0	7 6 7 7	13			Dark grey CLAY, trace Silt, moist, moderately stiff, mostly plastic	
									Dark grey CLAY and SILT, little very fine Sand, trace fine subangular Gravel, moist to wet, firm, slightly plastic	
15 -15	6	14-16	0.9	0.0	3 4 7 13	11			Dark grey CLAY and SILT, some fine Sand, trace fine to medium subangular Gravel, moist, firm, mostly plastic	
	7	16-17.5	1.4	0.0	25 26 50/4	NA			Black SHALE fragments lodged in sampling shoe. Refsual at 17.5 feet bgs	Cement-bentonite grout (1.0-17.5' bgs)
20 -20	8	17.5-22.5	60"	0.0	100	NA			Black SHALE, very finely laminated with iron staining along laminations, top of bedrock highly weathered. Horizontal fracture at 20.85' bgs Mechanical breaks at 18.0', 18.5', 19.5', 20.5', 21.1', 21.3' and 21.5' bgs. Mechanical break at 19.5' bgs oriented at 70 degrees. Sheen observed.	4" steel casing (0.2-22.5' bgs)
	9	22.5-24.5	24"	0.0	100	NA			Black SHALE, finely laminated with iron staining along laminations, hard. Mechanical breaks at 22.6', 22.9', 23.3', 23.4', 23.5', 23.8' bgs	
25 -25									Black SHALE, finely laminated with iron staining along laminations, hard. Horizontal fractures at 24.6', 25.5', and 28.2' bgs. Mechanical breaks at 25.1', 25.6', 26.0', 26.4', 27.1', 28.1', 28.8', 29.1', and 29.2' bgs.	3.8 inch HQ Core hole (22.5-34.2' bgs)

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Remarks: ags = above ground surface; bgs = below ground surface; NA = Not Applicable/Available; AMSL= Above Mean Sea Level; PID = photoionization detector; ppm = parts per million.

Boring hand cleared from 0 to 4 feet bgs, via air knife and vac truck.
Soils screened using 10.6eV lamp photoionization detector.

Client: National Fuel

Well/Boring ID: MW-16R

Borehole Depth: 34.2' bgs

Site Location:

31West 2nd Street
Dunkirk, New York

Depth (feet bgs) / Elevation (ft AMSL)	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Blow Count / RQD (%)	N-Value	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	10	24.5-29.5	60"	0.0	100	NA			Black SHALE, finely laminated with iron staining along laminations, hard. Horizontal fractures at 24.6', 25.5', and 28.2' bgs. Mechanical breaks at 25.1', 25.6', 26.0', 26.4', 27.1', 28.1', 28.8', 29.1', and 29.2' bgs.	
-30 -30									Black SHALE, finely laminated with iron staining along laminations, hard. Transitioning to grey in color from 29.8' to 30.2' bgs and 30.7' to 34.16' bgs. Horizontal fractures at 30.0', 30.8', and 33.4' bgs. Mechanical breaks at 30.7' oriented at 70 degrees.	3.8 inch HQ Core hole (22.5-34.2' bgs)
	11	29.5-34.2	56"	0.0	100	NA				
-35 -35									End of boring 34.2 feet bgs.	
-40 -40										

ARCADIS Design & Consultancy for natural and built assets

Remarks: ags = above ground surface; bgs = below ground surface; NA = Not Applicable/Available; AMSL= Above Mean Sea Level; PID = photoionization detector; ppm = parts per million.

Boring hand cleared from 0 to 4 feet bgs, via air knife and vac truck.
Soils screened using 10.6eV lamp photoionization detector.