EXPLANATION OF SIGNIFICANT DIFFERENCES
LEHIGHTON ELECTRONICS, INC. FACILITY
LEHIGHTON, PENNSYLVANIA
EPA RCRA ID: PAD 002 399 186

I. INTRODUCTION

This Explanation of Significant Differences (ESD) describes the United States Environmental Protection Agency's (EPA) proposed modifications to its final remedy (Final Remedy) for the Lehighton Electronics, Inc. Facility (LEI or Facility), located at 15 Blakeslee Blvd Drive West, Lehighton, Pennsylvania. The Final Remedy for the Facility was selected in 2002 in a Final Decision and Response to Comments (Final Decision) in accordance with the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments of 1984 (HSWA), 42 U.S.C. § 6901 et seq.

The Final Remedy required remediation of contaminated groundwater by pumping and treating the groundwater. The Final Remedy requires operation of the groundwater pump and treat system until federal Maximum Contaminant Levels (MCLs) which are drinking water standards, promulgated pursuant to Section 42 U.S.C. §§ 300f et seq. of the Safe Drinking Water Act and codified at 40 CFR Part 141, or EPA Region III Screening Levels (RSLs) for tap water, if there is no MCL for a contaminant, are achieved.

After 26 years of continuous pumping, concentrations of contaminants in groundwater still exceed the MCLs and RSLs selected in the Final Decision. This ESD proposes modifications to the Final Remedy by requiring additional environmental investigation, additional remediation if warranted by the results of the additional investigation, and land and groundwater use restrictions if contaminant concentrations remain above levels that pose an unacceptable risk to human health and the environment.

This proposed ESD modifying the Final Remedy and the documents supporting its issuance will be part of the Administrative Record for the Facility, which is located at the EPA Region III, RCRA Records Center, 1650 Arch Street, Philadelphia, Pennsylvania. The Administrative Record can be obtained by contacting the EPA Project Manager, Maureen Essenthier, at essenthier.maureen@epa.gov or at (215) 814-3416.

II. SUMMARY OF SITE HISTORY, CONTAMINATION AND THE SELECTED REMEDY

LEI is situated on a 0.6-acre parcel at 15 Blakeslee Blvd Drive West, Lehighton, PA. LEI manufactured printed circuit boards from 1963 to 2001 inside the single building located at the Facility. An area for container storage and wastewater treatment units was located on the west side of the buildings. The Facility is owned by Blew Enterprises, Inc. The corporation name was changed from Lehighton Electronics, Inc. to Blew Enterprises, Inc. on January 24, 2018, after the corporation ceased commercial operations. Figure 1, Facility Layout, shows the current property layout and the location of the groundwater wells.

On April 8, 2002, EPA issued a Final Decision selecting the Final Remedy at the Facility. The Final Remedy requires the following:

- Remediate contaminated groundwater by pumping the Facility's production well until trichloroethylene (TCE) achieves the MCL, TCE breakdown products remain below their respective MCLs, and Naphthalene remains below the RSL for tap water;
- Monitor groundwater at the Facility and nearest residential well on an annual basis;
- Remove the aboveground TCE storage tank;
- Remove the underground fuel oil tank;
- Provide any Facility user with a potable water supply that meets the requirements of the Safe Drinking Water Act. If treated groundwater is used as the potable water supply, the treatment system must be adequately sized with at least two treatment systems in series; and
- Upon transfer of the property, the transfer instrument shall prohibit the use of untreated groundwater as a potable water supply, until the groundwater is no longer contaminated.

Final Remedy Implementation

- Groundwater Remediation – Groundwater pump and treat operations started as an interim measure in 1994 and continues in accordance with the Final Decision. TCE is the primary groundwater contaminant. The contamination was attributed to releases from the aboveground TCE storage tank. The first 5 years of groundwater treatment reduced the TCE concentrations from approximately 150 parts per billion (ppb) to approximately 30 ppb. By 2010, the TCE concentration leveled off at approximately 20 ppb. Contamination has never been detected in nearby residential wells.

- Tank Removals – The aboveground TCE storage tank and underground fuel oil tank, including contaminated soil, were removed in 2006.

- Potable Water Supply – A granular activated carbon treatment system was installed and evaluated from September 2006 through March 2010. However, an operation and maintenance (O&M) plan for future use was never submitted for review. An O&M plan may be required based on site conditions after implementing the additional actions proposed in this ESD.

Subsequent Actions

In 2012, LEI submitted a plan for soil sampling below the foundation slab of the manufacturing building. The purpose was to determine whether contaminated soil below the foundation slab was acting as a continuing source of contamination to groundwater (originally attributed to spills from the aboveground TCE tank). Soil beneath the two sump areas of the building contained high concentrations of contamination, primarily TCE and lead. Additional samples were collected across the site boundaries, through 2018, to define the area of contamination for soil excavation.

In September 2019, contaminated soil was excavated and groundwater wells were installed in accordance with the *Proposed Phased Approach for the Completion of Investigation and Remedial Activities to Achieve Closure* (Phased Approach Plan) approved by EPA and the Pennsylvania Department of Environmental Protection (DEP). The Phased Approach Plan was originally submitted to EPA and DEP in June 2019, and most recently revised as of August 2020. The Phased Approach Plan is included in this ESD as Attachment B. The excavation areas and well locations are noted on Figure 1, Facility Layout.

The following actions were taken in accordance with the Phased Approach Plan:

- Approximately 97 cubic yards of contaminated soil were excavated from beneath the building foundation and disposed offsite. The excavations were centered on the sump areas that contained the highest soil contamination. The excavations were completed down to rock/gravel, approximately 10 feet deep. The excavations were backfilled with clean soil.

- Following the excavation of contaminated soil, 6 shallow groundwater wells were installed to define the area of groundwater contamination. Groundwater samples were analyzed for volatile organic compounds (including TCE and breakdown products) and metals.

Groundwater samples were collected for 3 consecutive quarters from the 6 shallow wells in November 2019, February 2020, and May 2020. No metals were detected above the drinking water standards. Four volatile organic compounds exceeded their respective drinking water standard. The average concentrations over the 3 quarters for the chemicals that exceeded the drinking water standards are provided for each well location in the table below.

Contaminant	Drinking Water Standard	MW-1S	MW-2S	MW-3S	MW-4S	MW-5S	MW-6S
1,1-dichloroethene	7	---	---	---	15	---	---
Cis-1,2-dichloroethene	70	---	---	308	92	---	---
trichloroethene	5	14	29	80	278	33	---
vinyl chloride	2	---	---	5.6	---	---	---

All units are parts per billion
--- no exceedance of drinking water standard

The highest concentrations of contamination are in wells MW-3S and MW-4S, located north and west of the building, immediately downgradient of where historic manufacturing, drum storage, and wastewater treatment operations were located. The wells are located near the downgradient (northern) property boundary, adjacent to State Route 443/Blakeslee Boulevard Drive West. Groundwater from the Facility flows toward Mahoning Creek, approximately 500 feet north of the Facility.

Blew Enterprises, Inc. is completing activities outlined in the Phased Approach Plan. Stage 1 and Steps 1-4 of Stage 2 of the Phased Approach Plan have been completed under the joint oversight of EPA and DEP. Stage 1 included characterization of the soil contamination, excavation of the contaminated soil, backfilling of the excavated areas, and tarping the building area to direct drainage away from excavation areas. The completed steps of Stage 2 include siting, installing, and sampling the shallow wells.

The concentrations of contaminants in groundwater are expected to decline due to the removal of contaminated soil, which appears to be acting as a source of continuing contamination. Groundwater will be monitored for a minimum of 8 quarters to determine whether contamination is attenuating.

Pennsylvania Land Recycling Program and One Cleanup Program

On June 10, 2020, Blew Electronics, Inc. submitted a Notice of Intent to Remediate (NIR) the Facility under the Pennsylvania Land Recycling Program (commonly known as Act 2). The NIR proposes the following:

- Completion of the investigation and remediation of the Facility in accordance with the Phased Approach Plan;
- Remediation of soil and groundwater to meet the Act 2 non-residential statewide health standards or site-specific standards; and
- Execution of an environmental covenant that will restrict the use of the Facility property to nonresidential and prohibit the use of the groundwater without treatment.

The NIR also requests participation in the One Cleanup Program. The One Cleanup Program was established in the Memorandum of Agreement (MOA) between DEP and EPA Region 3 on April 21, 2004. The MOA provides a streamlined approach for Pennsylvania facilities with corrective action obligations under RCRA to complete federal corrective action obligations and, concurrently, receive a liability release from DEP under Act 2. The full text of the MOA can be found at the following link: https://www.epa.gov/sites/production/files/2015-11/documents/pa_moa.pdf.

DEP sent a letter acknowledging receipt of the NIR to LEI on July 2, 2020. LEI was accepted into the One Cleanup program on July 30, 2020, with DEP identified as the lead agency under Act 2 and EPA as the responsible agency for oversight of RCRA corrective action issues.

III. DESCRIPTION OF SIGNIFICANT DIFFERENCES AND THE BASIS FOR PROPOSED CHANGES TO THE SELECTED CORRECTIVE MEASURE

This proposed ESD proposes to modify the Final Remedy by requiring the following:

1. Phased Approach Plan:
    - Additional environmental investigations and any necessary remediation shall be completed in accordance the Phased Approach Plan (Attachment B).
    - The Phased Approach Plan requires the following:
        - Complete the characterization of groundwater, including the siting and installation of bedrock groundwater wells;

- Conduct an aquifer test and evaluate aquifer characterization and groundwater quality so that EPA and PADEP may determine whether additional groundwater treatment or soil excavation are necessary; and
- Implement additional groundwater or soil remediation and monitoring, as required by EPA and PADEP.

2. Land and Groundwater Use Restrictions
    - Implementation of land and groundwater use restrictions for contaminants remain in groundwater above their respective MCLs or RSLs, as applicable, and in soil above levels suitable for unrestricted use.
    - Land and groundwater use restrictions shall be implemented in an environmental covenant pursuant to the Pennsylvania Uniform Environmental Covenants Act, 27 Pa. C.S.A. §§ 6501 et seq., to be recorded with the Carbon County Recorder of Deeds.

IV. SUPPORT AGENCY REVIEW

EPA has consulted DEP regarding the proposed modifications to the Final Remedy for the Facility as described above. DEP concurs with the proposal.

V. AFFIRMATION OF DECLARATION

EPA has determined that the Final Remedy selected in the FDRTC as modified by this ESD will remain protective of human health and the environment.

VI. PUBLIC PARTICIPATION

EPA is requesting comments from the public on this proposed modification to the Final Decision. The proposed ESD is available for public review at the location listed in Section VII below and at https://www.epa.gov/pa/epa-public-notices-pennsylvania. The public comment period will last thirty (30) calendar days from the date that a notice of the proposed ESD is published in the local newspaper. Comments on, or questions regarding, the proposed ESD may be submitted to the EPA Project Manager:

Maureen Essenthier (3LD20)
U.S. EPA, Region III
1650 Arch Street
Philadelphia, PA 19103
Telephone: (215) 814-3416
Email: essenthier.maureen@epa.gov

EPA will respond to all comments received. Based on comments received or other relevant information, if EPA makes minor changes to the modification proposed in the ESD, the ESD will become effective upon those changes being made. If, based on comments received or other relevant information, EPA makes significant changes to the modifications proposed in the ESD, EPA may seek additional public comments. All comments received during the thirty (30) day comment period will become part of the Administrative Record for the Facility, as will EPA responses to the significant comments.

VII. ADMINISTRATIVE RECORD

The Administrative Record supporting the issuance of the ESD is available for public review on Mondays through Fridays, from 9:00 a.m. to 5:00 p.m., by contacting the EPA Project Manager, Maureen Essenthier, at:

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Region III (3LD20)
1650 Arch Street
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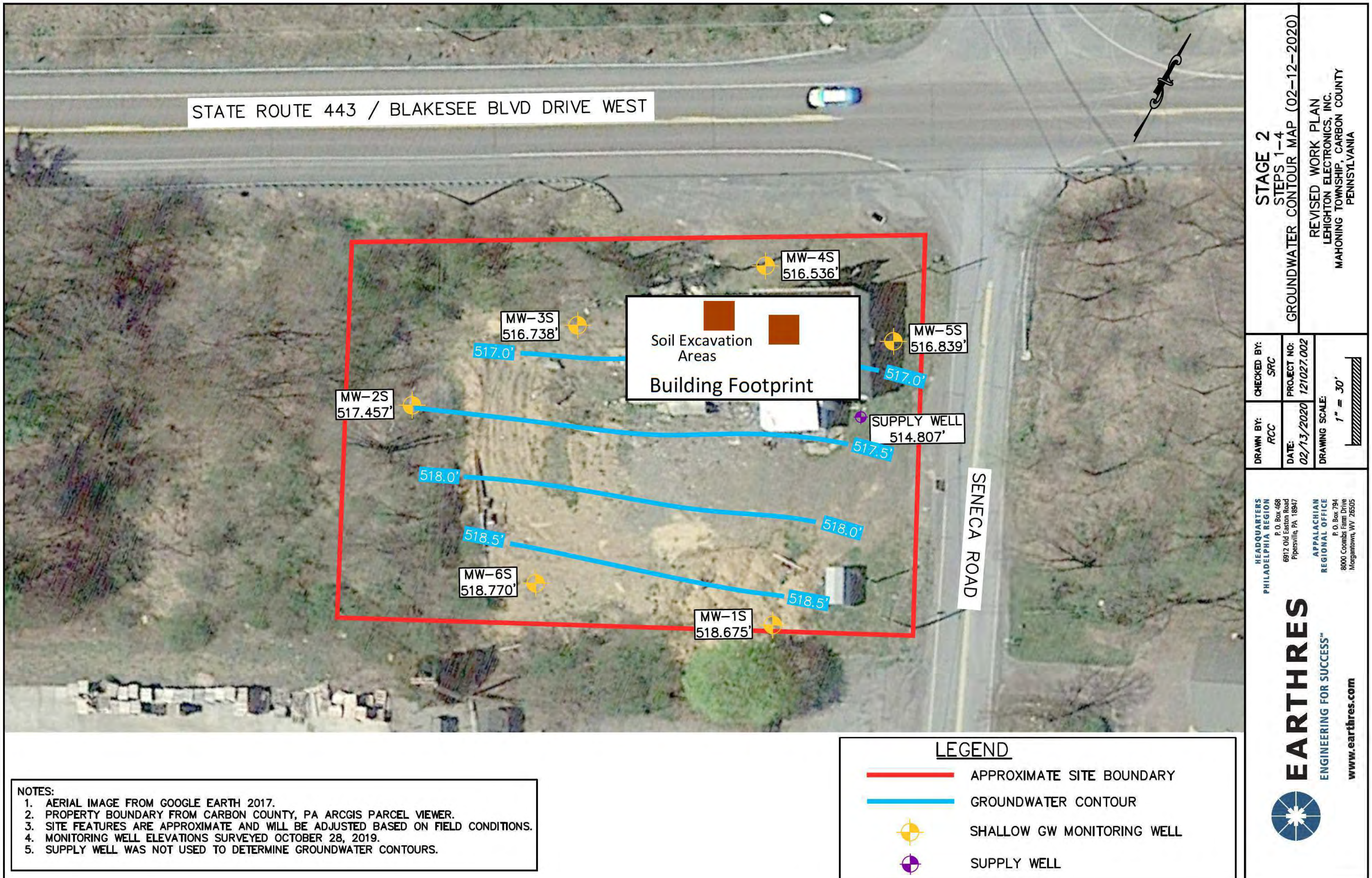
8/14/20
Date

John A. Armstead, Director
Land, Chemicals and Redevelopment Division
U.S. EPA Region III

Attachment A: Figure 1, Facility Layout

Attachment B: Proposed Phased Approach for the Completion of Investigation and Remedial Activities to Achieve Closure, revised August 2020



Lehighton Electronics, Inc.
Explanation of Significant Differences

Figure 1
Facility Layout

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Stage 1 Scope of Work
Proposed Phased Approach for the Completion of Investigation and Remedial Activities to Achieve Closure
Lehighton Electronics
Mahoning Township, Carbon County, Pennsylvania

Stage 1 – Complete during 3Q 2019: Excavate Primary Source Areas (soil from Pattern Plate Sump and Atlas Sump only)

- Step 1 – Characterize vertical extent with more soil samples, including Pattern Plate and Atlas Sumps (note: metals and soils are not expressly within the scope of the RCRA Corrective Action cleanup requirements, but excavation of soils impacted by metals and TCE around the Atlas Sump is proposed in an effort to cooperate and address groundwater impacts under the One Cleanup Program) – **Completed**.
- Step 2 – Perform waste characterization/TCLP for disposal (including for metals) – **Underway.**

<u>Stage 1: Steps 3, 4 and 5.</u>

- Step 3 – Engage and mobilize contractors to perform selective building demolition and excavation
- Step 4 – Backfill excavated areas with low-permeability soil (to serve as a cap)
- Step 5 – Re-tarp building footprint and direct drainage away

<u>Soil Excavation</u>

Prior to starting soil excavation activities, construction fencing and erosion & sedimentation controls will be installed by the contractor. Subsequently, a water storage tank and roll-off containers will be mobilized to the Site. The water tank will be used to temporarily store water that is pumped from the excavation area. The captured water will be sampled and properly disposed. Also, site utilities will be located and disabled.

Based upon the results of the 2012, 2018 and 2019 soil sampling events, following is the excavation strategy to remove the primary source areas for the metals and volatile organic compounds. For the Pattern Plate Sump, excavate an area approximately 10' x 10' x 12' deep (to the top of bedrock) centered on the Sump to remove soil impacted by excessive levels of the target contaminant groups. For the Atlas Sump, excavate an area approximately 10' x 10' x 13' deep (top of bedrock) centered on the Sump to remove soil impacted by excessive levels of the target contaminant groups. Soils and concrete will be placed in lined roll-off containers and secured with tie-down tarps. The limits of the excavation areas are shown on Figure 1.

Soil Disposal

Based on the historical industrial processes used at the Site, and after additional laboratory testing by the facilities, the soils impacted by metals and VOCs would be transported to the Ross facility or WTI facility located in Ohio. Soils impacted by VOCs would be transported to the BioGenie facility located in Canada while soils impacted by lead would be transported to the US Ecology facility located in York, Pennsylvania. Both the Canadian and Pennsylvania facilities would treat the soil which would then be landfilled.

Soil Backfill

Each excavation area will be backfilled/capped using certified clean fill. Low-permeability soils will be used to prevent infiltration by rainwater. The low-permeability soils shall consist of clean material free of rock, debris, organic matter, and other deleterious matter. The backfill will be placed by LEI's contractor in maximum of one (1) foot lifts and compaction will be completed either using the bucket of the trackhoe or a trackhoe-mounted compactor.

Re-tarp Building Footprint and Direct Drainage Away

Upon conclusion of the soil excavation and backfilling activities, the building footprint will be covered with a heavy duty tarp or plastic sheeting that will be sloped toward the west (open end of the building) to promote rainwater drainage away from the building. Also, silt socks may be utilized around the building to divert surface water run-on.

Future Stages:

Stage 2 – Complete by end of 4Q 2019: Drill Shallow and Deep Wells for Groundwater Investigation

i. Step 1– Evaluate criteria for well siting (and avoid areas where additional excavation could be performed in future)
ii. Step 2 – Drill shallow wells and sample once initially during 3Q 2019
iii. Step 3 – Survey locate and complete slug testing of shallow wells
iv. Step 4 – Evaluate initial results from shallow wells
v. Step 5 – Install core boring and finalize locations of deeper wells
vi. Step 6 – Drill deep wells (4Q 2019)
vii. Step 7 – Survey locate and complete slug testing of deep wells

Stage 3 – Complete by 4Q 2020: Full Evaluation of Groundwater Results

i. Step 1 – Continue to analyze results from groundwater wells and groundwater pumping system
ii. Step 2 – Begin to develop preliminary plan after two quarters of groundwater results from all wells (during 2Q 2020) to assess next steps, including:
    a. Effectiveness of pumping system
    b. Whether the following are warranted:
        i. Delineation of plume/cooperation with property owners
        ii. Groundwater modeling
        iii. Additional treatment/excavation
        iv. Draft NIR and Environmental Covenant

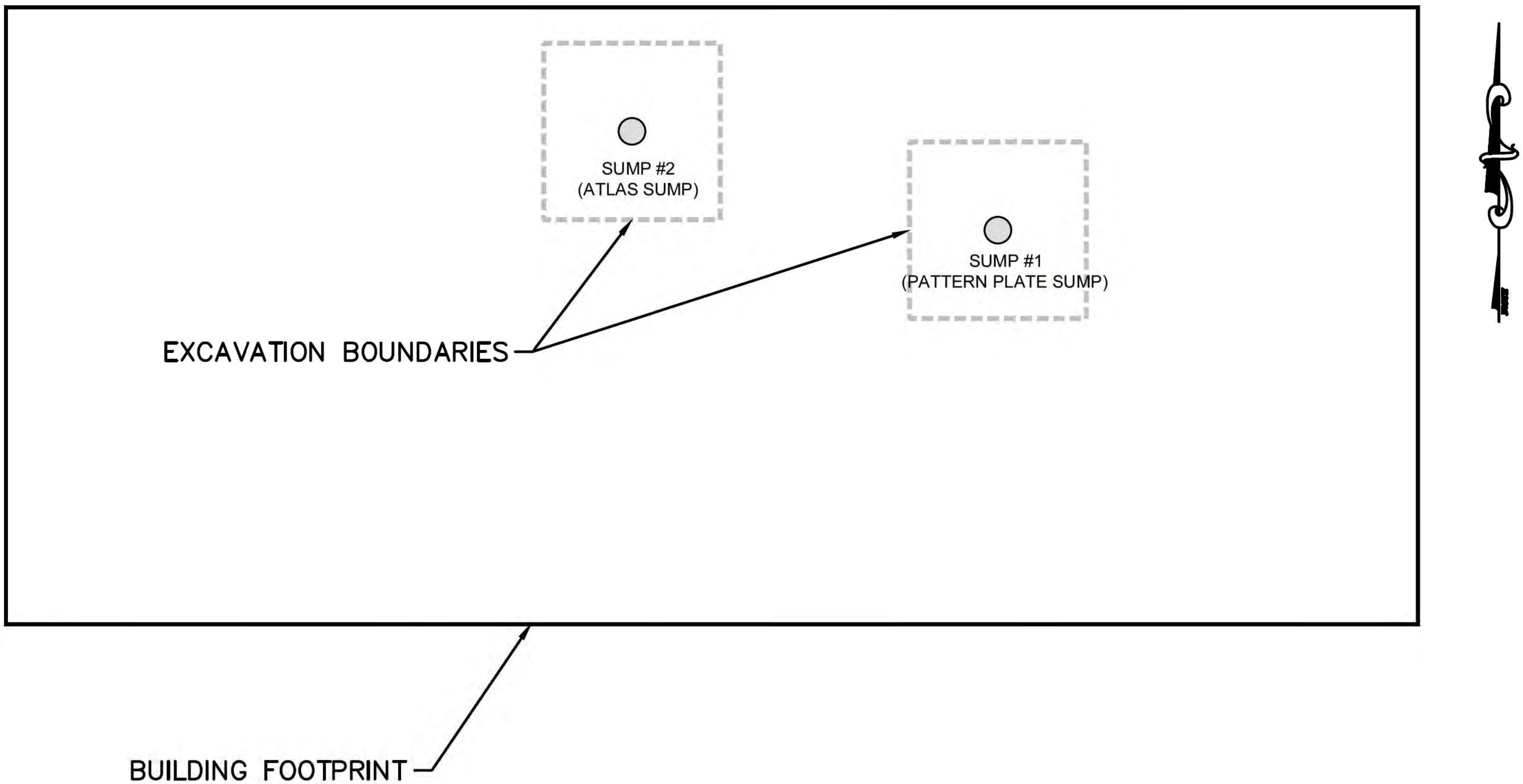
iii. Step 3 – Add final cap for other soil impacts (depending on groundwater results, etc.)
iv. Step 4 – Finalize plan with new proposed timeframes if needed

Stage 4A – Complete by end of 1Q 2021: Filings for Site Closure (Assuming No More Excavation/Treatment or Offsite Impacts)

i. Step 1 – Continue to monitor as needed to close out site (for EPA Corrective Action, two years of monitoring)
ii. Step 2 – Draft/submit Remedial Investigation/Final Report, other documents to close out site under Act 2

Stage 4B – As Needed (by 2022, depending on issues): Implementing Plan Based on Groundwater Results

i. Step 1 – Implement plan – depends on results, but options may include additional treatment/excavation
ii. Step 2 – Finalize monitoring and filings needed to close out EPA Corrective Action under COA, Act 2 closure



NOTES:
1. SAMPLES COLLECTED ON 6/21/19

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DRAWN BY:	CHECKED BY:
JJB	SRC
DATE: 07/15/19	PROJECT NO: 121027.002
DRAWING SCALE: 1" = 10'	

FIGURE 1
STAGE 1 SOIL EXCAVATION BOUNDARIES

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Stage 2 Scope of Work
Steps 1 through 4
Proposed Phased Approach for the Completion of
Investigation and Remedial Activities to Achieve Closure
Lehighton Electronics
Mahoning Township, Carbon County, Pennsylvania
(revised 9/27/19)

Stage 2 – Complete by end of 4Q 2019: Drill Shallow and Deep Wells for Groundwater Investigation

Step 1– Evaluate criteria for well siting - **Completed.**

- Step 2 – Drill shallow wells and sample once initially during **4**Q 2019;
- Step 3 – Survey locate and complete slug testing of shallow wells; and
- Step 4 – Evaluate initial results from shallow wells.

Stage 2: Steps 5, 6 and 7 – Planning Underway with Scope of Work to be Submitted.

- Step 5 – Install **rock** core boring and finalize locations of deeper wells;
- Step 6 – Drill deep wells (4Q 2019); and
- Step 7 – Survey locate and complete slug testing of deep wells.

Well Siting and Construction

Six (6) shallow groundwater monitoring wells are proposed and depicted on the attached Figure 1. Based on an assumed direction of groundwater flow toward Mahoning Creek to the north, Shallow Well #1 is expected to represent upgradient groundwater quality. The remaining shallow wells were placed based upon the expected hydraulic gradient toward the north and the soil sampling results that infer possible components of shallow groundwater flow toward the west and east.

Each well will be installed using an auger drill rig to a depth of approximately 20 feet below the ground surface or to top of bedrock. Drill cuttings will be drummed and later evaluated for disposal. The wells will be finished with 2" diameter SCH 40 PVC screen (#10 slot) and riser pipe, #1 quartz sand pack, #00 choker sand, a bentonite seal, bentonite grout to the ground surface, protective steel casing and a locking well cap with lock. A Typical Well Construction Schematic is attached. Once constructed, developed and sampled, the locations of the shallow wells will be evaluated using water level and laboratory analytical data to determine if additional shallow wells are needed. Any development and purge water will be drummed and later evaluated for disposal.

Groundwater Sampling

All monitoring wells will be purged and sampled in accordance with EPA/540/S-95/504, "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures" using a portable 2" Grundfos portable pump. **To prevent cross-contamination, the upgradient well will be purged/sampled first during each sampling event.** After the initiation of purging procedures and the subsequent acquisition of a low turbidity discharge from the pump, the purge scan feature on the Horiba U-50 Series Flow Cell will be set to record the stabilization parameters. The Flow Cell is set to record readings of temperature, pH, specific conductance, dissolved oxygen and oxygen-reduction potential (ORP) at time intervals of every four (4) minutes to determine parameter stabilization. Purging must continue until three successive readings should be within ± 0.1 units for pH, ± 3% for specific conductance, ± 10 mV for oxygen-reduction potential, and ±0.2 mg/l for dissolved oxygen.

Once parameter stabilization at the monitoring wells is attained, a sample will be collected and placed into pre-preserved laboratory bottleware. Samples to be analyzed for dissolved metals will be field filtered using a 0.45-micron filter connected directly to the pump discharge tubing. All readings are recorded on a field-sampling log at each sampling location. The groundwater samples will be analyzed by ALS Environmental for total and dissolved RCRA metals plus copper and zinc, and TCL volatile organic compounds.

Equipment Decontamination

Proper decontamination of all field equipment associated with groundwater sampling is critical to successful and accurate site assessment and for the prevention of cross-contamination. Non-dedicated groundwater sampling equipment will be scrubbed using appropriate cleaning solutions, rinsed with distilled water, and allowed to air dry. All non-dedicated equipment will be decontaminated prior to and between each use. Disposable tubing, bailers and filters are designed to be single use. Disposable sampling equipment will be removed from manufacturer packaging immediately prior to use and will be disposed immediately after use in a marked plastic bag to eliminate the potential for cross contamination and/or equipment reuse.

Field Quality Control Samples

Sampling protocols require submission of a daily equipment decontamination blank, one (1) duplicate per event and laboratory-supplied trip blanks. The quality control samples track the path of the samples from the laboratory into the field then back to the laboratory. They are analyzed to assess whether any impact has resulted from any part of the shipping processes.

Sample Preservation, Storage and Shipment

Bottleware supplied by the laboratory are pre-preserved. The preservative used is clearly indicated on the sample label. Once samples are collected, the sample container and samples should be cooled to 4 degrees Celsius from the time the sample is collected through the time of analysis. Samples should be maintained in coolers containing double bagged ice packs. Samples submitted to the laboratory for chemical analyses have holding times as established by the US EPA or other state or regulatory agencies. The holding time is the maximum number of days (or hours) a sample can be kept in cold storage from the time of sample collection until the extraction and/or analysis is completed in the laboratory. Samples not analyzed within the required holding times are not valid and may be subject to resampling.

During sampling, the sampler records the following information in the field notes using permanent ink: sample identification, the source of the sample, date and time of sample collection, and name(s) of sampler(s). All sample containers are labeled by the sampler, wrapped in bubble wrap or other protective material, placed in a cooler with bagged ice and the completed chain-of-custody (see below), and picked up by the laboratory's courier or shipped via a courier service. The laboratory will be notified of the sample type, number of samples, and expected arrival time of the cooler(s). Typically, the laboratory will already have the shipment scheduled for analysis and the lab will have supplied EARTHRES with pre-preserved sample jars and coolers.

Sample custody (chain-of-custody) is used to establish an accurate written and verified record of the sample possession from the moment of collection until receipt by the laboratory. Sample custody will be established by accurate record keeping of the type and quantity of samples collected and completion of the laboratory-supplied chain-of-custody form as described below.

The method of shipment is entered on the bottom of the chain-of-custody, and the sampler will sign and date the form. If the samples are to be shipped via a courier service, the chain-of-custody is then placed in a waterproof bag and sealed in the cooler with the respective samples. The cooler lid and body are then secured by wrapping tape or seals and initialed by the sampler.

If the laboratory picks up the samples from the site, sealing the chain-of-custody inside the cooler is not necessary. The lab courier accepts sample custody through signing the appropriate section of the chain-of-custody. Upon arrival at the lab, the tape seal will be checked and all sample labels will be compared with the chain-of-custody to assure that all samples designated on the chain-of-custody have been received. The Lab Coordinator will note the cooler's internal temperature and any discrepancies concerning the shipment (if any), indicate the analysis due date, deliver the chain-of-custody to the sample control center, and submit the samples to the appropriate area for analysis.

Survey Locate and Slug Testing

EARTHRES personnel will locate and establish the top of casing elevation for the wells using a survey grade GPS.

Slug testing is performed by instantaneously raising or lowering the water level in a well and monitoring the recovery of the water level over time.

The test is performed by rapidly introducing, withdrawing, or displacing a volume of well water. The term "falling head test" refers to the displacement test in which the water level is suddenly increased and subsequently monitored while it returns or falls to its initial (static) level. The term "rising head test" refers to the withdrawal test in which the water level is suddenly lowered and then monitored while it returns or rises to its initial level. Both rising and falling head tests will be performed on each well as part of the current investigation.

Prior to testing, the static water level and the total depth of the well will be measured using a water level indicator. A pressure transducer will then lowered to the bottom of the well and cabled to a data logger. The data logger will be programmed to record water levels from the transducer at one-second intervals. After the completion of pretest measurements and programming the data logger, the test will be started by rapidly lowering the slug into the water column. When the water level reaches equilibrium the slug will then be rapidly withdrawn.

Slug test data will be analyzed by means of the methodology developed by Bouwer and Rice (1976) and updated by Bouwer (1989). A summary of this method is presented in the following sections. The height of the water recovery in a well (in feet) following slug injection or withdrawal is plotted on the logarithmic axis (Y-axis) of semi-logarithmic paper against time, which is plotted on the normal axis (X-axis). A line is fitted to the second straight line portion of the curve (the first straight line portion usually indicates a high permeability zone corresponding to the well sand pack) and the hydraulic conductivity (K) is calculated by the following equations.

I. The well casing radius is corrected for sand pack effects using Equation 1-1:

$$r_{cc} = \left[(1-n)r_c^2 + n\,r_w^2\right]^{1/2}$$

where:
r_{cc} = corrected casing radius (feet)
r_c = casing radius (feet)
r_w = well bore radius (feet)
n = sand pack porosity (percent)

II. Solve for $\ln\left(\frac{R_e}{r_w}\right)$ using either Equation 1-2 or 1-3:

$$\ln\left(\frac{R_e}{r_w}\right)=\left[\frac{1.1}{\ln\left(\frac{H}{r_w}\right)}+\frac{C}{\left(\frac{L}{r_w}\right)}\right]^{-1}$$

A. Fully penetrating wells where height of the water column (H) is equal to the total water depth (D) (H = D):

B. Partially penetrating wells where height of the water column is less than the total water depth (H < D):

$$\ln\left(\frac{R_e}{r_w}\right)=\left\{\frac{1.1}{\ln\left(\frac{H}{r_w}\right)}+\frac{A+B\ln\left[\frac{(D-H)}{r_w}\right]}{\left(\frac{L}{r_w}\right)}\right\}^{-1}$$

where: R_e = effective radius of the well (feet),
H = distance from static water level to bottom of well (feet),
D = distance from static water level to impermeable bottom layer (saturated thickness) (feet),
L = well screen length (feet), and
A, B, and C = determined graphically as functions of L/r_w.

III. Calculate the hydraulic conductivity (K) by Equation 1-4:

$$K=\frac{r_{cc}^{2}\ln\left(\frac{R_e}{r_w}\right)}{2L}\,x\,\frac{1}{t}\,x\,\ln\left(\frac{Y_o}{Y_t}\right)$$

where: K = hydraulic conductivity (feet/minute)
t = a picked time (in minutes) less than the t intercept (t_o) of the line plotted from the recovery verses time graph
Y_t = recovery (in feet) corresponding to the chosen t

Y_o = Y intercept of the line plotted from the recovery verses time graph

IV. Calculate the transmissivity (T) by Equation 1-5:

$$T = Kb$$

where: b = aquifer thickness

Data Evaluation

Upon completion of the previously described tasks, a summary report will be prepared and submitted to both EPA and PADEP. The report will contain a description of site activities and present the results of the investigation including data evaluation, conclusions and recommendations. The summary report will also contain:

- A written narrative describing the results;
- Monitoring well logs;
- Shallow groundwater flow map(s);
- Supporting calculations; and
- Laboratory Data Tables.

ATTACHMENTS

Shallow Well Investigation (revised)

Typical Well Construction Schematic

NOTES:
1. AERIAL IMAGE FROM GOOGLE EARTH 2017.
2. PROPERTY BOUNDARY FROM CARBON COUNTY, PA ARCGIS PARCEL VIEWER.
3. SITE FEATURES ARE APPROXIMATE AND WILL BE ADJUSTED BASED ON FIELD CONDITIONS.
4. UTILITIES MUST BE LOCATED AND DISABLED PRIOR TO START OF DEMOLITION.

LEGEND

- UNDERGROUND UTILITY
- SUPPLY WELL
- PROPOSED SHALLOW GW MONITORING WELL (APPROXIMATE)

STAGE 2
STEPS 1–4
(SHALLOW WELL INVESTIGATION)

REVISED WORK PLAN
LEHIGHTON ELECTRONICS, INC.
MAHONING TOWNSHIP, CARBON COUNTY
PENNSYLVANIA

DRAWN BY: JJB	CHECKED BY: SRC
DATE: 7/18/19	PROJECT NO: 121027.002
DRAWING SCALE: 1" = 30'	

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PHILADELPHIA REGION
P.O. Box 468
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Morgantown, WV 26505

TYPICAL WELL CONSTRUCTION SCHEMATIC

Elevation (TOC): ____________
Elevation (Surface): ____________
Depth to Static Water Level (SWL): ____________
Date SWL Measured: ____________ (mm/dd/yy)

Project: SOIL REMEDIATION SUPPORT SERVICES (121027.002)
Client: LEHIGHTON ELECTRONICS, INC.
Geologist/Engineer: ____________
County: CARBON
Township or Municipality: MAHONING TOWNSHIP
Logged By: ____________

Depth (FEET)		Comments		Depth (FEET)

Depth scale (feet): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32

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Stage 2 Scope of Work
Step 5
Proposed Phased Approach for the Completion of
Investigation and Remedial Activities to Achieve Closure
Lehighton Electronics
Mahoning Township, Carbon County, Pennsylvania
(Revised January 7, 2020)

Stage 2 – Complete by end of 4Q 2019: Drill Shallow and Deep Wells for Groundwater Investigation

Step 1– Evaluate criteria for well siting - **Completed.**

- Step 2 – Drill shallow wells and sample once initially during 4Q 2019;
  - **Wells installed with development and sampling to follow. Completed.**
- Step 3 – Survey locate and complete slug testing of shallow wells;
  - **Wells surveyed with slug testing to be completed after sampling. Slug testing to be completed.**
- Step 4 – Evaluate initial results from shallow wells.
  - **Shallow well laboratory data has been evaluated and submitted to both EPA and PADEP. The next round of shallow well water samples will be obtained in February 2020.**

<u>Stage 2: Steps 5, 6 and 7</u>

- Step 5 – Install rock core boring and complete additional downhole testing/straddle packer sampling/data analysis to determine locations and construction methods of bedrock wells;
- Step 6 – Drill bedrock wells (2Q 2020); and
- Step 7 – Survey locate and complete slug testing of bedrock wells.

I. ROCK CORING

One (1) rock core will be advanced at the location shown on Figure 1 to a depth up to 150 feet, which approximates the greatest depth to the first water-bearing zone in a domestic supply well (83748) drilled into the Mahantango Formation along strike from the Site (Table 1 in Attachment B). This is 1.5 times the depth as the adjacent Well 83038.

Based upon what is observed during the drilling, the depth of the core drilling may be modified to better characterize and evaluate the bedrock groundwater system beneath the Site. The exact core location will be determined and marked in the field at the time of drilling. A water-based drilling operation will be used, and a tub will be positioned to collect and filter fluid return flows. As a result, continuous wetting of the core will be accomplished during drilling to minimize the generation of dust. Retrieved cores will be boxed, labeled and stored on-site for logging and analysis. Clearance of above ground and below ground utilities will be performed at the Site before mobilization of drill crew. A typical wireline rock coring system using an HQ-size core barrel as described in ASTM D 2113 will be used. The drilling equipment will be decontaminated using a steam cleaner on a temporary decontamination pad. The generated IDW will be pumped from the pad to a DOT 17-H drum upon completion. An appropriately-sized casing will be installed through the overburden and into the top five feet of competent bedrock to prevent collapsing of loose materials into the borehole, the loss of drilling fluid, and to prevent the downward movement of surface contaminants. Advancement of a 5-inch diameter casing will be accomplished with rotary drilling using 6.25-inch diameter hollow stem augers, and will be cemented in place. Drilling fluids will be recirculated during drilling operations, and will be pumped from the recirculation trough into DOT 17-H drums upon completion. The investigative derived wastes (IDW) will be stored on site and later characterized for the purposes of disposal.

An EARTHRES geologist will be on site during drilling to visually log all core that is recovered from the drilling. The EARTHRES geologist will set a pressure transducer in Site Well 7883 before drilling takes place to record water levels changes during drilling. This information will be used to evaluate whether there are interconnected water-bearing zones between the two boreholes. The rock core logging will include a geological description and the percentage of core recovery. Description of the rock cores will consider the following evaluations:

A. Recovery,
B. RQD,
C. Rock type,
D. Color,
E. Mineralogy, Grain size & Texture,
F. Bedding,
G. Fractures,
H. Size range of core pieces,
I. Hardness,
J. Weathering,
K. Additional observations,
L. Photographs, and
M. Rock Core Log.

The results are to be recorded and used to prepare a log for the rock core.

A. Recovery

The Geologist should record the recovery (in percent) as the length of core recovered divided by the total length of the core run, multiplied by 100. Areas where loss is likely to have occurred (soft seams, fractures with edges that don't match, zones of decay, etc.) should be noted.

B. RQD

The Rock Quality Designation (RQD) is calculated in order to estimate the quality of the intact rock mass by dividing the sum of all the recovered pieces of core equal to or greater than 4 in. (100 mm) in length by the total length of the core run, then multiplying by 100. In effect, the RQD is a measure of the spacing of the discontinuities (bedding, fractures, faults, joints, shear zones, etc.) in the rock mass. Only naturally occurring discontinuities will be considered when calculating RQD. Weak and/or weathered rock core is not included in the RQD calculation.

C. Rock Type

Rocks suitable for coring are divided into three groups - Igneous, Metamorphic, and Sedimentary (see Attachment A).

D. Color

The color of the recovered rock core will be made upon recovery, or after misting with water, and recorded on the drilling log.

E. Mineralogy, Grain Size and Texture

The major, field observable minerals, size, and texture will be identified and recorded on the drilling log. The general descriptions of mineralogy, grain size, and texture for the various rock types are included in the rock type tables in the Attachment A.

F. Bedding

The categories of bedding used in describing sedimentary rock are provided in a table in the Attachment A. For igneous and metamorphic rocks, observable planar features (foliation, banding, etc.) may be recorded using the same thickness designations as sedimentary bedding.

G. Fractures

The spacing, orientation, filling, and degree of healing of the fractures can be important in determining the properties of the rock mass. The tables that list the fracture density (FD) and fracture healing (FH) categories are included in the Attachment A.

H. Size Range of Core Pieces

Indicate the range of size of pieces of core recovered in the run. The size may range from fragments too small to measure up to a single piece the entire length of the run. Note the locations of significant fragmented zones.

I. Hardness

The rock hardness categories to be used are in the table in the Attachment A.

J. Weathering

The table that lists the weathering categories is provided in the Attachment A.

K. Additional Observations

Additional observations may include noting the obvious presence of odor, staining, and sheen on the rock core. Also, organic vapor readings of suspect zones based on the additional observations will be recorded using a photo-ionizing detector.

L. Photographs

The core will be photographed at the time of recovery from the core barrel. The Geologist will take representative digital photographs of the individual core runs and additional photographs of important portions of the cores (fragmented zones, soft seams, lithology changes, etc.) where applicable.

M. Rock Core Log

The description of each run will be recorded upon observation using the template in Attachment A.

II. DOWNHOLE GEOPHYSICS

Following completion of the HQ core hole, a suite of downhole geophysics will be completed in the core hole to identify potential water-bearing fractures. In addition, the well pump will be removed from the on-site pumping well and downhole geophysics will be completed for this well. The following downhole tools will be used:

- QL40-OBI-2G Optical Televiewer – to assess fracture orientation;
- QL40-CAL 3-arm caliper – to assess borehole diameter and integrity;
- QL40 FTC Fluid Temperature and Conductivity Probe – to assess location of fluid flow and water intervals of differing quality; and
- HFP-2293 Heat Pulse Flow Meter (HPFM) – to assess flow rates, transmissivity, and hydraulic head of each water-bearing zone under static and pumping conditions.

The hydraulic conductivity of each water-bearing zone will be calculated by dividing the HPFM-derived transmissivity by the thickness of the zone, which will be determined from the rock core data and geophysical information. The pumping rate during the stressed portion of the HPFM test will be one (1) gallon per minute. During the HPFM test, water levels in select site wells will be measured to record changes in the water level during the pumping portion of the HPFM test. This information will be used to evaluate whether there are interconnected water-bearing zones between the wells and core hole. The IDW generated during this testing will be containerized in drums, stored on site and later characterized for the purposes of disposal.

III. STRADDLE PACKER SAMPLING

Upon completion of the downhole geophysics for both points, and using this data in conjunction with the data obtained from review of the rock core to identify water bearing zones, straddle packer sampling will be completed for both the core hole and on-site pumping well to obtain groundwater samples from isolated water bearing zones. Field parameters (pH, temperature, specific conductance, and dissolved oxygen) will be monitored and recorded during purging of the zone(s) that have been isolated. After three purge volumes have been removed and field properties have stabilized, a groundwater sample will be collected from the zone being tested. The discrete zone groundwater samples will be analyzed for TCL volatile organic compounds (VOCs) similar to the shallow wells. The IDW generated during this testing will be containerized in drums, stored on site and later characterized for the purposes of disposal.

After completion of the packer testing, the core hole will be temporarily sealed using a FLUTe ™ (Flexible Liner Underground Technologies) liner until the final use of the core hole is determined. Also, the submersible pump will be returned to the on-site well and pumping of this well will resume.

The data obtained from the completion of rock core, downhole geophysics and straddle packer sampling will be used by EARTHRES' Hydrogeologists to determine the following:

- Location and number of bedrock wells to best characterize vertical and horizontal groundwater quality on-site; and
- The screened intervals for the bedrock wells to determine if the use of nested wells is warranted.

GEOLOGY AND HYDROGEOLOGY
(Preliminary Site Hydrogeological Conceptual Model)

Geology

Regional geology and the Site location are depicted in Figure 2. The Site is overlain by a thin layer of Quaternary alluvium and colluvium[1]. The alluvium is a six (6) to 16-foot thick mantle of stratified silt, sand, and gravel with some boulders and localized lenses of yellowish brown to yellowish red silty or sandy clay that have been mapped along the north margin of the Site [1]. However, the majority of the Site is mantled with a similar thickness of colluvium that consists of cobble-size shale and sandstone clasts from gray shale and sandstone bedrock that are supported by a reddish-brown matrix. The shale clasts are typically a few centimeters long and less than a centimeters thick, whereas the sandstone clasts are usually 10 to 25 centimeters across and a few centimeters thick. In places, there are lenses or pockets of clast supported matrix or clasts without matrix[1]. The angular, tabular clasts exhibit a strong downslope orientation or form crudely layered lenses[1].

Beneath the alluvium/colluvium surficial deposits, the Site geology consists of the Middle Devonian Hamilton Group, specifically the Mahantango Formation to a depth of approximately 400 feet, and below that, the older Marcellus Shale[2]. The Site is approximately 250 feet south of the geologic contact between the Mahantango Formation and the Marcellus Shale (Figure 2), which stratigraphically would place the Site near the base of the Mahantango Formation. The Mahantango Formation is between 1,100 to 1,600 feet thick[3], consists of gray, brown, and olive shale and siltstone in various members characterized by coarsening-upward cycles[4], and conformably overlies the Marcellus Shale.

Regionally, between the Delaware River to the east and the Susquehanna River to the west, the Mahantango Formation consists of alternating beds of fossiliferous olive-gray to dark gray sandy shale and sandstone (with local thin beds of calcareous shale, and coral limestone), and the fossiliferous coarse sandstone and dark shaley sandstone of the Montebello Member[3]. Locally, the Mahantango Formation is a massive, nonbedded, medium- to dark-gray, silty shale with four

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1 Braun, D. D., 1996, Surficial Geology of the Nesquehoning 7.5' Quadrangle: Open-File Report 96-25. Pennsylvania Geological Survey, Harrisburg, PA 17105-8453.
2 Wood, G. H., 1974, Geologic Map of the Nesquehoning Quadrangle, Caron and Schuylkill Counties, Pennsylvania: Department of the Interior, United States Geological Survey
3 Lohman, S. W., 1957, Ground Water in Northeastern Pennsylvania: Bulletin W 4, Commonwealth of Pennsylvania Topographic and Geologic Survey, Harrisburg, PA.
4 https://mrdata.usgs.gov/geology/state/sgmc-unit.php?unit=PADmh%3B0

thin zones with abundant fossils[5]. Fossils include Brachiopods, Crinoids, Trilobites, Bivalves, and Bryozoans. Regionally, the Marcellus Shale consists of dark marine shales and slate that are approximately 800 feet thick, and exhibit severe strain by folding and faulting[3]. Locally, the Marcellus Shale consists of a grayish-black, fissile, clay shale, with few fossils with a 38-foot thick calcareous zone and bentonite base in the lower part[5].

Structural Geology

The Site lies within the Blue Mountain Section of the Ridge and Valley Physiographic Province[6], which is characterized by a series of parallel ridges and valleys that result from folding and faulting of rock formations of differing resistance to erosion. The folding, which is most intense in central to northeastern Pennsylvania, created cleavage in the rock that is more prominent than bedding[7]. These structural features are the result of the rocks being deformed in the roots of ancient mountains, with the ridges resulting from the edges of folds where resistant rock layers (sandstone, conglomerate, or quartzite) occur, and the valleys resulting from rock (shale and siltstone) that has little resistance to erosion[7]. Axes of anticlines commonly are valleys, whereas the axes of synclines commonly coincide with ridges[7].

Structurally, the Site is located on a fold limb between the Lehighton anticline and the Weir Mountain syncline[2]. The formations in this limb dip southeast and strike northeast[2]. The axis of the Lehighton anticline plunges southwest and trends 025°, and is located about 0.7 miles north of the Site[2]. The axis of the Weir Mountain syncline is located 1.6 miles south, and has a similar orientation as the Lehighton anticline[2]. Deep beneath the site (estimated between 1,100 and 1,300 feet based on the cross-section), the South Tamaqua Fault is mapped as a listric thrust fault with displacement along the fault plane to the northwest where it crops out in the Strauss Valley[2] approximately four miles northwest of the Site (Figure 2).

Bedrock mapped at the Site consists of the Mahantango Formation, and much deeper, the Marcellus Shale. The Mahantango Formation has prominent cleavage in most places[5], and the beds of the Marcellus Shale have been severely crushed by folding and faulting, and dip steeply to the north in most places but are locally vertical or overturned[3]. The Site is within the Mahoning Creek Valley with the Mahoning Mountain to the immediate south, and the Mauch Chunk Ridge

5 Epstein, Jack Burton, and William D. Sevon, 1974, Bedrock geologic map of the Lehighton and Palmerton 7 1/2-minute quadrangles, Pennsylvania: 1:24000, Commonwealth of Pennsylvania Bureau of Topographic and Geologic Survey.
6 Sevon, W. D., 2018, Physiographic Provinces of Pennsylvania; Map 13, Scale 1:2,000,000: Commonwealth of Pennsylvania, Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey. www.dcnr.pa.gov/Geology
7 Trapp, Jr., Henry and Marilee A. Horn, 1997, Ground Water Atlas of the United States; U.S. Geological Survey, Hydrologic Atlas 730-L. https://pubs.usgs.gov/ha/ha730/ch_l/

approximately a mile to the north. Structurally, this places the Site near the crest of the Lehighton anticline. The cross-section indicates the Lehighton anticline to be an asymmetric fold, with the Site on the shallower fold limb that gradually transforms into the broad, gentle fold of the Weir Mountain syncline[2].

On Site, the geology was observed during soil excavation conducted on October 2, 2019 to consist of silt and clay from land surface to a depth of nine (9) feet. At that depth, a 1.5-foot thick layer of cobbles was encountered overlaying black shale. The observed geology supports the mapped units at the Site to consist of alluvium on top of colluvium to about 10.5 feet, where the dipping black shale beds of the Mahantango Formation are encountered.

Local Hydrogeology

The principal aquifers in the Valley and Ridge Province are carbonate rocks and sandstones, with the more productive aquifers occurring in valley limestones[7]. Sandstone formations also can yield large quantities of water to wells where the sandstone is fractured, and locally, fractured shale beds form productive aquifers[7]. In the Valley and Ridge, the groundwater flow paths are generally short, and in all rock types, groundwater moves mostly along fractures and bedding planes[7]. These features constitute the secondary porosity of the rock, which formed after almost all the original primary porosity was filled with fine-grained material or mineral cement during lithification[7].

The secondary porosity has preferred orientations, and where interconnected, form a water-bearing zone. Wells completed within such a zone can have dissimilar heads and specific capacities compared to wells completed in the intervening bedrock or other water-bearing zones so that the pumping of one well will have little effect on water levels in the other[7].

Structurally, secondary porosity from fractures and rock cleavage is more abundant at fold hinges, and beds that dip at angles of less than 15 degrees generally yield more water to wells than beds that are inclined more steeply because more bedding-plane partings are penetrated by a well in nearly horizontal strata[7]. Anticlines typically yield more water to wells than synclines because the tensional stress that formed the fractures at anticlines are more open than those formed from the compressional stress that developed at synclines[7].

Where it is not covered by the thin layer of alluvium and colluvium, the Mahantango Formation crops out at the Site in a northeast-southwest trending belt approximately 2,000 feet wide (Figure 2). The groundwater in the Mahantango Formation is reported to be of good quality with moderate yields obtainable from the shale and siltstone beds, and large yields from the sandstone beds[3]. In the shale and siltstone beds, groundwater storage and flow is largely restricted to rock discontinuities, such as fractures, faults, joints, cleavage, and bedding planes. The greater reported well yields in the sandstone beds are likely attributed to a much better developed system of fractures, due to the relatively greater strength of the rock, compared to the shale and siltstone beds. A fracture lineament trace analysis at the Site is shown in Figure 2.

The Mahantango Formation yields small supplies of groundwater to shallow domestic wells, but can have large yields to deep wells that penetrate sandstone beds[3]. Shallower wells between 72 and 127 feet deep reportedly yield 5 to 10 gallons per minute (GPM), whereas a well drilled to 305 feet in depth reportedly yields 150 GPM[3]. A 150-foot deep artesian well (Well 729) drilled into the Hamilton Group in Lehighton free flows 3 to 4 GPM from a zone 100 feet deep, and is believed to have considerably higher yield if pumped[3]. The nearby artesian condition indicates separate water-bearing zones that are recharged from higher elevations exist in the Manantango Formation.

The Marcellus Shale crops out immediately north of the Site in a northeast-southwest trending belt about one mile wide (Figure 1), and consists entirely of black shale and slate. The shales and particularly the hard, brittle slates have been crushed and fractured, so that numerous openings have been provided for the movement of ground water[3]. Groundwater in the Marcellus yields 10 to 15 GPM to a few shallow domestic wells less than 50 feet deep, and is of good quality[3].

Local Wells

Several geologic factors influence well yields in the Valley and Ridge Province. Wells located along fracture traces in any type of rock usually yield much more water than wells that do not penetrate fractures, and wells in valley bottoms generally are more productive than those on ridges or uplands because fracture zones tend to be concentrated in valleys[7]. The Site is located on the south margin of a valley and near several fracture traces (Figure 2). These fractures traces may be further investigated during completion of Step 6 through the installation of bedrock wells. Figure 3 depicts the PAGWIS wells found within one-half mile of the Site, while Table 1 summarizes the provided PAGWIS well data.

One water supply well (7883) is present on the Site. Information on construction, geology, or hydrogeology of this well is not available in the PAGWIS database. Groundwater on Site was measured on October 1, 2019 to be 10.5 feet below the top of the casing in Well 7883. Groundwater was also observed entering a 10.5-foot deep pit from the 1.5-foot thick layer of cobbles at the same time. The observed mottled soil above the saturated cobble layer suggests perched groundwater conditions are present in the cobble layer. However, the silt and clay above the cobble layer did not appear to transmit groundwater.

The PAGWIS database indicates that the domestic supply wells located within one-half mile of the Site were typically drilled to 140 feet with 40 feet of 6-inch diameter steel casing (based on the geometric mean of all the well and casing depths shown on Table 1). According to this database summarized in Table 1, wells drilled and tested in the Mahantango Formation are typically 171 feet deep, yield 33 GPM from water-bearing zones encountered between 30 and 272 feet deep, and have a static water level of 34 feet below land surface. The average specific capacity for these wells is 0.25 GPM per foot of drawdown (GPM/ft).

One well (83038) is located 200 feet east of the Site (Figure 2), and was drilled to a depth of 103 feet in sandstone, with 63 feet of steel casing, and a yield of 30 GPM from production zones at 55 and 90 feet (Table 1). In contrast, Well 83782 is 775 feet southeast and off strike of the Site, is drilled 275 feet into slate of the Mahantango Formation, yields 22 GPM from two water-bearing zones at 247 and 272 feet, and has a static water level of 129 feet below the surface. Two other wells drilled into the Mahantango Formation are located approximately 1,000 feet east, and along strike, of the Site, and are drilled to a depth of 100 and 300 feet with yields between 18 to 100 GPM. The large range of static water levels, from 10 to 129 feet deep, indicates the water-bearing units are not hydraulically connected. Four water-bearing zones were encountered in one of these wells, and collectively the tops of the first water-bearing zones ranged from a depth of 30 to 247 feet.

Local wells in the Marcellus Shale typically yield 15 GPM from water-bearing zones 30 feet deep and greater with a static water level of 26 feet below land surface, and a specific capacity of 0.33 GPM/ft. Based on the information from PAGWIS, exploratory drilling at the Site will likely encounter multiple bedrock water-bearing zones in the Mahantango Formation, rendering it unnecessary to drill deeper to encounter the Marcellus Shale to characterize the bedrock groundwater system.

Site Groundwater Hydraulic Gradients, Velocity and Potential Travel Times

Based on the PAGWIS records, the static water levels in bedrock wells drilled into the Mahantango Formation around the Site vary. This indicates the water-bearing zones encountered in the wells are not all hydraulically connected, likely due to being off strike from one another. However, Site Well 7883 and adjacent Well 83038 (Figure 2) both have a static water level of approximately 10 feet below land surface. The similar level suggests, but does not demonstrate, that Site Well 7883 may intercept the same water-bearing zone encountered between 55 and 90 feet at Well 83038 (Table 1).

Shallow groundwater flow is likely in a northerly direction from the Mahoning Mountain to Mahoning Creek based on the topography of the Site vicinity and the local drainage (Figure 2). Mahoning Creek flows to the northeast within Mahoning Valley, and is the major drainage in the valley. At Seneca Road near the Site, the Mahoning Creek drains 27.8 square miles, has a baseflow of approximately 20 cubic feet per second (cfs), a mean annual stream flow of about 50 cfs, a 7-day, 10-year low flow rate of 1.27 cfs, and a 100-year peak flood of 5,290 cfs[8]. Assuming shallow

8 USGS StreamStats: https://streamstats.usgs.gov/ss

bedrock groundwater flows from the Site to Mahoning Creek, the horizontal hydraulic gradient is estimated using the October 1, 2019 Site well water level elevation (512.5 feet MSL), the creek bed elevation (512 feet MSL), and the distance between the Site well and the creek (425 feet) to be approximately 0.001 feet per foot. Vertical gradients are expected to be downward in areas of recharge such as along the Mahoning Mountain, and upward in areas of discharge, such as along Mahoning Creek. Additionally, vertical gradients may vary significantly between adjacent water-bearing zones within the shale bedrock. However, along much of the flow path, the vertical gradient is likely to be more neutral, such as at the Site.

The hydraulic conductivity of the Mahantango Formation has been evaluated to range from 0.3 to 0.15 feet per day using a calibrated groundwater model[9]. Porosity of shale typically ranges from 1% to 10%[10]. From these rough estimates, the horizontal velocity of groundwater flow in the shallow bedrock water-bearing zones can be estimated to range from 0.0015 feet per day (fpd) to 0.03 fpd. This indicates that a particle of water would take between about 40 and 800 years to travel from the Site well to Mahoning Creek. Site exploration is required to produce more accurate, reliable, and Site-specific measurements. Site-specific exploration will involve drilling, geophysical logging, and testing an exploratory rock core hole to prepare a conceptual site model (CSM).

---

9 Ronald A. Sloto, 2008, Effects of Land-Use Changes and Ground-Water Withdrawals on Stream Base Flow, Pocono Creek Watershed, Monroe County, Pennsylvania: Scientific Investigations Report 2008–5030 U.S. Department of the Interior, U.S. Geological Survey. Reston, VA.

10 http://www.aqtesolv.com/aquifer-tests/aquifer_properties.htm

LEGEND

- UNDERGROUND UTILITY
- SUPPLY WELL
- PROPOSED ROCK CORE LOCATION

NOTES:

1. AERIAL IMAGE FROM GOOGLE EARTH 2017.
2. PROPERTY BOUNDARY FROM CARBON COUNTY, PA ARCGIS PARCEL VIEWER.
3. SITE FEATURES ARE APPROXIMATE AND WILL BE ADJUSTED BASED ON FIELD CONDITIONS.
4. UTILITIES MUST BE LOCATED AND DISABLED PRIOR TO START OF DEMOLITION.

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DRAWN BY: JJB	CHECKED BY: SRC
DATE: 01/06/2020	PROJECT NO: 121027.002
DRAWING SCALE: 1" = 40'	

FIGURE 1
REVISED ROCK CORE LOCATION MAP

STAGE 2 – STEP 5 WORK PLAN
LEHIGHTON ELECTRONICS, INC.
MAHONING TOWNSHIP, CARBON COUNTY
PENNSYLVANIA

Stage 3 - Step 2b
Scope of Work
Phased Approach for the Completion of
Investigation and Remedial Activities to Achieve Closure
Lehighton Electronics
Mahoning Township, Carbon County, Pennsylvania
August 7, 2020

Stage 3 – Complete by end of 4Q 2020: Full Evaluation of Groundwater Results

- Step 1– Continue to analyze results from groundwater wells and groundwater pumping system: **Ongoing.**

- Step 2 – Begin to develop preliminary plan after two quarters of groundwater results from all wells (during 2Q 2020) to assess next steps, including:
    a. Effectiveness of pumping system **Ongoing.**
    b. Whether the following are warranted:
       Delineation of plume/cooperation with property owners

Off-Site Shallow Well Siting and Construction

Based upon review the shallow groundwater well laboratory results and the shallow groundwater flow maps, LEI is proposing to begin an off-site shallow groundwater investigation. The shallow wells/points are proposed for locations both downgradient and side gradient to the LEI Site.

As a first step, access letters will be sent to the four (4) property owners shown on Figure 1. These parcels are currently undeveloped. The draft access letters are attached to this Scope of Work.

Assuming the property owners are agreeable with the project, up to six (6) shallow groundwater monitoring wells/points are initially proposed and depicted on the attached Figure 1. Depending on the level of difficulty gaining access for the tracked drill rig, hand installed well points may also be utilized for both initial groundwater screening and long-term monitoring. The well points will consist of 1” diameter screened and slotted PVC, a sand pack and bentonite seal. The anticipated depth of the well points would range from ten (10) to fifteen (15) feet below the ground surface.

For the monitoring wells, each well will be installed using an auger drill rig to a depth of approximately 20 feet below the ground surface or to top of bedrock. Drill cuttings will be drummed and later evaluated for disposal. The wells will be finished with 2” diameter SCH 40 PVC screen (#10 slot) and riser pipe, #1 quartz sand pack, #00 choker sand, a bentonite seal, bentonite grout to the ground surface, protective steel casing and a locking well cap with lock. A Typical Well Construction Schematic is attached. Once constructed, developed and sampled, the locations of the shallow wells will be evaluated using water level and laboratory analytical data to determine if additional shallow wells/points are needed. Any development and purge water will be drummed and later evaluated for disposal.

<u>Groundwater Sampling</u>

Well points will be purged and sampled either by using mini-bailers or a peristaltic pump.

All monitoring wells will be purged and sampled in accordance with EPA/540/S-95/504, "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures" using a portable 2" Grundfos portable pump. After the initiation of purging procedures and the subsequent acquisition of a low turbidity discharge from the pump, the purge scan feature on the Horiba U-50 Series Flow Cell will be set to record the stabilization parameters. The Flow Cell is set to record readings of temperature, pH, specific conductance, dissolved oxygen and oxygen-reduction potential (ORP) at time intervals of every four (4) minutes to determine parameter stabilization. Purging must continue until three successive readings should be within ± 0.1 units for pH, ± 3% for specific conductance, ± 10 mV for oxygen-reduction potential, and ±0.2 mg/l for dissolved oxygen.

Once parameter stabilization at the monitoring wells is attained, a sample will be collected and placed into pre-preserved laboratory bottleware. Samples to be analyzed for dissolved metals will be field filtered using a 0.45-micron filter connected directly to the pump discharge tubing. All readings are recorded on a field-sampling log at each sampling location. Initially, the groundwater samples will be analyzed by ALS Environmental for total and dissolved RCRA metals plus copper and zinc, and TCL volatile organic compounds. Based upon the initial results, the list of target analytes may be modified.

<u>Equipment Decontamination</u>

Proper decontamination of all field equipment associated with groundwater sampling is critical to successful and accurate site assessment and for the prevention of cross-contamination. Non-dedicated groundwater sampling equipment will be scrubbed using appropriate cleaning solutions, rinsed with distilled water, and allowed to air dry. All non-dedicated equipment will be decontaminated prior to and between each use. Disposable tubing, bailers and filters are designed to be single use. Disposable sampling equipment will be removed from manufacturer packaging immediately prior to use and will be disposed immediately after use in a marked plastic bag to eliminate the potential for cross contamination and/or equipment reuse.

<u>Field Quality Control Samples</u>

Sampling protocols require submission of a daily equipment decontamination blank, one (1) duplicate per event and laboratory-supplied trip blanks. The quality control samples track the path of the samples from the laboratory into the field then back to the laboratory. They are analyzed to assess whether any impact has resulted from any part of the shipping processes.

Sample Preservation, Storage and Shipment

Bottleware supplied by the laboratory are pre-preserved. The preservative used is clearly indicated on the sample label. Once samples are collected, the sample container and samples should be cooled to 4 degrees Celsius from the time the sample is collected through the time of analysis. Samples should be maintained in coolers containing double bagged ice packs. Samples submitted to the laboratory for chemical analyses have holding times as established by the US EPA or other state or regulatory agencies. The holding time is the maximum number of days (or hours) a sample can be kept in cold storage from the time of sample collection until the extraction and/or analysis is completed in the laboratory. Samples not analyzed within the required holding times are not valid and may be subject to resampling.

During sampling, the sampler records the following information in the field notes using permanent ink: sample identification, the source of the sample, date and time of sample collection, and name(s) of sampler(s). All sample containers are labeled by the sampler, wrapped in bubble wrap or other protective material, placed in a cooler with bagged ice and the completed chain-of-custody (see below), and picked up by the laboratory's courier or shipped via a courier service. The laboratory will be notified of the sample type, number of samples, and expected arrival time of the cooler(s). Typically, the laboratory will already have the shipment scheduled for analysis and the lab will have supplied EARTHRES with pre-preserved sample jars and coolers.

Sample custody (chain-of-custody) is used to establish an accurate written and verified record of the sample possession from the moment of collection until receipt by the laboratory. Sample custody will be established by accurate record keeping of the type and quantity of samples collected and completion of the laboratory-supplied chain-of-custody form as described below.

The method of shipment is entered on the bottom of the chain-of-custody, and the sampler will sign and date the form. If the samples are to be shipped via a courier service, the chain-of-custody is then placed in a waterproof bag and sealed in the cooler with the respective samples. The cooler lid and body are then secured by wrapping tape or seals and initialed by the sampler.

If the laboratory picks up the samples from the site, sealing the chain-of-custody inside the cooler is not necessary. The lab courier accepts sample custody through signing the appropriate section of the chain-of-custody. Upon arrival at the lab, the tape seal will be checked and all sample labels will be compared with the chain-of-custody to assure that all samples designated on the chain-of-custody have been received. The Lab Coordinator will note the cooler's internal temperature and any discrepancies concerning the shipment (if any), indicate the analysis due date, deliver the chain-of-custody to the sample control center, and submit the samples to the appropriate area for analysis.

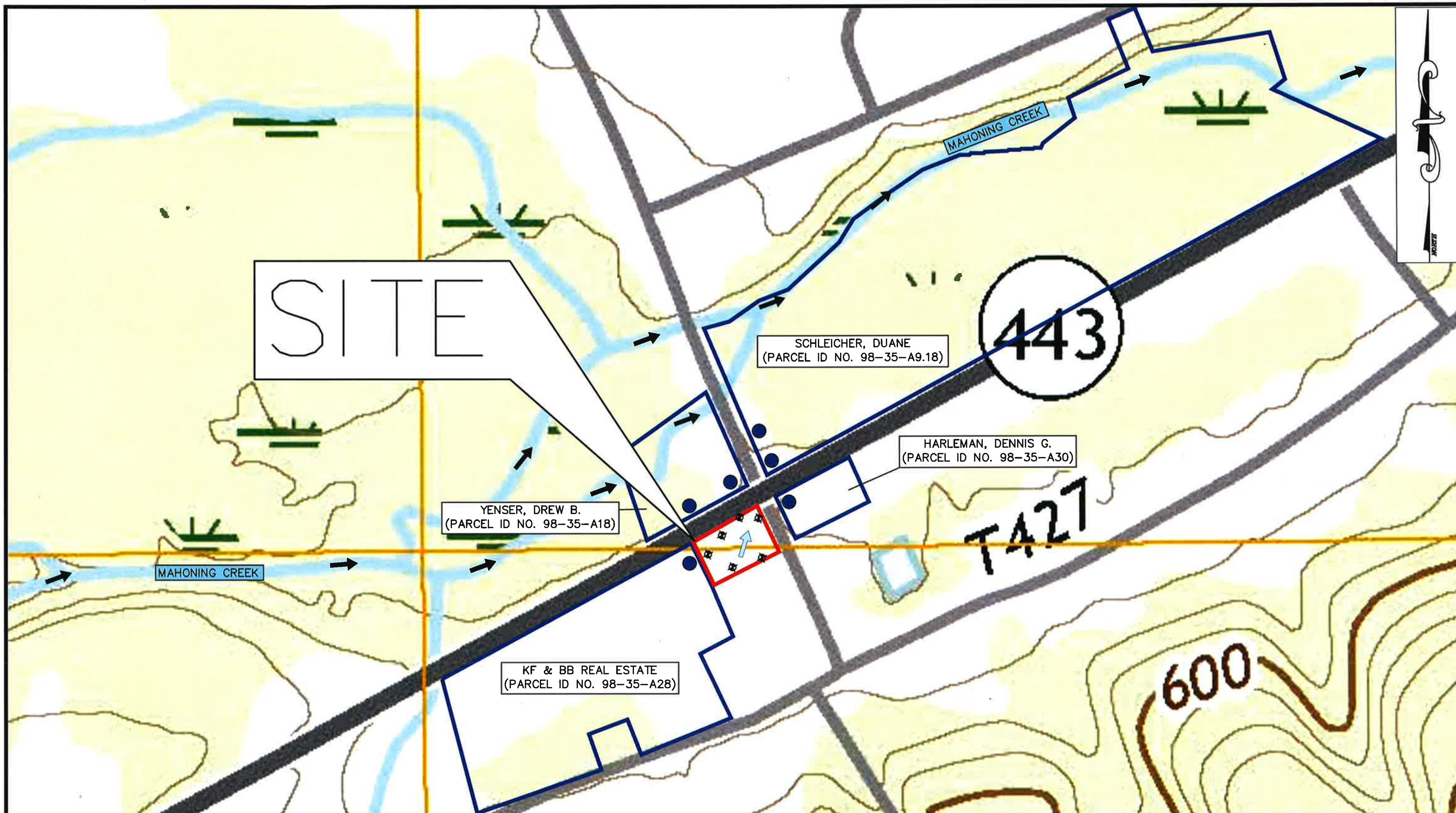
<u>Survey Locate</u>

EARTHRES personnel will locate and establish the top of casing elevation for the wells using a survey grade GPS.

<u>Data Evaluation</u>

Upon completion of the previously described tasks, a summary report will be prepared and submitted to both EPA and PADEP. The report will contain a description of site activities and present the results of the investigation including data evaluation, conclusions and recommendations. The summary report will also contain:

- A written narrative describing the results;
- Monitoring well logs;
- Shallow groundwater flow map(s);
- Supporting calculations; and
- Laboratory Data Tables.



SOURCE: USGS 7.5 MINUTE QUADRANGLE – NESQUEHONING, PA (2016)

LEGEND

- —SITE PARCEL BOUNDARY
- —ADJACENT PARCEL FOR PROPOSED OFF-SITE MONITORING WELL
- —EXISTING ON-SITE SHALLOW MONITORING WELL
- —PROPOSED OFF-SITE SHALLOW MONITORING WELL OR POINT
- —DIRECTION OF SHALLOW GROUNDWATER FLOW AT LEI
- —DIRECTION OF SURFACE WATER FLOW AT MAHONING CREEK

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DRAWN BY:	CHECKED BY:
RCC	SRC
DATE: 07/07/2020	PROJECT NO: 121027.002
DRAWING SCALE: 1" = 250'	

FIGURE 1

PROPOSED OFF-SITE SHALLOW GROUNDWATER MONITORING WELL LOCATIONS

LEHIGHTON ELECTRONICS, INC.
MAHONING TOWNSHIP, CARBON COUNTY
PENNSYLVANIA

F:\PROJECTS\Lehighton Electronics\121027.002 Soil Remediation Support Srvs 2018\CAD\Drawings\Rev 0\Off-Site Shallow Well Figure 1.dwg Layout: B SIZE LAND User: Jbernard 07/29/2