Voluntary Action Program

Phase II Property Assessment

For

Hudson Public Power/Hudson Bus Garage
95 & 91 Owen Brown Street
Hudson, Ohio 44236

Phase II Report Date: October 14, 2016

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1.0 INTRODUCTION

Environmental Design Group and Mr. Matthew J. Montecalvo, PE, Voluntary Action Program (VAP) Certified Professional (CP) No. 345 performed a Phase II Property Assessment (Phase II) in accordance with the Ohio VAP rule as described in Ohio Administrative Code (OAC) Section 3745-300-07 of the property located at 95 and 91 Owen Brown Street in Hudson, Ohio in Summit County. The property consists of approximately 17.3 acres of land as defined in the legal description in **Appendix A**. According to the Summit County Auditor's property report card, the parcels that make up the Property are owned by the City of Hudson Village and Hudson Local School District. The Phase II project staff includes the VAP CP, environmental engineer, and environmental geologist. Specific project team individuals and their roles are presented in Section 1.3

1.1 Phase I Property Assessment

A VAP Phase I Property Assessment (Phase I) was prepared by Environmental Design Group, the Phase I property inspection was performed on June 5, 2015, and the final report is dated September 15, 2015. Sampling of environmental media for the Phase II was performed between February 23 and May 26, 2016. The Phase II report was completed on October 14, 2016.

1.2 Phase II Statement of Work

Environmental Design Group completed a Phase II Statement of Work (SOW) for the Property after completing the Phase I. The Phase II SOW was completed on September 15, 2015. This Phase II SOW included a summary of the identified areas (IAs) included as **Figure 2**, the data quality objectives (DQOs) for the project, and other relevant information needed to assess the Property under OAC 3745-007.

1.3 Project Team

The project team members were selected based on individual project experience related to the specific tasks required. A brief description of what each individual's project responsibilities were is provided below:

Ms. Kelly Beavers, Environmental Geologist – Ms. Beavers served as the Geologist during the project and was responsible for on-site sampling activities and adherence to the Phase II SOW, and conducted data management for the project. Ms. Beavers also completed the assemblage of this report.

Ms. Tiffany Thoma, P.E., Environmental Engineer – Ms. Thoma completed the Phase I SOW under the direction of the VAP CP and she served as the Quality Assurance Officer to evaluate data quality during the Phase II. Ms. Thoma also contributed to the assembling of this report.

Matthew J. Montecalvo, P.E., Certified Professional No. 345 – Mr. Montecalvo participated in developing the scope of work for the investigation and served as the Project Manager. Mr. Montecalvo evaluated data and conclusions of this report, and he also served as the technical reviewer for the project as the VAP CP.

PACE Analytical Services, Inc. (PACE) was utilized as the analytical services contractor. PACE is a nationwide laboratory with resources available to complete all environmental analyses. PACE is also an Ohio VAP Certified Laboratory.

Timmerman Geotechnical Group, Inc. was utilized as the drilling services contractor and laboratory for the geotechnical sampling. They also provided the collection and analysis of geotechnical samples from the Property.

Underground Detective was utilized to perform the ground penetrating radar (GPR) survey in the area of the former underground storage tanks (USTs).

2.0 PHASE I PROPERTY ASSESSMENT AMENDMENT

The Phase I was conducted by Environmental Design Group on the Property in accordance with OAC 3745-300-06(E). The following IAs were recognized as possibly containing hazardous substances or petroleum:

- Identified Area # 1 – Due to storage of transformers containing Polychlorinated Biphenyls (PCBs) and the lack of documentation on the storage and removal of PCB containing equipment, PCBs, as listed in the Environmental Database Report, are a suspected Chemical of Concern (COC) for portions of the Property, specifically on the Hudson Public Power parcels. Suspected COCs would include PCBs.

- Identified Area # 2 – Staining was observed on aggregate in the parking lot of parcels 3203132 and 3201855, specifically on the Hudson Public Power parcels. Suspected COCs would include Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), Total Petroleum Hydrocarbon (TPH), and resource conservation and recovery act (RCRA) 8 metals.

- Identified Area # 3 – Historic Auto Repair activities were conducted on the Property at **Building 1**, specifically on the Hudson Public Power parcels. This information was provided as a result of an interview. Suspected COCs would include VOCs, poly-aromatic hydrocarbons (PAHs), TPH, and RCRA metals.

- Identified Area # 4 – Historic fill on all of parcel 3201855, specifically on the Hudson Public Power parcel, consisting of asphalt grindings, brick and other aggregate. This information was provided as a result of an interview and observation. Suspected COCs would include VOCs, SVOCs, and RCRA metals.

- Identified Area #5 – Former USTs were known to exist on the Hudson Public Power property, as identified in the Environmental Database Report, Fire Department, and the Bureau of Underground Storage Tank Regulations (BUSTR) records. Former USTs were stated to include one (1) 6,000-gallon gasoline tank and another potential UST of an unknown size. Closure reports for these USTs did not provide enough information to evaluate whether the closures met current VAP standards and if a tank may still be present on the Hudson Public Power property. Suspected COCs would include Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), Methyl tert-butyl ether (MTBE), PAHs, TPH, and Lead.

- Identified Area #6 – Adjacent Off-Property parcel where a former UST was located to the south of the Property. This was confirmed in the Environmental Database, Fire Department records, and BUSTR records. Closure report for this UST did not provide enough information to evaluate whether the closures met current VAP standards. Suspected COCs would include BTEX, MTBE, PAHs, and Lead.

- Identified Area # 7 – Staining was observed on the Property on the floors of **Building 3**, specifically on the Hudson Bus Garage parcel. Suspected COCs would include VOCs, PAHs, TPH, and RCRA metals.

- Identified Area # 8 – Historic Auto Repair activities were conducted on the Property at **Building 3**, specifically on the Hudson Bus Garage parcel. This information was provided as a result of an interview and observation. Suspected COCs would include VOCs, PAHs, TPH, and RCRA metals.

- Identified Area #9 – Former USTs were known to exist on the Hudson Bus Garage property, as identified in the Environmental Database Report, Fire Department, and BUSTR records. Former USTs were stated to include one (1) 8,000-gallon gasoline tank, one (1) 1,000-gallon waste oil tank, and one (1) 550-gallon gasoline tank. Closure reports for these USTs did not provide enough information to evaluate whether the closures met current VAP standards. Suspected COCs would include BTEX, MTBE, PAHs, TPH, and Lead.

Phase II activities commenced in less than 180 days following the completion of the Phase I. No changes in use or ownership occurred during the time between the Phase I and the start of the Phase II. No amendments have been made to the Phase I to date.

3.0 STATEMENT OF LIMITATIONS OR QUALIFICATIONS

Limitations to the collection of various data were encountered during fieldwork. Boring placement was altered from the Phase II SOW for two IAs. In addition, damage was sustained to a groundwater monitoring well that rendered it unusable. It is believed that neither of the limitations materially affected the results of this report. No other limitations or qualifications were identified as part of the Phase II. Specific information that describes these two limitations is provided in the following subsections.

3.1 Soil Boring Relocation

The locations of the borings within IA-1/IA-4/IA-2 on the western portion of the Property were adjusted from the planned locations in the Phase II SOW due to access limitations. The locations of the borings within IA-1/IA-2, near the salt dome, were adjusted from the Phase II SOW due to access limitations because utility poles were staged in that area. The locations of the borings in IA-9 were adjusted from the planned locations in the Phase II SOW because heavy incoming traffic caused a safety hazard. These borings were originally placed in the middle of the driveway to the Bus Garage. The locations of the borings within IA-7 and IA-8 were adjusted from the planned locations in the Phase II SOW due to access limitations in the rear of the bus garage. A lower than anticipated ceiling height and the need to avoid underground utilities within the building required moving three borings. These boring locations also could not be surveyed because incapacitated busses were parked in these locations and could not be moved. The locations of each of these borings were measured from the walls of the bus garage and the finished floor elevation was used as the boring elevations.

3.2 Groundwater Monitoring Well Damage

It was determined during the second round of groundwater sampling at the Property that groundwater monitoring well MW-2 had been damaged by vehicular traffic and could not be resampled. The concrete pad and plug on the groundwater monitoring well had been run over and detached from the well. Due to the damage to the well, it was not resampled during the second round of groundwater sampling. No COCs, with the exception of barium, were detected within this groundwater monitoring well during the initial groundwater sampling. Other groundwater monitoring wells are located up-gradient and downgradient of this MW-2. Also, very few compounds were detected in this well. As such, this groundwater monitoring well was not reinstalled for additional groundwater monitoring.

3.3 Deviations from the Phase II Statement of Work

The Phase II SOW stated that all permanent groundwater monitoring wells installed on the Property would be 2-inch wells. Groundwater in the area of MW-4 was more difficult to identify. Therefore, a 1-inch temporary well was installed at 20 feet below ground in similar geology to all other wells on the Property. This well did not produce water, so it was properly removed. The boring was then drilled to 36 feet where water was observed. A 1-inch permanent groundwater monitoring well was installed in the location of MW-4.

The Phase II SOW stated that a 100-foot hollow-stem auger (HSA) boring would be installed on the Subject Property. The purpose of this boring was to collect geotechnical samples to get a better understanding of the geology on site, and to document the presence of a confining layer of clay that was believed to be present underlying the site. The 100-foot HSA boring was not completed as planned because an apparent confining layer was observed at shallower than anticipated depths while drilling some of the deeper soil borings on-Property. As such, geotechnical samples were collected during the installation of MW-2, and the deep boring was eliminated.

The Phase II SOW stated that slug/yield testing of select groundwater monitoring wells would be conducted. The VAP CP determined that groundwater could, at this point, be assumed to be Class A groundwater, and since no additional data on groundwater flow characteristics were deemed necessary for this stage of the assessment, slug/yield testing was not performed; although it may be deemed necessary in the future..

The Phase II SOW stated that all soil borings would be advanced until they reached a depth of 20 to 25 feet, groundwater, or refusal, whichever is shallowest. Several of the soil borings were only advanced to a depth of 12 feet since geology was consistent across the Property. The VAP CP determined that deeper migration of contaminants from surface releases through the consistent, low permeability soils was unlikely did not warrant sampling at deeper depths.

4.0 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) has been prepared to illustrate the relationships between contaminants, transport media, and receptors in connection with the Property. The CSM has been prepared in accordance with OAC 3745-300-07 (C)(7) and (J) and graphically illustrates relationships between contaminants, transport media and receptors on the Property at the time of this assessment. A graphic representation of this pathway analysis is provided as **Figure 3**. Summaries of the analysis and conclusions are provided in the following sub-sections.

4.1 Contaminant Source Evaluation

The primary contaminate sources evaluated in the CSM include surface soils, subsurface soils, shallow groundwater, deep groundwater, surface water and sediment. The potential receptors were identified as potential future residential occupants, commercial/industrial onsite workers, onsite construction and excavation workers, off-site residential occupants, off-site commercial/industrial workers, and off-site construction and excavation workers. Potential biological receptors include biological receptors located within onsite wetland areas. The Property is located within a residential and commercial area of Hudson and both residential properties and commercial properties are adjacent to the Property. The future use of the Property was unknown at the time this assessment was conducted; Therefore, it was assumed that future end use could include residential land use.

4.2 Exposure Pathway Evaluation

Exposure pathways for each environmental media identified on the Property were evaluated to determine potential exposure pathway completeness. **Table 3** illustrates the summary of exposure pathways prior to applicable standards determination or remedy solutions.

4.2.1 Exposure Pathway Evaluation for Surface Soils

Potential exposure pathways for surface soils (i.e. those soils located between zero and two feet below ground surface (bgs)) include oral, dermal and inhalation pathways to onsite residential users, commercial/industrial workers, and onsite construction worker due to direct contact with the soils and particulate emissions due to wind erosion. Inhalation due to volatilization of soil gas from surface soils into onsite structures is also an exposure pathway. Off-site exposure pathways to off-site residents, commercial/industrial workers and construction workers from shallow surface soils include oral, dermal and inhalation pathways due to particulate emissions from wind and erosion. Finally leaching of COCs in soil to groundwater beneath the Property is an exposure pathway.

4.2.2 Exposure Pathway Evaluation for Subsurface Soils

Potential exposure pathways to subsurface soils (i.e. those soils located below two feet bgs) include oral, dermal and inhalation pathways to residential occupants and construction workers due to direct contact during excavation or construction activities on-site. An additional exposure pathway to subsurface soils is the inhalation pathway from soil gas to onsite structures to onsite residents or commercial/industrial workers. Finally leaching of COCs from soil to groundwater beneath the Property is an exposure pathway.

4.2.3 Exposure Pathway Evaluation for Groundwater

Potential exposure pathways for shallow and deep groundwater include the oral, dermal and inhalation pathways to onsite and off-site residential, commercial/industrial workers and construction workers due to direct contact or ingestion of groundwater. Volatilization of COCs from shallow groundwater into indoor air is also a potential pathway. The potential receptors for indoor air include onsite residential occupants and commercial/industrial workers. If groundwater leaving the Property contains VOCs off-site residential occupants and commercial/industrial workers are also a potential receptor.

4.2.4 Exposure Pathway Evaluation for Surface Water and Sediment

There are wetlands on the southwestern and northern portions of the Property. Wetlands on the northern portion are not located within an IA and it does not appear these areas would have been impacted from activities on other areas of the Property since the flow of surface water runoff on the Property is away from these areas. Potential exposure pathways for surface water and sediment include oral, dermal and inhalation pathways to onsite residential users, commercial/industrial workers, and onsite construction worker due to direct contact with surface water and sediment. Due to the location of the wetlands on the southwestern portion of the Property and the surrounding land use, it appears that off-site exposure pathways would include commercial/industrial workers and construction workers from surface water and sediment leaving the Property including oral, dermal and inhalation pathways from surface water run-off and erosion.

5.0 SAMPLING PROCEDURES

The purpose of this project was to conduct a VAP Phase II Assessment following VAP procedures, and in general accordance with OAC 3745-300-007 to comply with certain requirements of the VAP. The Phase II goal was to determine which VAP applicable standards are met or not met for the Property. The following subsections summarize the DQOs for the project that guided the investigation. In addition, descriptions of the procedures and methods used to obtain data are also provided.

5.1 Data Quality Objectives

DQOs are qualitative and quantitative criteria for clarifying project objectives, defining the appropriate types of data needed, and defining the tolerable levels of potential decision errors for the project. General Sampling requirements and methodologies were developed as part of the VAP Phase II SOW developed for the project.

5.1.1 Project Limits

The Property consists of approximately 17.3 acres of land as defined in the legal description in **Appendix A**. As previously stated, the Summit County Auditor's property report card indicates the City of Hudson Village and Hudson Local School District own the parcels that are make up the Property.

The Phase I completed for the Property revealed nine (9) IAs. Each IA was evaluated for its potential to be the source for a release to the environment located on the Property.

5.1.2 Data Collection

Phase I information and the Project Limits were taken into consideration, and a matrix was developed to determine likely COCs in each IA as well as the proposed sampling strategies that were selected to assess each IA for those COCs. **Table 1** summarizes that analysis. A minimum of three (3) soil samples and one (1) groundwater sample were collected in each identified area, in accordance with VAP requirements. Surface water and sediment samples were not collected within the onsite wetlands during this assessment.

Activities summarized in **Table 1** were implemented and soil and groundwater were sampled across the Property. The sampling was devised to provide an insight into whether impacts are present on and/or emanating from the Property. These soil and groundwater samples were analyzed to establish concentrations of COCs at the Property. **Table 2** summarizes analytical parameter group of COCs within the IAs and the analytical methods used to analyze for them.

Other data were also reviewed to complete the picture of the regional and local geologic and hydrogeologic conditions. Some information was provided as part of the Phase I, such as groundwater hydrogeology maps, regional mine lands mapping, Ohio Department of Natural Resources (ODNR) soils maps of Summit County, etc. However, these were re-evaluated as part of the Phase II to provide insight of on-Property soil and groundwater conditions.

Data were used to hone the CSM to confirm media and pathways. Then a pathway completeness determination was made to establish what pathways needed to be evaluated. The spacial and temporal distribution of these data were reviewed to establish the nature and extent of the impacts. Soil and groundwater analytical sample results were then compared to current VAP applicable standards.

5.2 Regional and Property-Specific Data Collection

As noted previously, Environmental Design Group completed a Phase II SOW for the Property after completing the Phase I. This Phase II SOW included a summary of the IAs, the DQOs for the project, and other relevant information needed to assess the Property pursuant to the VAP.

Prior to mobilizing field crews, a review of regional soils, geologic conditions, and groundwater resources mapping was completed. This information, along with topographic and surface water resource references, were used to establish likely geologic, morphologic, and hydrologic conditions for the Property. This supported the establishment of locations, depths, and types of soil and groundwater samples to be collected.

Field work was completed on February 18 through March 4, 2016 and consisted of the completion of twenty-three (23) direct push soil borings (SB-1 thru SB-23) and eight (8) groundwater monitoring wells. These activities resulted in twenty-nine (29) soil samples and eight (8) groundwater samples. Soil borings were advanced and continuously sampled. Field work consisting of a second round of groundwater seven sample collection was completed on May 24 through May 26, 2016. The location of the soil borings and groundwater monitoring wells installed during this Phase II Investigation are shown on **Figure 4**.

5.2.1 Quality Assurance and Quality Control

Prior to addressing any data collection, review, and reporting, a quality assurance (QA) process was established to provide a baseline for procedures that would lead to technically accurate work. The QA process required review of assessments, evaluations, calculations, and conclusions by competent, peer staff possessing similar or concurrent skill sets.

Another part of the QA process was to set specific quality control (QC) requirements for the various elements of the project. In general, these consisted of confirming and documenting equipment calibration, utilizing appropriate and thorough equipment decontamination techniques for field equipment, and utilizing laboratory quality controls including temperature blanks and evaluating the laboratory QC information for reported analyses. These QC elements are described in the following subsections for each relevant element of the work.

Specific QA/QC activities included: utilizing PACE, who is a VAP certified laboratory. Also, each chain of custody notified the laboratory that samples were being used for a VAP project. Data were transferred under affidavit. VAP affidavits were provided by PACE along with the laboratory reports. While these measures are mandated under the VAP, they are a form of QA/QC for the project. Laboratory data reports, chains-of-custody, and laboratory VAP affidavits are included as **Appendix B**.

5.2.2 Regional Published Data Evaluation

Current and historic topographic maps were consulted to evaluate the potential for anthropogenic fill on the Property. United States Geologic Survey 15 and 7.5-minute quadrangle topographic maps were used. National Resource Conservation Service soil surveys were also used to provide some insight on soil conditions at the site both historically and currently.

Groundwater resource maps available from the Ohio Department of Natural Resources give some indication of where groundwater may be encountered. These maps also give a good potential representation of the location and type of bedrock that may be encountered in the area of the Property.

5.2.3 Soil Boring Installation

Environmental Design Group advanced twenty-three (23) soil borings between February 18 and February 29, 2016. The borings ranged from twelve (12) to thirty-six (36) feet bgs. Subsurface Exploration Logs for all soil borings are provided in **Appendix C**.

All of the soil samples were retrieved via direct push technology, which utilized a truck-mounted Geoprobe rig to hydraulically push and hammer a specially designed, stainless steel, Dual Tube sample tube into the ground at locations designated by Environmental Design Group. The stainless steel Dual Tube was lined with an acetate sleeve which filled with soil as the tube assembly was driven into the ground via static force and percussion.

Upon completion of a standard four (4) foot sampling run, the Dual Tube assembly was extracted, disarticulated, and the acetate liner (which contained the sample) removed from the Dual Tube. The acetate liner was then split, which exposed the enclosed material and facilitated material description and sample collection. The process was repeated in four (4) foot increments until the soil boring was terminated by Environmental Design Group.

5.2.4 Soil Sampling and Field Screening

Materials were sampled directly from the opened acetate liner and divided into two (2) representative discrete samples, one for analysis at the lab and one for field screening purposes. Samples were collected in two (2) foot intervals unless poor recovery made it necessary to combine the entire four (4) foot interval into one sample to fill the required laboratory jars. Environmental Design Group utilized a head-space field screening procedure for the quantitative evaluation of total organic vapors (TOV) in soil. Field screening was done to provide real-time data and to help determine which soil samples were to be submitted to the laboratory for analysis. All samples were field-screened with a photo ionization detector (PID), specifically an RAE Systems, Inc. *ppb*Rae equipped with a 10.2 eV lamp. The PID was calibrated using a span gas of isobutylene (100 (parts per million (ppm) in air) according to the manufacturer's instructions.

Dividing the soil core produced two (2) representative soil samples, which were packaged for analysis. One sample was placed into labeled laboratory-supplied jars with polypropylene-lined lids, and kept in a cooler containing ice until delivery to the laboratory. The second representative sample, collected for field screening was placed in a zip lock bag and sealed until screened.

The samples collected for field screening were agitated and allowed to equilibrate for at least 10 minutes prior to screening. PID readings were obtained by agitating the sample bag and puncturing it with the tip of the probe thereby inserting the probe into the bag. The results of the field screening are recorded on the Subsurface Exploration Logs provided in **Appendix C**. The results are presented in ppm.

Selected soil samples were shipped to PACE to be analyzed for one or more of the following: VOCs by EPA Method 8260; SVOCs by EPA Method 8270; PAHs by EPA

Method 8270; BTEX/MTBE by EPA Method 8260; 8 RCRA Metals by EPA Method 6010/7470; Lead by EPA Method 6010; PCBs by EPA Method 8081; and TPH by method by EPA Method 8015. Laboratory data reports, chain of custodies, and laboratory VAP affidavits are included as **Appendix B**.

Selected soil samples were collected to identify the presence of COCs. Visual and olfactory observations and additional field screening techniques (i.e., PID screening) were used to identify samples for laboratory analysis. The sample selection hierarchy was based on the following: 1) the highest PID reading; 2) visual and olfactory observations which may indicate chemical impact; and 3) proximity to the ground surface or groundwater. **Tables 4.1** through **Table 4.5** summarize the results of the soil analyses.

5.2.5 Groundwater Monitoring Well Installation

Eight (8) groundwater monitoring wells were installed between February 24 and February 29, 2016 to collect groundwater samples. Once terminal boring depth was reached, the stainless steel dual tube was removed and the groundwater monitoring well riser and prepacked screen were installed in the borehole. Groundwater monitoring wells screens were set at a depth of twenty (20) feet with the exception of MW-5 which was set at a depth of thirty-six (36) feet bgs.

One monitoring well (MW-5) was installed consisting of ten (10) feet of 1-inch diameter, schedule 40 polyvinyl chloride (PVC) pre-packed well screen with 0.010-slot size . Well riser pipe was installed using enough 1-inch diameter, schedule 40 PVC pipe sufficient to terminate above the ground surface. All other groundwater monitoring wells consisted of ten (10) feet of 2-inch slotted PVC schedule 40, 0.010-slot size well screen pipe with lengths of 2-inch diameter, schedule 40, PVC) riser pipe sufficient to terminate above the ground surface. Groundwater monitoring well sand was installed to a depth of two (2) feet above the groundwater monitoring well screen. Granular bentonite was placed above the sand to prevent the downward migration of surface water. Groundwater monitoring well as-built diagrams are included on the Subsurface Exploration Logs presented in **Appendix C** and include specific details for individual wells.

5.2.6 Groundwater Monitoring Well Development and Sampling

A static water level meter was used to determine the water level within the groundwater monitoring wells after completion. The static water level meter was decontaminated with a thorough Liquinox/Deionized (DI) water bath then rinsed two (2) times in pure DI water before taking the first well reading, between each well reading, and before leaving the Property. The depths to groundwater within groundwater monitor wells MW-1 through MW-8 are recorded on the subsurface logs included as **Appendix C.**

Groundwater monitoring wells MW-1, MW-2, MW-3, MW-4, MW-7 and MW-8 were developed using a Hydrolift II Waterra pump and high density polyethylene (HDPE) tubing. A plastic footvalve was connected to the HDPE tubing to allow for the upward movement of water through the tubing. New tubing was used at each groundwater monitoring well and the footvalve was decontaminated with a thorough deionized (DI) water bath then rinsed two (2) times in DI water. During development each groundwater monitoring well was pumped dry with the exception of MW-1 in which approximately 10 well volumes were removed. Groundwater monitoring wells MW-5 and MW-6 were developed and sampled using a polyethylene disposable bailer. Groundwater monitoring well MW-6 was developed on February 29. Groundwater monitoring well MW-5 was developed on March 2. The recharge of the wells was slow and the water within the wells was removed, at which point the groundwater monitoring wells were dry. MW-5 was allowed to recharge for 48 hours and was sampled on March 4. MW-6 was allowed to recharge for 72 hours and was sampled on March 3. Groundwater monitoring well development sheets are included in **Appendix C**.

5.2.6.1 Round 1 Groundwater Sampling

A low flow sampling method using a bladder pump was utilized to sample majority of the groundwater monitoring wells. The pump rate was kept around 100 ml/min or slower during purging of the wells. This rate was further reduced during the collection of VOC samples. A minimum of one (1) well volume was removed from each well prior to the collection of groundwater samples. The well drawdown was also monitored during purging to determine if drawdown was stable prior to sample collection. Due to slow recharge of the wells sufficient water could not be purged from all wells to allow for all parameters to stabilize prior to sample collection. Groundwater monitoring wells MW-5 and MW-6 were sampled using hand bailing techniques because there was not enough water in the water column for the pump to function properly. In addition, these wells were not purged prior to sampling.

Groundwater monitoring well MW-2 was sampled on March 2, 2016, wells MW-1, MW-4, MW-6, MW-7, and MW-8 were sampled on March 3, 2016, and wells MW-3 and MW-5 were sampled on March 4, 2016. Groundwater monitoring well purge sheets are included in **Appendix C**. The groundwater samples were shipped to PACE to be analyzed for VOCs, SVOCs, PAHs, BTEX/MTBE, PCBs, RCRA Metals, and/or Lead.

5.2.6.2 Round 2 Groundwater Sampling

A low flow sampling method using a bladder pump was utilized to sample all of the groundwater monitoring wells. The pump rate was kept at approximately 100 ml/min or slower during purging of the wells. This rate was further reduced during the collection of VOC samples. A minimum of one (1) well volume was removed from each well prior to the collection of groundwater samples. The well drawdown was also monitored during purging to determine if drawdown was stable prior to sample collection. Due to slow recharge of the wells sufficient water could not be purged from all wells to allow for all parameters to stabilize prior to sample collection. Groundwater monitoring well purge sheets are included in **Appendix C**. All wells had more than 15 feet of water in them. No wells were purged or sampled dry in the second groundwater sampling event.

The 1-inch well, MW-5, was sampled on May 24, 2016. Groundwater monitoring wells MW-1, MW-4, MW-6, and MW-8 were sampled on May 25, 2016. Groundwater monitoring wells MW-3 and MW-7 were sampled on May 26, 2016. Groundwater monitoring well MW-2 was damaged by Hudson Public Power workers. This well was unable to be located and was not sampled for a second time. MW-2 had no exceedances during the first round of groundwater sampling and the only COC detected was Barium. The groundwater samples were shipped to PACE to be analyzed for VOCs, SVOCs, PAHs, BTEX/MTBE, PCBs, RCRA Metals, and/or Lead.

5.2.7 Investigation-Derived Waste Characterization

The Phase II SOW stated that investigation-derived waste (IDW) characterization would be performed to assess that wastes collected and drummed during the soil and groundwater collection process would meet qualifications of landfills. Samples were collected from drums of IDW and results concluded that IDW was non-hazardous. The drums were picked up and taken off-site for proper disposal.

5.2.8 Ground Penetrating Radar Survey

The Phase I completed for the Property revealed that former USTs were known to exist on the Hudson Public Power portion of the Property, as identified in the Environmental Database Report, Fire Department records, and BUSTR records. Former USTs were stated to included one (1) 6,000-gallon gasoline tank and another potential UST of an unknown size. Closure reports for these USTs did not state if the tanks were removed. It was thought that tanks could have still existed on the Hudson Public Power property. A GPR survey was conducted to determine if USTs did exist underground on the Property.

5.2.9 Property Survey

A survey of the Property was completed by a State of Ohio licensed professional surveyor. The survey coordinate system used for the project was the Ohio State Plane North Coordinate System, and the datum was the NAVD88 (2011) datum. All figures in the document reference this survey unless otherwise noted.

The location and elevation of each boring and groundwater monitoring well was surveyed after their installation. A boundary survey was also conducted for the Property and a legal description was produced. The boundary survey and legal description are included in **Appendix A**.

6.0 DATA COLLECTION ACTIVITIES

Laboratory data were obtained from the sampling process and procedures described in Section 5.0. The reviews of various published data sources, also described in Section 5.0 yielded specific information that was used in the evaluation of nature and extent of contaminants on the Property. The following subsections provide a summary of those various data.

6.1 Regional and Property-Specific Topography and Surface Waters

The USGS topographic map (**Figure 1**) shows the Property at an approximate elevation of 1050 feet above mean sea level. The Property experiences a slight downward slope to the east towards an unnamed tributary.

This area is characterized by land surface modifications and fill areas that have changed the original topography. The nearest surface water body to the site is an unnamed creek, a north-south-flowing tributary. This water body approaches within approximately 200 feet to the east of the Property.

There are wetlands on the southwestern and northern portions of the Property. A formal wetland delineation was completed concurrent with the Phase II. Results of that delineation indicate wetlands and streams are present on, and adjacent to the Property. **Figure 11** shows the locations of these wetland and stream complexes on and adjacent to the Property.

6.2 Regional and Property-Specific Geology

Regional geology influences potential for Property-specific variations and provides indicators of where and how to install soil borings and monitoring wells. An understanding of regional and Property-specific geology is necessary to understand the ability and likelihood of COCs to migrate on, from, or on-to the Property.

6.2.1 Regional Geology

According to the Soil Survey of Summit County, Ohio, three (3) soil types are assigned to the Property. Soils on the Property are mapped as Trumbull silt loam 0-2% slopes (Tr), Mahoning silt loam 0-2% slopes (MgA), and Mahoning-Urban land complex 0-2% slopes (Mn).

The Trumbull series consists of nearly level, poorly drained soils that formed in silty clay loam. Trumbull soils have very slow permeability in the subsoil and in the underlying glacial till. They are saturated with water for long periods in winter, spring, and early summer. Runoff is slow, and ponding commonly occurs after a heavy rain. Trumbull silt loam (Tr) is mainly along small drainage ways or in small depressions adjacent to areas of the better drained Mahoning soils. Seasonal wetness is the major limitation to the use of this soil.

The Mahoning series consists of nearly level to gently sloping, somewhat poorly drained soils. These soils formed in silty clay loam. Mahoning soils have slow permeability in the subsoil and underlying glacial till. They are saturated with free water late in winter and in spring. Mahoning silt loam (MgA) occurs in areas between drainage ways. Runoff is slow to ponded, and seasonal wetness is a severe limitation. Mahoning-Urban land complex (Mn) consists of nearly level to undulating areas where much of the original Mahoning soils have been disturbed, removed, or covered by grading and digging. Most of this mapping unit is used for urban or industrial development. Fill material occupies 1-3 feet above undisturbed Mahoning soils and consists of sticky silty clay loam.

6.2.2 Property-Specific Geology

During soil boring installation and soil collection activities, geologic units were logged. Approximately two (2) to six (6) feet of gravely fill was observed in some areas throughout the Property. Brick fragments, concrete, asphalt, foundry sand, and slag were observed within the fill material. Fill consisting of debris such as rubber, plastic, and rope were observed in one area on the western portion of the Property where historic fill activities were noted during the Phase I ESA. Clay was observed below the fill across the Property to depths of at least 36 feet.

Geotechnical samples on the Property were collected during the installation of MW-2 on February 24, 2016. Geotechnical samples were analyzed from fill material at a depth of 0'-2' bgs, clay material at a depth of 6'-8' bgs, and from clay at a depth of 18' to 20' bgs in this boring. All geotechnical samples were analyzed for liquid/plastic limits, grain size analysis, moisture content, specific gravity of soil, Walkley Black VAP modified total organic carbon. Flex wall permeability was also analyzed in one (1) clay sample. Geotechnical samples were analyzed to determine a confining layer in the aquifer system.

The sample collected from 0'-2' bgs has a USCS Classification of well-graded Gravel with Sand. The moisture content was reported at 10.6%, specific gravity was reported at 2.39 and the average total organic carbon was not detected within the sample.

The sample collected from 6'-8' bgs has a USCS Classification of Silty Clay. The moisture content was reported at 17.3%, specific gravity was reported at 2.73, and the average total organic carbon was reported at 0.507%.

The sample collected from 18-20' bgs has a USCS Classification of Silty Clay. The moisture content was reported at 21.4%, specific gravity of 2.74, average total organic carbon of 1.196%, liquid limit of 29.5%, plastic limit of 14.8%, plasticity index of 14.7% and average permeability of 4.2E-08 cm/sec @ 20°C.The geotechnical laboratory reports are included in **Appendix D**.

During soil boring installation, fill material was observed in varying depths across the Property. Fill material consisting of clay, sand, gravel, asphalt fragments, concrete fragments, brick fragments, and slag was observed to depths between one (1) and six (6) feet bgs across the Property. Dark gray, soft, sticky clay and brown, hard, brittle clay was observed below the fill material to depths between two (2) and thirty-six (36) feet bgs. Two (2) geological cross sections, one oriented northwest-southeast and another oriented southwest-northeast across the Property were completed and included as **Figure 6a** and **Figure 6b**. **Figure 5** shows the location of the soil borings included in the Geologic Cross-Section.

6.3 Regional and Property-Specific Hydrogeology

As with geology, understanding regional hydrogeology helps anticipate conditions and formations that may be encountered on the Property. Property-specific hydrogeology is critical to understanding the potential for spread of groundwater-borne contaminants.

6.3.1 Regional Hydrogeology

Review of the Groundwater Resources Map of Summit County map indicates that the Property is in an area where groundwater is obtained from thin, not extensive, sand and gravel deposits interbedded with thick clayey till. Wells must be drilled below the level of the adjacent drainage to obtain 3 to 10 gallons per minute. If sand and/or gravel deposits are not encountered, well are developed in the underlying bedrock to obtain private domestic supplies.

A search for water wells within half-mile radius from the Property was conducted during the Phase I. No water wells were identified on the Property. Fifty-eight (58) wells are located within a half-mile radius. Thirteen (13) wells were identified for domestic purposes. The closest well listed as domestic use was located approximately 0.21 miles to the north of the Property. The well was reported as being set at 64 feet bgs in sand. Several wells were located approximately 0.3 miles to the southeast of the Property whose use was not listed. These wells were set between 162 feet and 170 feet bgs in shale. Remaining wells are utilized for monitoring purposes or uses were not listed. No wells are located within close proximity to the Property. The wells are completed to depths between 10 and 283 feet in sand & gravel, silt & clay, and shale.

6.3.2 Property-Specific Hydrogeology

The groundwater monitoring wells on the Property as part of the Phase II were evaluated to establish potential groundwater flow and direction. The upper most saturated zone was observed at varying depths between 1.5 feet bgs and 7 feet bgs in the underlying clay throughout the Property.

A potentiometric surface map was constructed to display the flow of groundwater across the Property. Environmental Design Group created a potentiometric surface map using stable groundwater elevations collected in MW-1 through MW-8 on April 14, 2016 and the surface elevations of the groundwater monitoring wells, collected during survey activities. This map is included as **Figure 7**. A groundwater elevation table used in making the potentiometric map is included as **Table 7**. Groundwater flow in the upper most aquifer was established to be in the southeast-east direction. Water levels within monitoring wells onsite were between 1046 and 1053 feet below mean sea level (msl).

No yield testing was performed. The uppermost saturated zone is assumed to be a groundwater zone with the classification of Class A Groundwater. The presence of a low-permeability confining layer of clay below this initial groundwater bearing zone was also noted. More than 20 feet of clay having a laboratory-tested permeability of less than 1x10-7 centimeters/second was observed.

6.4 Soil Sampling Results

Soil samples were collected in varying depths, from 2 feet to 26 feet deep across the Property. Analytical results for soil samples are divided into surface soil, 0-2 feet bgs, and subsurface soil, or any soils present below 2 feet bgs. Soil samples were analyzed for VOCS, SVOCs, RCRA metals, TPH, and/or PCBs, depending on the IA in which the soil boring was located. The following subsections summarized detected parameter categories and COCs found within surface and subsurface soil samples.

6.4.1 Surface Soil Results

Surface soil samples were collected from 0 to 2 feet. Fifteen (15) of the twenty-seven (27) soil samples collected are considered surface soil samples.

Metals were detected in all fifteen (15) of the surface soil samples. Analytical results from soil samples showed detections of multiple of the 8 RCRA metals including: arsenic, barium, cadmium, chromium, and lead. The maximum concentration of any metal detected in surface soil was 122 milligrams/kilogram (mg/kg) of barium from samples collected in soil boring SB-8.

VOCs were detected in three (3) of the fifteen (15) surface soil samples. Analytical results from soil samples collected in SB-1, SB-3, and SB-19 showed detections of multiple VOCs including: 1,2,4-trimethylbenzen, 2-butanone (MEK), acetone, and tetrachloroethene. The maximum concentration of any VOC detected in surface soil was 0.21 mg/kg of acetone from samples collected in soil boring SB-3.

SVOCs were detected in ten (10) of the fifteen (15) surface soil samples. As many as 16 SVOCs were detected in soil samples from these soil borings. Analytical results in these soil borings were detected over a range of over four orders of magnitude (i.e., $1x10^4$). A maximum concentration of 2.0 mg/kg of fluoranthene was detected in soil boring SB-4. In addition, no PCBs were detected in any of the fifteen (15) surface soil samples.

TPH was detected in eleven (11) of the fifteen (15) surface soil samples. Analytical results from soil samples showed detections of TPH C_{10}-C_{20} and TPH C_{20}-C_{34}. A maximum concentration of 1,850 mg/kg was detected in soil boring SB-19.

6.4.2 Subsurface Soil Results

Subsurface samples were collected from below 2 feet bgs. Twelve (12) of the twenty-seven (27) subsurface soils samples collected are considered subsurface soil samples.

Metals were detected in all twelve (12) of the subsurface soil samples. Analytical results from soil samples showed detections of multiple of the 8 RCRA metals including: arsenic, barium, chromium, and lead. The maximum concentration of any metal detected in subsurface soil was 139 milligrams/kilogram (mg/kg) of barium from samples collected in soil boring SB-20.

VOCs were detected in two (2) of the twelve (12) subsurface soil samples. Analytical results from soil samples collected in SB-6 and SB-20 showed detections of multiple VOCs including: 1,2,4-trimethylbenzen, 1,2-dichlorobenzen, 2-butanone (MEK), and acetone. The maximum concentration of any VOC detected in subsurface soil was 0.36 mg/kg of acetone from samples collected in soil boring SB-6.

SVOCs were detected in five (5) of the twelve (12) subsurface soil samples. Analytical results from soil samples collected in SB-6, SB-12, SB-16, SB-20, and SB-21 showed detections of as many as 14 SVOCs. A maximum concentration of 12.2 mg/kg of phenanthrene was detected in soil boring SB-6. No PCBs were detected in any of the twelve (12) subsurface soil samples.

TPH was detected in two (2) of the twelve (12) subsurface soil samples. Analytical results from soil samples collected in SB-20 and SB-9 showed detections of TPH C10-C20 and TPH C20-C34. A maximum concentration of 4,770 mg/kg was detected in soil boring SB-20.

6.5 Groundwater Sampling Results

Groundwater samples were collected from eight (8) groundwater monitoring wells across the Property. Groundwater samples were analyzed for VOCS, SVOCs, RCRA metals, and/or PCBs, depending on the IA in which the groundwater monitoring well was located. The first round of groundwater sampling occurred on March 2 through March 4, 2016. The second round of groundwater sampling occurred on May 24 through May 26, 2016. The following subsections summarizes detected parameters found within groundwater soil samples.

6.5.1 Round 1 Groundwater Results

Metals were detected in all seven (7) of the groundwater samples. Analytical results from groundwater samples showed detections of multiple of the 8 RCRA metals including: arsenic, barium, chromium, and lead. The maximum concentration of any metal detected in groundwater was 1,540 micrograms per liter (ug/L) of barium from samples collected in groundwater monitoring well MW-4.

SVOCs were detected in two (2) of the groundwater samples. Analytical results from groundwater samples showed detections of as many as twelve (12) SVOCs. A maximum concentration of 9.6 ug/L of naphthalene was detected in monitoring well MW-1.

No PCBs were detected in any of the eight (8) groundwater samples. Also, no VOCs were detected in any of the eight (8) groundwater samples.

6.5.2 Round 2 Groundwater Results

Metals were detected in four (4) of the groundwater samples. Analytical results from groundwater samples MW-1, MW-3, MW-4, and MW-8 showed detections of multiple of the 8 RCRA metals including: arsenic, barium, cadmium, chromium, and lead. The maximum concentration of any metal detected in groundwater was 2,270 ug/L of barium from samples collected in groundwater monitoring well MW-1.

SVOCs were detected in two (2) of the groundwater samples. Analytical results from groundwater samples showed detections of as many as thirteen (13) SVOCs. A maximum concentration of 4.0 ug/L of phenanthrene was detected in monitoring well MW-1.

No PCBs were detected in any of the eight (8) groundwater samples. In addition, no VOCs were detected in any of the eight (8) groundwater samples.

6.6 Other Environmental Media

The potential impacts to surface water and sediment on the Property and the potential completeness of exposure pathways to COCs would be determined by the collection and analysis of surface water and sediment samples. Surface water is present on the Property in several wetlands on the southwestern and northern portions of the Property. It is assumed that sediment is also present within the wetlands.

Surface water and sediment samples were not collected during this assessment. Wetlands located on the northern portion of the Property were not located within an IA and it does not appear the surface water or sediment in this area would have been impacted by the former uses of the Property. If the wetland located on the southwestern portion of the Property is to remain on the Property, the potential impacts to this wetland should be evaluated.

6.7 Ground Penetrating Radar

A GPR survey was conducted in the parking lot of the Hudson Public Power portion of the Property in the area of the former USTs. The GPR survey revealed no evidence of any USTs or other voids that may represent USTs. The GPR survey report is included in **Appendix D**.

7.0 DETERMINATIONS

Determining applicable standards is based on both the reasonably anticipated land uses of the Property and the COCs discovered that have impacted the Property. The future uses of the Property are unknown at the time of this assessment and it has been assumed that the Property could be redeveloped for residential, commercial or industrial uses. A review of the site conceptual model and analytical results guide the determinations and was also completed in comparison to the various data collected throughout the investigation. The following media were evaluated: soil, groundwater, and sediment. Applicable standards were established for each media depending upon completed pathways identified in the site conceptual model. The following subsections describe the process of evaluating each media and pathway individually as well as how the standard will be used to determine compliance.

For the purposes of these determinations, the point of compliance for the direct contact soil pathway is ten (10) feet for residential/unrestricted land use, two (2) feet for commercial/industrial receptors, and 15 feet for construction/excavation workers. The point of compliance for potable groundwater is the uppermost saturated zone, and for vapor intrusion is the location of any existing or future habitable structure. The point of compliance for direct contact groundwater is the uppermost saturated zone.

7.1 Applicable Standards for Surface Soils

For the purpose of this report, surface soils are considered to be above the two-foot point of compliance. Surface soils are analyzed from the surface to 2 feet bgs. Due to the presence of COCs within groundwater beneath the Property the soil to groundwater leaching pathway was not evaluated.

Complete exposure pathways for surface soils include pathways to onsite residential occupants, onsite commercial/industrial workers, and onsite construction/excavation worker due to direct contact with the soils and particulate emissions due to wind erosion. Off-site exposure pathways to off-site residential land use, commercial/industrial workers, and construction/excavation workers from shallow surface soils include oral, dermal and inhalation pathways due to particulate emissions from wind and erosion. Table II: Generic Numerical Direct-Contact Soil Standards (commercial/industrial land use category) and Table III: Generic Numerical Direct-Contact Soil Standards (construction/excavation activities categories) within Appendix A of OAC 3745-300-08 were used to determine compliance with the oral, dermal and inhalation risks for COC including RCRA metals, SVOCs, PAHs, VOCs and PCBs for onsite and offsite exposure. Several COCs were detected in soils for which a VAP Generic Direct-Contact Soil Standard is not available. In accordance with OAC 3745-300-09, Supplemental Criteria Direct-Contact Soil Standards provided in the Ohio EPA - Voluntary Action Program Chemical Information Database and Applicable Regulatory Standards (CIDARS) (current as of June 15, 2015) were used as the applicable direct contact standard.

Total chromium was initially analyzed in soil samples. Since there is no current generic direct contact standard for total chromium and multiple results for total chromium exceeded the chromium (VI) standard the two (2) samples with the highest total chromium were rerun for chromium (VI). Chromium (VI) was not detected above the laboratory detection limits in these samples and since there is no known source of chromium (VI) the total chromium results were compared to the chromium (III) generic direct contact standard.

Inhalation due to volatilization of soil gas from surface soils into onsite structures is also an exposure pathway.

Table I: Total Petroleum Hydrocarbon Soil Saturation Concentrations within OAC 3745-300-09 was used to determine compliance for TPH within onsite soils. Residual Saturation Concentrations for Sand and Gravel soils were compared to TPH concentrations.

7.2 Applicable Standards for Subsurface Soils

For the purpose of this report, subsurface soils are considered to be below the two-foot point of compliance. Subsurface soils are considered to be anything below 2 feet bgs.

Potential exposure pathways to subsurface soils include pathways to residential occupants, construction workers and the inhalation pathway from soil gas to onsite structures to onsite commercial/industrial workers. The VAP Generic Direct-Contact Soil Standards and Supplemental Criteria for residential land use and construction/excavation activities categories were used to determine compliance with the oral, dermal and inhalation risks for COC including RCRA metals, SVOCs, PAHs, VOCs and PCBs for residential occupants and construction worker exposure. Residual Saturation Concentrations for Sand and Gravel soils were compared to TPH concentrations.

7.3 Applicable Standards for Groundwater

The upper most saturated zone was observed at varying depths between 1.5 feet bgs and 7 feet bgs in the underlying clay throughout the Property. No yield testing was performed and the uppermost saturated zone is assumed to be a groundwater zone.

The inhalation exposure pathways for shallow groundwater from volatilization of COCs from groundwater into indoor air is incomplete since no detections of VOCs were reported in groundwater. The onsite oral and dermal exposure pathways for shallow groundwater can be eliminated by a use restriction. The standards in Table VI: Generic Unrestricted Potable Use Standards Based on Maximum Contaminant Levels and Table VII: Risk-based Generic Unrestricted Potable Use Standards within Appendix A of OAC 3745-300-08 were compared to the shallow groundwater analytical results.

In accordance with OAC 3745-300-07(F)(3) the volunteer may justify that sampling of a groundwater zone underlying the Property is not necessary to determine that the groundwater in that zone does not contain concentrations of COCs in exceedance of the unrestricted potable use standard via a weight-of-evidence approach using relevant Property-specific information. Property specific information was evaluated to determine the potential impact to deep groundwater zones underlying the Property.

The nature, type, and concentration of COCs detected in the upper groundwater zone and shallow and deep soils were evaluated. No VOCs were detected in shallow groundwater and only three (3) SVOCs were detected in exceedance of the VAP Unrestricted Potable Use Standards (UPUS) at low concentrations. Multiple metals were detected in shallow groundwater. Relatively low levels of VOCs and SVOCs were detected within shallow and deep soil on the Property. Multiple metals were also observed within shallow and deep soils on the Property.

The physical and chemical characterization of the soil beneath the Property was also evaluated. Dark gray, soft, sticky clay and brown, hard, brittle clay was observed at depths between two (2) and to at least thirty-six (36) feet bgs on the Property. A sample collected from the gray clay at a depth of 18-20' bgs was analyzed and reported with an average permeability of 4.2E-08 cm/sec @ 20°C. Due to the low concentrations of VOCs and SVOCs, the low mobility of metals within clay and the existence of at least 36 feet of clay underlying the Property it is reasonable to assume that deep aquifers underlying the Property have not been impacted.

7.4 Applicable Standards for Sediment and Surface Water

Small areas of wetlands do exist on the southwestern and northern portions of the Property. For the purpose of this report, sediment is considered to be found in these surface water bodies. However, no sediment or surface water analyses were performed in this investigation.

Potential exposure pathways for surface water and sediment include pathways to onsite residential occupants, onsite commercial/industrial workers, onsite construction/excavation worker and onsite ecological receptors due to direct contact with sediments and surface water located within onsite wetlands. There is also the potential to offsite exposure to offsite commercial/industrial workers, offsite construction/excavation workers and offsite ecological receptors due to the transportation of onsite surface water and sediment offsite due to runoff and erosion.

8.0 BACKGROUND DETERMINATIONS

No background levels of chemicals of concern were used to serve as the Applicable Standard within this report. The Ohio EPA "*Evaluation of Background Metal Soil Concentrations in Summit County –Summary Report"* developed background concentrations of arsenic, barium, cadmium, chromium, lead, mercury and selenium in soils in the Summit County area

9.0 MODELING

No modeling was conducted as part of this Phase II Assessment.

10.0 URBAN SETTING DESIGNATION

The Property does not have an urban setting designation (USD) for groundwater. The potable use pathway will be evaluated for on-Property and off-Property receptors.

11.0 PROPERTY-SPECIFIC RISK ASSESSMENT

No Property-specific risk assessment (PSRA) was conducted as part of this Phase II Assessment. However, based on the data obtained in the Phase II, a PSRA would be required to fully address whether the Property meets applicable standards. However, some work was completed to properly establish exposure point concentrations (EPC) for exposure units on the Property. These efforts are described in the following subsections.

11.1 Exposure Point Concentration

Comparison of EPC to the applicable standard is the primary mechanism for determining whether compliance with an applicable standard has been achieved. The EPC is derived as the highest or most representative (in the case of using the 95% upper confidence limit (UCL) of a range of values) concentration of each chemical of concern for each specific media of concern within a specific exposure unit.

EPC were developed for data associated with each exposure pathway. These concentrations were, in some cases, maximum concentrations. The groundwater exposure pathways were evaluated via use of the maximum concentrations. Other EPC were developed using the 95% UCL of the data set. The exposure pathways that were evaluated using the 95% UCL of the data set to establish the EPCs were direct contact with soil pathway. A 95% UCL was calculated for benzo(a)pyrene to determine compliance with direct contact standards and cumulative adjustment risk ratios.

11.2 Cumulative Adjustment

Once an EPC was established for the dataset, a cumulative adjustment was completed for the data sets for the direct contact with soil exposure pathways. This was completed assuming that the entire Property was a single exposure unit. The process of developing the EPC and the cumulative adjustment for each pathway is described in the following subsections. A cumulative adjustment was not completed for groundwater due to exceedance of unrestricted potable use standards observed in the groundwater data.

Since multiple COCs were detected within soil samples, a cumulative adjustment including detected COCs was conducted to determine the cumulative cancer risk ratio and cumulative non-cancer risk ratio for the Property. The cumulative risk ratios were initially calculated using the maximum detected soil value for each COC on the Property. A cumulative adjustment was conducted for both the residential land use category and the construction/excavation land use categories. In accordance with OAC 3745-300-08, lead and TPH were not included in the cumulative adjustment calculations. Cumulative adjustment calculations are included in **Appendix E.**

11.2.1 Construction/Excavation Direct Contact

A cumulative adjustment was calculated for the construction/excavation land use category using the maximum detected values of each COC. The maximum for each COC was divided by the VAP Direct Contact Standard or Supplemental Criteria standard for commercial/industrial land use category and then summed to determine the non-carcinogenic and carcinogenic cumulative risk ratios. The cumulative cancer risk ratio and the cumulative non-cancer risk ratio result should not be greater than one to meet comparative risk levels. The non-carcinogenic risk ratio for this land use category was calculated at 0.01. The carcinogenic risk ratio for commercial/industrial land use was calculated at 0.3.

11.2.2 Residential Direct Contact

The cumulative cancer risk ratio and the cumulative non-cancer risk ratio for the residential land use categories was also calculated using the VAP Direct Contact Standard or Supplemental Criteria standard for residential land use categories and the maximum value of each detected COC on the Property after removing the two (2) soil exceedances of the residential land use categories including benzo(a)pyrene in SB-6 (2-4') and arsenic in SB-20 (0-2'). The initial calculation for cumulative risk exceeded the comparative risk ratio of 1.0 for carcinogenic risk.

It was determined that benzo(a)pyrene and arsenic were the largest contributors to cumulative risk ratio. 95% upper confidence limits (UCL) were calculated for benzo(a)pyrene and arsenic using ProUCL 5.0.00. Analytical results for twenty-five (25) samples analyzed for benzo(a)pyrene throughout the Property were included in the 95% UCL calculations. The sample result for SB-6 (2-4') were not included in the calculation, all other results were used for the calculation. The 95% Chebyshev (Mean, Sd) UCL calculation was the suggested UCL to be used for this data set by the ProUCL program. The 95% UCL for benzo(a)pyrene was calculated at 0.351 mg/kg.

Analytical results for fifteen (15) samples analyzed for arsenic throughout the Property were included in the 95% UCL calculations. The sample result for SB-20 (0-4') were not included in the calculation, all other results were used for the calculation. The 95% Student's-t-UCL calculation was the suggested UCL to be used for this data set by the ProUCL program. The 95% UCL for arsenic was calculated at 8.469 mg/kg. The cumulative adjustments for the residential land use category were recalculated using the results for the 95% UCL calculations for benzo(a)pyrene and arsenic as the site values for these COCs. The cumulative carcinogen risk ratio still exceeded 1.0.

The cumulative adjustments for residential land use were recalculated with the next two (2) highest sample results for benzo(a)pyrene removed from the calculations. After removing the sample results for SB-2 (0-2') and SB-4 (0-2') the cumulative adjustment was recalculated. The resulting risk ratios were both below 1.0, with the cumulative carcinogen risk ratio calculated at 0.9 and the cumulative non-carcinogen risk ratio calculated at 0.2. It was determined that the impacted soils in the area of SB-2 (0-2'), SB-4 (0-2'), SB-6 (2-4'), and SB-20 (0-2') would need to be addressed to bring the Property into compliance with risk and hazard levels described in paragraph (A)(2) of 3745-300-08.

12.0 REMEDIAL ACTIVITIES PRIOR TO NFA LETTER

An NFA letter has not been conducted at the time this Phase II Assessment was completed. No remedial activities were conducted as part of this Phase II Assessment.

13.0 COMPLIANCE WITH APPLICABLE STANDARDS

Data has been accumulated and the applicable standards for each exposure pathway have been determined. The next step is to compare data results to the applicable standards and to make recommendations on additional work needed to bring the Property into compliance with applicable standards.

13.1 Surface Soil Evaluation

Surface soils include soils above the 2-foot point of compliance. Exposure pathways for surface soils were determined to be direct contact with soils, volatilization of COCs into indoor air if structures are present and the leaching of COCs to groundwater from surface soils. The completeness of each of these pathways is evaluated below. A map of soil sample exceedances is included as **Figure 8**.

13.1.1 Direct Contact Pathway

Surface soils were compared to VAP Generic Direct Contact Standards and the VAP Supplemental Criteria when Generic Direct Contact Standards were not available to evaluate the completeness of the direct contact pathway. Surface soils were compared to the standards for residential land use, commercial/industrial land use, and construction/excavation activities categories. TPH results in soil were compared to the VAP TPH Soil Saturation Standards for sand and gravel soil types. The following areas contain exceedances of VAP Generic Numerical Direct-Contact Soil Standards or Supplemental Criteria in soils within the 0-2 feet point of compliance:

IA-8:
SB-20 (0-2'), contained arsenic at 12.6 mg/kg exceeding VAP residential land use category standard of 12.0 mg/kg.

13.1.2 Volatilization to Indoor Air

Several VOCs were detected in surface soil samples including 1,2,4-Trimethylbenzene, 2-Butanone (MEK), Acetone, and Tetrachloroethene. VOCs were detected in soil borings SB-1 (0-2'), SB-3 (0-2'), and SB-19 (0-2'). Soil gas samples and indoor air samples were not collected as part of this Phase II Assessment. Additional data and/or evaluation would be needed to determine if the volatilization of surface soils to indoor air pathway is complete.

13.1.3 Soil Leaching to Groundwater

TPH results in soil were compared to the VAP TPH Soil Saturation Standards for sand and gravel soil types to determine the potential for leaching of TPH to groundwater and the potential existence of free product within soils and groundwater on the Property. No TPHs exceeded the VAP standards in surface soils. The potential for leaching of other COCs from surface soil to groundwater was not evaluated in this report due to the current existence of COCs within the shallow groundwater underlying the Property.

13.2 Subsurface Soils Evaluation

Subsurface soils include soils below the 2-foot point of compliance. Exposure pathways for surface soils were determined to be direct contact with soils, volatilization of COCs into indoor air if structures are present and the leaching of COCs to groundwater from surface soils. The completeness of each of these pathways is evaluated below. A map of soil sample exceedances is included as **Figure 8**.

13.2.1 Direct Contact Pathway
Subsurface soils (soil below 2-foot point of compliance) were compared to VAP Generic Direct Contact Standards and the VAP Supplemental Criteria when Generic Direct Contact Standards were not available. Subsurface soils were compared to the standards for residential land use and construction/excavation activities categories. The following area contains an exceedance of the VAP Generic Numerical Direct-Contact Soil Standards or Supplemental Criteria in soils below the two-foot soil point of compliance:

IA-1/IA-4:
SB-6 (2'-4'), contained benzo(a)pyrene at 4.1 mg/kg exceeding the VAP residential land use category standard of 1.2 mg/kg

13.2.2 Volatilization to Indoor Air
Several VOCs were detected in subsurface soil samples including 1,2,4 Trimethylbenzene, 1,2-Dichlorobenzene, 2-Butanone (MEK), and Acetone. VOCs were detected in soil borings SB-6 (2-4') and SB-20 (2-4'). Soil gas samples and indoor air samples were not collected as part of this Phase II Assessment. Additional data and/or evaluation would be needed to determine if the volatilization of surface soils to indoor air pathway is complete.

13.2.3 Soil Leaching to Groundwater
TPH results in soil were compared to the VAP TPH Soil Saturation Standards for sand and gravel soil types to determine the potential for leaching of TPH to groundwater and the potential existence of free product within soils and groundwater on the Property. No TPHs exceeded the VAP standards in subsurface soils. The potential for leaching of other COCs from subsurface soil to groundwater was not evaluated in this report due to the current existence of COCs within the shallow groundwater underlying the Property.

13.3 Groundwater Evaluation
Exposure pathways for groundwater were determined to be direct contact with groundwater and volatilization of COCs into indoor air if structures are present. The completeness of each of these pathways is evaluated below. A map of groundwater sample exceedances is included as **Figure 9**.

13.3.1 Direct Contact - Potable Use
Groundwater results were compared to the VAP UPUS to determine compliance with the potable use pathway to evaluate the direct contact pathway. Several COCs were detected at levels in exceedance of the VAP UPUS including two (2) PAHs (benzo(a)pyrene and naphthalene) and three (3) metals (arsenic, lead, and chromium).

The following areas contain COCs with laboratory detection limits for several PAHs and metals reported above the VAP UPUS:

IA-2:
- MW-1 contained arsenic at 13.8 ug/L exceeding the VAP UPUS of 10 ug/L, lead exceeding the VAP UPUS of 15 ug/L, benzo(a)pyrene at 0.20 ug/L which is also the VAP UPUS standard, and naphthalene at 9.6 ug/L exceeding the VAP UPUS of 1.4 ug/L.

IA-3:
- MW-4 contained arsenic at 130 ug/L exceeding the VAP UPUS of 10 ug/L, chromium at 343 ug/L exceeding the VAP UPUS of 100 ug/L, and lead at 256 ug/L exceeding the VAP UPUS of 15 ug/L.

IA-5:
- MW-6 contained lead at 294 ug/L exceeding the VAP UPUS of 15 ug/L.

13.3.1.1 Round 1 Groundwater Exceedances

The first round of groundwater samples were collected on February 2-4, 2016.

IA-1/IA-2/IA-4: MW-1 exceeded for the following:

- Benzo(a)pyrene at 0.20 micrograms per liter (ug/L) at the VAP UPUS of 0.2 ug/L
- Naphthalene at 9.6 ug/L exceeding the VAP UPUS of 1.4 ug/L
- Arsenic at 13.8 ug/L exceeding the VAP UPUS of 10 ug/L
- Lead at 22.4 ug/L exceeding the VAP UPUS of 15 ug/L

IA-3: MW-4 exceeded for the following:

- Arsenic at 130 ug/L exceeding the VAP UPUS of 10 ug/L
- Chromium at 343 ug/L exceeding the VAP UPUS of 100 ug/L
- Lead at 256 ug/L exceeding the VAP UPUS of 15 ug/L

IA-5: MW-6 exceeded for the following:

- Lead at 294 ug/L exceeding the VAP UPUS of 15 ug/L.

13.3.1.2 Round 2 Groundwater Exceedances

The second round of groundwater samples were collected on May 24-26, 2016.

IA-1/IA-2/IA-4: MW-1 exceeded for the following:

- Naphthalene at 1.6 ug/L exceeding the VAP UPUS of 1.4 ug/L
- Arsenic at 263 ug/L exceeding the VAP UPUS of 10 ug/L
- Lead at 487 ug/L exceeding the VAP UPUS of 15 ug/L
- Cadmium at 6.7 ug/L exceeding the VAP UPUS of 5.0 ug/L
- Chromium at 570 ug/L exceeding the VAP UPUS of 100 ug/L

IA-1/IA-2: MW-3 exceeded for the following:

- Dibenz(a,h)anthracene at 0.34 ug/L exceeding the VAP UPUS of 0.092 ug/L

Metals in Round 2 groundwater sample results were almost 20 times higher than in Round 1. However, PAHs decreased. Also in Round 2, groundwater monitoring wells MW-6 and MW-4 had no exceedances.

13.3.2 Groundwater Volatilization to Indoor Air

VOCs were not detected in any groundwater samples with the exception of Naphthalene in MW-1. Although this COC was listed on the SVOC list it has volatilization characteristic. Soil gas samples and indoor air samples were not collected as part of this Phase II Assessment. Additional data and/or evaluation would be needed to determine if the volatilization of surface soils to indoor air pathway is complete.

13.4 Surface Water and Sediment

Since the surface water and sediment within the wetlands located on the Property were not evaluated as part of this assessment, it is unknown if they meet applicable standards. If the wetlands are not removed from the Property during redevelopment, in accordance with Army Corps and Ohio EPA regulations and applicable permits, the wetlands should be evaluated to determine their compliance with applicable VAP standards and to determine if remedial action is needed concerning onsite surface water and sediments.

13.5 Conclusion

The Certified Professional has determined that the Property is not in compliance with applicable standards through the collection and analysis of 27 bulk soil samples from the nine (9) IAs, and eight (8) groundwater samples from eight (8) permanent groundwater monitoring wells. All chemical analysis was performed by PACE, which is certified under the VAP for the analyses conducted. Direct contact with soils, volatilization of organic compounds into the indoor air of buildings, and potential surface water and sediment exposures were found to either exceed applicable VAP standards or require additional assessment to completely evaluate. Proposed excavation areas and Remedial Activities Map is included as **Figure 10**. **Table 6** includes all applicable standard and remedial activities for each exposure pathway,

13.5.1 Direct Contact of Soils

Soils exceeding VAP applicable standards for direct contact can be managed by excavating those soils and properly disposing them off-Property. By removing the material that is causing the exceedance, the Property would be in compliance with the applicable standard.

13.5.2 Groundwater Potable Use

Groundwater resources on the Property are contaminated with limited amounts of SVOC and metals compounds. These contaminants exceed the applicable standard for groundwater use under the VAP. A use restriction that prohibits using groundwater from the Property for potable purposes will address this standard and bring the Property into compliance.

The applicable standard for groundwater use also applies to off-Property receptors. The information collected and developed as part of this Phase II is not sufficient to assess whether groundwater off-Property is and will remain un-impacted. Additional assessment of the groundwater near the down-gradient Property boundary or limited modeling could be implemented to confirm the condition of groundwater leaving the Property and thus demonstrating whether this applicable standard is met.

13.5.3 Vapor Intrusion

Very low levels of VOCs were detected in both soil and groundwater. The data collected and evaluated under this Phase II is not sufficient to establish whether this pathway meets applicable standards or not. Additional sampling of soil gas may provide the information needed to demonstrate compliance with this applicable standard. Also, prohibiting habitable structures on the Property or requiring vapor-mitigation measures in constructed buildings in areas where VOCs were detected is another way of mitigating this pathway so that applicable standards can be met.

13.5.4 Sediment and Surface Water

Sediment and surface water were not sampled as part of this Phase II. However, these media pathways are only complete if the media are present. It is feasible that the on-Property wetland and stream section considered potentially impacted could be filled to mitigate that pathway. At that time, the pathway would not exist and no comparison to applicable standards would be required.

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