August Mack
ENVIRONMENTAL
4401 Rockside Road, Suite 300 ▪ Independence, OH 44131
augustmack.com

October 18, 2025

Christopher Biro
Ohio Environmental Protection Agency
Northeast District Office
2110 East Aurora Road
Twinsburg, Ohio 44087

Re: RCRA Facility Investigation Work Plan – Final
Material Sciences Corporation
460 W Main Street
Canfield, Ohio 44406
OHD000810283
August Mack Project Number: JZ0412.372

Dear Mr. Biro,

On behalf of Material Sciences Corporation (MSC), August Mack Environmental, Inc. (August Mack) is submitting this Final Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan for the MSC Canfield property (Site) in Canfield, Ohio. This final submittal was prepared in accordance with the Director's Final Findings and Orders and Ohio Environmental Protection Agency (EPA) comments, which were effective on December 31, 2024. This RFI Work Plan is intended to address data gaps identified during the Initial Site Investigation (ISI) and subsequent investigation activities to characterize the nature and extent of potential source areas and impacts. The nature and extent of soil and groundwater contamination will be determined using residential standards assuming a target cancer risk of 1e-06 and a non-cancer hazard index of 0.1.

This RFI Work Plan is proposing to collect soil, sediment, and groundwater at on- and off-Site locations. The data collected from this investigation will be summarized in the RFI Report and incorporated into the overall remedial strategy for the Site. This RFI Work Plan discusses the investigation background, Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs), the proposed scope of work, and conclusions and timing.

INVESTIGATION BACKGROUND

The Site is a metal galvanizing and coil coating facility located in Canfield, Ohio and has been operating since the 1950s under various entities including Canfield Steel and Pittsburgh Steel. MSC acquired the facility in 2013 and has operated the Site since then. In July 2024, brown liquid was visually observed in the ditch, adjacent to the east of the facility by a pedestrian on the Mill Creek Metroparks bikeway (bike path). This brown liquid discharge was contained and collected; however, during the response efforts, residual impacts from historical facility operations were discovered in various media at multiple locations in and around the Site. MSC was issued a Notice of Violation (NOV) from the Ohio EPA in October 2024. The Site is currently undergoing RCRA Corrective Action (CA) through the RCRA FIRST pathway.

A list of investigation reports submitted to Ohio EPA since December 2024 is provided below, which is followed by a summary of those reports and the identified SWMUs and AOCs at the Site.

- Initial Site Investigation Report, dated December 12, 2024;
- Trichloroethene (TCE) Interim Measures (IM) Plan, dated January 14, 2025;
- Groundwater and Vapor Intrusion Investigation Report, dated February 24, 2025;
- TCE IM Implementation Report, dated March 31, 2025;
- Ditch IM Monitoring Plan, dated April 8, 2025;
- Wetland and Downstream Sawmill Creek Sampling Work Plan, dated April 18, 2025; and
- Wetland and Downstream Sawmill Creek Sampling Implementation Report, dated July 3, 2025.

Historical investigation locations are summarized from the above reports and are presented on **Figure 1** through **Figure 3.**

Initial Site Investigation Report, December 12, 2024

The ISI activities were performed based on the Ohio EPA approved Sampling and Analysis Plan (SAP) dated September 30, 2024. The ISI was a very broad assessment effort and focused on a large suite of chemicals (including those which are not currently or ever used at MSC). The ISI was initiated in October 2024, which included collecting a total of 248 soil samples and 24 grab groundwater samples across the Site, the adjacent ditch, adjacent wetland area, and within Sawmill Creek. The ISI results summarized in the report include the following:

- Semi-volatile organic compounds (SVOCs), zinc, hexavalent chromium, cadmium, total cyanide and/or arsenic were identified above applicable screening levels (SLs) in certain soil samples.
    - Arsenic was identified above applicable SLs in certain soil samples; however, arsenic is not used at the site. Further, there is no evidence that arsenic was ever used at the site historically. Further, according to the February 2020 *Evaluation of Background Metal Soil Concentrations in Mahoning County* developed by the Ohio EPA's division of environmental response and revitalization for Ohio EPA's voluntary action program, arsenic concentrations detected on and off-site were generally within the background levels established in Mahoning county. Although these background levels are not generally applicable for RCRA sites, it is an important line of evidence with the fact that arsenic isn't used at the site now or historically. As such, arsenic is not identified as a site contaminant of concern (COC).
- SVOCs, TCE, hexavalent chromium, lead, and/or zinc exceeded applicable SLs in certain grab groundwater.
- SVOCs, total cyanide, mercury, and/or zinc exceeded applicable SLs in certain surface water samples.

Based on the facility's historical Site usage and metal galvanizing/coating processes, the ISI results, and a Corrective Action Framework meeting with Ohio EPA in February 2025, the following compounds were identified as the primary Site COCs:

- Total cyanide
- Free cyanide
- Zinc
- Hexavalent Chromium
- TCE and breakdown products

Groundwater and Vapor Intrusion Investigation Report, dated February 24, 2025

Groundwater samples were collected from 15 monitoring wells (MW-1 through MW-15; installed as part of the ISI) in November 2024. Samples were collected via low-flow methodology and the following COCs were identified above applicable SLs:

- TCE, naphthalene, free cyanide, and/or metals were identified in groundwater from select monitoring wells.

Based on the elevated TCE concentrations identified on-Site, vapor intrusion (VI) samples were collected within Building 1. Five (5) indoor air (IA) and one (1) outdoor air (OA) samples were collected in December 2024. All IA and OA samples were below laboratory reporting limits, which indicates an incomplete VI exposure pathway.

TCE IM Implementation Report, dated March 31, 2025

Based on the TCE impacts identified in groundwater samples collected on-Site, and out of an abundance of caution, additional sampling was conducted east of the Site on the Canfield High School (CHS) property. A TCE IM Plan was submitted on January 14, 2025, which was subsequently approved by Ohio EPA on February 4, 2025. The investigation was conducted in February 2025 and consisted of the following:

- Installation of eight (8) temporary piezometers to enable the collection of grab groundwater samples.
- Installation of 12 exterior soil gas (SGe) sampling points.
- Installation of two (2) sub-slab (SGss) ports to collect sub-slab air samples within two (2) structures on the CHS property.

While TCE, cis-dichloroethene (cDCE), and metals were identified in certain grab groundwater samples, the impacts were limited to two (2) locations on the bike path and were not detected on CHS property. Furthermore, the SGe and SGss results were below applicable SLs, which again indicates an incomplete VI exposure pathway, therefore no additional VI sampling was proposed.

Wetland and Downstream Sawmill Creek Sampling Implementation Report, dated July 3, 2025

In an effort to further delineate known impacts and to understand potential exposure pathways, Ohio EPA requested expedited sampling in the adjacent wetland and downstream of Sawmill Creek. The sampling work plan was submitted and subsequently approved by Ohio EPA on April 30, 2025. The investigation was conducted in April/May 2025 and consisted of the following:

- Advancement of 19 soil borings within the wetland to characterize soil/sediment impacts, including
    - Eleven (11) locations on the perimeter of the wetland
    - Five (5) locations within the interior of the wetland
    - Three (3) locations adjacent to previous samples for vertical delineation
- Collection of sediment and/or surface water samples from nine (9) downstream sampling locations within Sawmill Creek.

- Wetland soil samples were submitted for total and free cyanide, zinc, and hexavalent chromium.
- Sawmill creek downstream sediment samples were submitted for laboratory analysis of total and free cyanide.
- Sawmill creek downstream surface water samples were analyzed for field pH and submitted for laboratory analysis of total and free cyanide.

Site-related COCs were detected above Residential Regional Screening Levels (RSLS) within the wetland, including three (3) perimeter borings. No surface water or sediment detections were reported above applicable Ohio EPA non-drinking surface water human health criteria (for surface waters) or United States Environmental Protection Agency (U.S. EPA) RSLS (for sediments) downstream of the intersection of Sawmill Creek and Cardinal Drive.

SWMUS AND AOCS

In addition to the recent investigation activities, a Preliminary Assessment/Visual Site Inspection (PA/VSI) was previously conducted and was summarized in a March 19, 1993 report. The PA/VSI identified 12 SWMUs and no AOCs at the Site. During the PA/VSI, no releases to groundwater, surface water, air, and/or on-Site soils were documented. The 12 SWMUs are summarized below and depicted on **Figure 4**.

- SWMU-1: Satellite Accumulation Areas
    - 1A: Flammable Solids and Liquids
    - 1B: Waste Chrome Solids
    - 1C: Waste Cell Sludge
    - 1D: Waste Filter Sludge
    - 1E: Nonhazardous Waste Iron Phosphate Oily Sludge
    - 1F: Hazardous Waste Storage Shed[1]
- SWMU-2: Former Waste Chrome Solution Treatment Area
- SWMU-3: Sodium Carbonate Crystal Tray
- SWMU-4: Waste Filter Cake and Miscellaneous Floor Sweepings Accumulation Area
    - 4A: Past Location
    - 4B: Current Location
- SWMU-5: Waste Skimmed Oil Tanks
- SWMU-6: Waste Zinc Phosphate Solution and Rinse Water Tank Area

[1] SWMU 1F was not listed in the 1993 PA/VSI and was recently added based on current waste storage operations.

- SWMU-7: Former Waste Zinc Phosphate Solution and Rinse Water Tank Staging Area
- SWMU-8: Former Flammable Liquid Storage Shed
- SWMU-9: Storage Building
- SWMU-10: Former Container Accumulation Area
- SWMU-11: Main Building Former Nonhazardous Waste Accumulation Area
- SWMU-12: Roll Grindings Dust Collector
    - 12A: Past Location
    - 12B: Current Location

These 12 SWMUs will be assessed through sample data already collected during the ISI and/or sample locations designed to assess the AOCs detailed below.

Based on the recent investigation results and the historical SWMUs, August Mack has identified the following six (6) AOCs, which are depicted on **Figures 5A** and **5B**.

- AOC-1: Adjacent Ditch
- AOC-2: Wetland Area
- AOC-3: Sawmill Creek
- AOC-4: Sitewide Perched Water and Shallow Soil
- AOC-5: Sitewide Groundwater
- AOC-6: Building One

The AOCs were determined while developing a Conceptual Site Model (CSM), which evaluates contaminant transport and the associated risks to human health and the environment. The CSM is provided as **Attachment A**. The CSM includes a shallow perched water unit, AOC-4, (currently thought to be in the shallow backfill beneath the concrete), which is impacted with the brown liquid that contains cyanide, zinc, and hexavalent chromium. Shallow soil contamination will be evaluated in this area as well as in the wet forested depression to the northwest that receives runoff from the concrete. The shallow perched water unit is likely related to the historical operations and the former red and yellow stormwater lines; however, additional investigation is warranted to evaluate the contaminant transport mechanism and how it relates to the stormwater at the Site.

Multiple AOCs have been affected by uses of cyanide by the on-site facility. Cyanide toxicity to humans and aquatic life is mainly associated with free cyanide; however, the

metal-cyanide complexes, especially the strong complexes, are significantly less toxic. Weak metal-cyanide complexes can dissociate under certain conditions (i.e., low pH, hydrolysis, sunlight/weather exposure, etc.) to yield toxic free cyanide. Thus, all forms of cyanide may be of concern depending on site-specific conditions. MSC currently uses an alkali metal cyanide in the form of sodium cyanide (a.k.a, hydrocyanic acid, sodium salt [NaCN]). For reference, the safety data sheet for NaCN is included in **Attachment B**.

NaCN, often referred to as a "simple cyanide", readily dissociates in water or soil moisture, forming hydroxide ions (OH-) and hydrogen cyanide (HCN). Analytically, the sum of HCN and the cyanide anion (CN-) is termed "free cyanide". The breakdown components of free CN are directly correlated to pH; typically free CN exists as the CN- anion if pH is greater than 9.2 and as HCN in more neutral and acidic environments. Since the toxic risk for cyanide is driven by HCN exposure, free cyanide will be used to determine risk to future populations. Since site-specific environmental conditions such as pH, redox potential, temperature, and soil characteristics influence the degradation, mobility, and transformation of cyanide species, the concentrations of total cyanide, cyanide chemistry, and fate and transport will be considered when evaluating risk to receptors.

The Sitewide groundwater unit, AOC-5, is located deeper in the subsurface (approximately 20-feet below grade (ft bg)) and appears to be separated from the shallow perched water by the widespread fine-grained soils. A cross-section location plan view map and cross sections are provided as **Figure 6**, **Figure 6A**, **figure 6B**, and **Figure 6C**. The analytical results from the groundwater (mainly impacted with TCE) compared to the shallow perched water (mainly impacted with cyanide, zinc, or hexavalent chromium) further justifies this separation. This groundwater unit also warrants additional investigation within the building. The CSM will be updated and provided in the RFI Implementation Report following the proposed RFI Investigation activities.

RFI SCOPE OF WORK

AOC-1: Adjacent Ditch

A Ditch IM Work Plan was provided to the Ohio EPA on November 15, 2024, which was subsequently approved and implemented starting in November 2024. Liner completion activities began in July 2025 after receiving Ohio EPA final design approvals. Contaminant extents within the ditch are not completely delineated. To that end,

transects that do not have defined boundaries for zinc, hexavalent chromium, or cyanides will be further investigated laterally, perpendicular to the ditch flowpath.

Up to three soil samples will be obtained at each location identified on **Table 1** of **Attachment C** and illustrated on **Figure 7** for delineation. One boring is proposed upstream of the culvert to evaluate the background conditions. Logistics to access the area between building one and the neighboring property to the east will be evaluated. If safely feasible, a boring will be advanced and sample collection will be performed as described in the section under shallow soil and perched groundwater investigation.

A watershed map will be prepared to help determine where and how stormwater enters the ditch. The watershed map will be utilized to identify areas that can cause or contribute to potential stormwater contamination. These areas will be investigated and mitigated where necessary to reduce potential impacted stormwater contamination in the adjacent ditch.

Additionally, certain investigation activities below (specifically Sitewide perched water) will provide additional information to evaluate the stormwater entering the adjacent ditch. Ohio EPA approved releasing stormwater from the Adjacent Ditch in July 2025. The Ditch IM Monitoring Plan, which was submitted on April 8, 2025 and subsequently approved on April 21, 2025, is currently being implemented. Specifically, any precipitation of 0.1-inch or greater of accumulation will prompt confirmation sampling in accordance with the April 2025 revised interim measure monitoring plan.

AOC-2: Wetland Area

As discussed above, and in accordance with Ohio EPA requests to expedite certain activities, MSC submitted the *Wetland and Downstream Sawmill Creek Sampling Work Plan* on April 18, 2025, to further investigate the wetland area. Results from the investigation indicated that delineation was incomplete on the northern and eastern periphery of the wetland. Six additional borings are proposed to delineate this area as outlined in **Table 2** of **Attachment C** and presented on **Figure 8**.

AOC-3: Sawmill Creek

As discussed above, and in accordance with Ohio EPA requests to expedite certain activities, MSC submitted the *Wetland and Downstream Sawmill Creek Implementation Report* on April 18, 2025. COCs in downstream surface water results were detected below the Ohio EPA's non-drinking surface water human health criteria. COCs in downstream

soil results were detected below the U.S. EPA residential soil RSLS (assuming TCR 1e-6/hi 0.1). Future compliance for Sawmill Creek will be evaluated using aquatic life criteria for water entering the Ohio River (OAC 3745-1 – *Aquatic Life and Human Health Tier I Criteria and Tier II values*).

In addition to those samples already collected further downstream, August Mack proposes installing up to three (3) transects within Sawmill Creek from approximately T2-1950 to T2-2575. Samples will be collected in three (3) locations (northern bank, center, southern bank) across each transect at depths of 0-0.5-ft, 0.5-1.0 ft, 1.0-2.0-ft, 2.0-3.0-ft, and 3.0-4.0-ft[2] using a hand auger, and/or a slide hammer (as practicable, additional tools such as a trowel, shovel, etc. may be used to supplement the effort in order to collect the sample). Soil/sediment will be continuously logged and visually inspected (staining and/or odor). Upon completion of the sampling, locations will be backfilled with soil cuttings and/or bentonite. This scope of work will be contingent on gaining access to multiple private properties. Sample locations are provided on **Figure 9**. Details regarding location rationale, number of samples, and laboratory analysis are summarized in **Table 3** of **Attachment C.**

It is anticipated that additional soil sampling along Sawmill Creek will be implemented (for delineation purposes, garden evaluation, etc.). Sampling will be based on historical data collected along Sawmill Creek in October 2024 as well as specific requests by homeowners to Ohio EPA. Soil samples collected from residential parties will be collected in the same effort as described above. Access to third parties is currently being negotiated and final locations are pending; however, the proposed locations are included on **Figure 9**.

Ecological Assessment for Multiple AOCs (AOC-1, AOC-2, and AOC-3)

Integral Consulting Inc. (Integral) has conducted Level I and II Ecological Risk Assessments at/near the Site. Copies of these assessments are included as **Attachment D**. Additionally, Integral, August Mack, and Ohio EPA personnel conducted a Site visit to determine biological sampling recommendations (locations and methods) to support investigation at the Site. Integral's scope for this work is provided in **Attachment E**. The biological sampling took place in mid-July 2025. The location of the habitat and biological study is depicted on **Figure 10**. Scopes of work for additional ecological assessments will be provided following completion of the biological survey.

[2] The laboratory will initially analyze all intervals down to 2-ft; deeper intervals will be held at the laboratory and analyzed as necessary for vertical delineation.

AOC-4: Sitewide Perched Water and Shallow Soil

Based on field observations, shallow perched water is believed to be located in the coarse-grained fill material located beneath the concrete at the Site. The shallow perched water is impacted with the brown liquid that contains cyanide, zinc, and hexavalent chromium. August Mack proposes to characterize and delineate the shallow perched water located in the coarse-grained fill material to evaluate the perched water concentrations and flow mechanisms. Additionally, shallow soils in this area and the wet depression within the forested area to the northwest which receives runoff from this area will be evaluated for site COCs.

August Mack proposes to install up to 29 shallow soil boring locations on-Site to further evaluate this perched water zone and shallow soil contamination. The locations were proposed along transects, in proximity to the red and yellow lines, and at known areas where the perched water appears to surface. The soil borings will be advanced up to approximately five (5) ft bg, with large bore drill tooling (e.g., Macrocore or equivalent) to facilitate water infiltration and collection. Where borings are not logistically possible, a hand auger will be used to advance soil borings. Test pits utilizing a shovel or mini-excavator will only be used if the prior methods are proven to be ineffective. Soil samples will be collected continuously in two-foot intervals from each location for the purpose of lithologic evaluation and headspace analysis utilizing a Photoionization Detector (PID) and field analysis of soil pH.

The goal of these soil borings is to locate the shallow perched zone at the Site, which was not identified during ISI activities; therefore, these boreholes will be left open for up to 24-hours to allow for water to accumulate within the hole. If the perched water is present, one representative grab water sample will be collected using a peristaltic pump. When the perched water is present, pH concentrations will be field measured at each sampled location and the water samples will be analyzed on-Site with the Hach DR900 for dissolved free cyanide and dissolved zinc, field filtered via a 0.45-micron disposable filter.

Once delineation is complete via field analyses, three to six confirmatory locations ("SB-CF" borings) will be advanced around the periphery of perched water contamination and soil/groundwater samples will be collected as outlined above. Additionally, one location will be advanced at the presumed center of the perched water contamination for laboratory confirmation. Perched water samples will be analyzed for:

- Dissolved cyanide (field filtered),

- Dissolved free cyanide (field filtered),
- Total zinc,
- Dissolved zinc (field filtered),
- Hexavalent chromium, and
- TCE and breakdown products.

Soil samples will be collected at the interval(s) demonstrating contamination based on field pH readings and submitted for:

- Total cyanide,
- Free cyanide,
- Zinc,
- Hexavalent chromium, and
- TCE and breakdown products

Depending on the field results, additional shallow soil borings may be advanced to further delineate the impacted perched zone and evaluate the stormwater entering the adjacent ditch. Further, depending on field results, shallow soil samples will be collected to better understand shallow soil impacts. The proposed shallow soil boring locations are depicted on **Figure 11.** Details regarding location rationale, number of samples, and laboratory analysis are summarized in **Table 4** of **Attachment C.**

AOC-5: Sitewide Groundwater

During previous investigations, groundwater samples were collected both on- and off-Site from a combination of temporary sampling points and permanent monitoring wells, which identified TCE impacts. August Mack is proposing seven (7) additional monitoring wells (MW-16 through MW-22) to define the extent of TCE impacts in groundwater. In preparation for monitoring wells, August Mack will install soil borings prior to well advancement. Soil samples will be collected continuously in two-foot intervals from the boring for the purpose of lithologic evaluation, headspace analysis utilizing a PID, and soil analytical samples. August Mack will utilize a drill rig equipped with 8.25-inch hollow stem augers to convert the soil boring locations into seven monitoring wells:

- Four monitoring wells will be installed within the footprint of Building One [AOC-6].
- One monitoring well (MW-20) will be installed on the CHS property.
- One monitoring well (MW-21) will be installed west of MW-4 near the west adjacent wet area.

  - Final well placement will be field located based on property access, drill rig access, and clearing requirements.
  - Wells will be finished with an above-grade protective cover.
- One monitoring well (MW-22) will be installed on/adjacent to the bike path for delineation.

Proposed monitoring well locations are depicted on **Figure 12** and details regarding location rationale, number of samples, and laboratory analysis are summarized in **Tables 5** and **6** of **Attachment C**.

Following well installation and development, the seven (7) new monitoring wells will be allowed to equilibrate for at least two (2) weeks prior to sampling. Water level measurements within 0.01-feet will be collected from the monitoring wells prior to groundwater sampling. Following water level gauging, the entire monitoring well network will be sampled using low-flow sampling techniques in general accordance with U.S. EPA low-flow sampling procedures (U.S. EPA, 1996).

Additionally, the crock in the basement of building one will be further evaluated. To determine if the crock is hydro-geologically connected with site groundwater, the water level within the crock will be gauged in conjunction with monitoring well network gauging. This data will be used to establish groundwater level fluctuation trends. A basement crock sample will be collected for laboratory analysis of site COCs during the RFI implementation.

AOC-6: Building One

During the ISI, several borings were installed surrounding the building, but none were installed within the building due to access issues and the speed of the investigation. Additional investigation is needed to assess SWMUs, further delineate the TCE impacts, and determine the potential for perched water beneath Building One footprint. Soil boring and monitoring well locations are depicted on **Figure 13** and details regarding location rationale, number of samples, and laboratory analysis are summarized in **Table 5** and **6** of **Attachment C.**

August Mack will utilize a Geoprobe direct-push drill rig to advance the locations to characterize conditions beneath Building One to a maximum depth of 28 ft bg. Soil samples will be collected continuously in two-foot intervals from each boring for the purpose of lithologic evaluation, headspace analysis utilizing a PID, and field analysis of

soil pH. Two samples are initially proposed at each location. If field conditions warrant (i.e., gross contamination or abnormal field screening), additional samples may be collected and analyzed. Samples will be obtained as follows:

- 0-2 ft bg (or immediately below the concrete)
- Highest PID / highest pH
- If no contamination is evident, a sample will be collected above the groundwater interface.

One grab groundwater sample will be collected from each soil boring using a peristaltic pump with dedicated tubing. Field filtering techniques will be utilized where appropriate for sample collection. August Mack will utilize a drill rig equipped with 8.25-inch hollow stem augers to convert four of the soil boring locations into permanent monitoring wells, which is discussed above.

General Overall Procedures/Considerations

August Mack standard operating procedures (SOPs) for investigating environmental subsurface soil, groundwater, and vapor media are provided as **Attachment F**.

Data quality objectives (DQOs), quality assurance/quality control (QA/QC) practices, and applicable screening criteria are outlined in the quality assurance project plan (QAPP) provided as **Attachment G**.

The following investigation activities will be implemented during sampling efforts associated with this RFI Work Plan:

- Private and public utility locating will be conducted to identify underground utilities prior to any drilling activities both on and off-Site.
- Non-disposable sampling equipment will be decontaminated between each soil boring and/or monitoring well.
- IDW will be properly containerized for characterization purposes and properly disposed.
- All samples will be transferred to clean, labeled sample containers (provided by the laboratory) and placed on ice in a cooler for preservation in the field.
- Quality Assurance/Quality Control (QA/QC) samples will also be collected during the RFI Work Plan at the minimum frequency described below:
    - One (1) duplicate sample per 10 samples
    - One (1) Matrix Spike/Matrix Spike Duplicate (MS/MSD) sample per 20 samples

- One trip blank per cooler per day (for VOC samples only)
- One (1) equipment blank (EB) and one rinse blank (RB) per event (as necessary).

CONCLUSIONS AND PROPOSED TIMELINE

Based on historical operations and the recent environmental investigation results, this RFI Work Plan is necessary to address data gaps and characterize the nature and extent of potential source areas and impacts. August Mack is proposing to collect multiple samples from various environmental media to better understand on- and near the Site and to further develop a CSM. This RFI Work Plan will be implemented in three distinct phases based on priority.

- **RFI Phase I –** The Ditch Interim Measure Plan was submitted, subsequently approved, and implemented at the Site. Stormwater concentrations have been documented to be less than 0.4 milligrams per liter [mg/l]. Ohio EPA has given approval to finalize the Ditch IM, which is now completed.

  Establishing the ditch watershed map and conducting the perched water investigation to identify areas that may potentially be contributing to stormwater contamination is paramount in order to reduce the stormwater contamination in the adjacent ditch and receive Ohio EPA approval to complete the Ditch IM. Based on this high priority determination, August Mack will conduct the proposed AOC-1 and AOC-4 investigations during the RFI Phase I. Depending on the field results, additional shallow soil borings may be advanced to further delineate the impacted perched zone and evaluate the stormwater entering the adjacent ditch. After the Ditch IM is finalized and phase I of the RFI is complete, the RFI Phase II will be conducted.

- **RFI Phase II –** Once the Ditch IM is finalized, MSC can focus resources on investigating AOC-3, AOC-5, and AOC-6. August Mack will initiate the soil, sediment, and groundwater samples described above.

- **RFI Phase III –** After the RFI Implementation Report is submitted, which will summarize RFI Phases I and II, any remaining data gaps will be investigated during the RFI Phase III. It is anticipated that MSC, August Mack, and Ohio EPA will continue to work collaboratively to confirm data gaps needs, ensure potential

exposure pathways remain incomplete, and determine future investigation and/or interim measures for the Site.

The RFI Phases I and II will be summarized in an RFI Implementation Report, which will include but may not be limited to the following:

- Description of field activities;
- Potential modifications from the RFI Work Plan;
- Rationale for sampling efforts;
- Soil boring logs;
- Monitoring well diagrams;
- Low-flow sampling purge records;
- Tabulated analytical results;
- Figures showing sample locations; and
- Laboratory analytical reports

Should you have any questions or need any additional information, please do not hesitate to contact us,

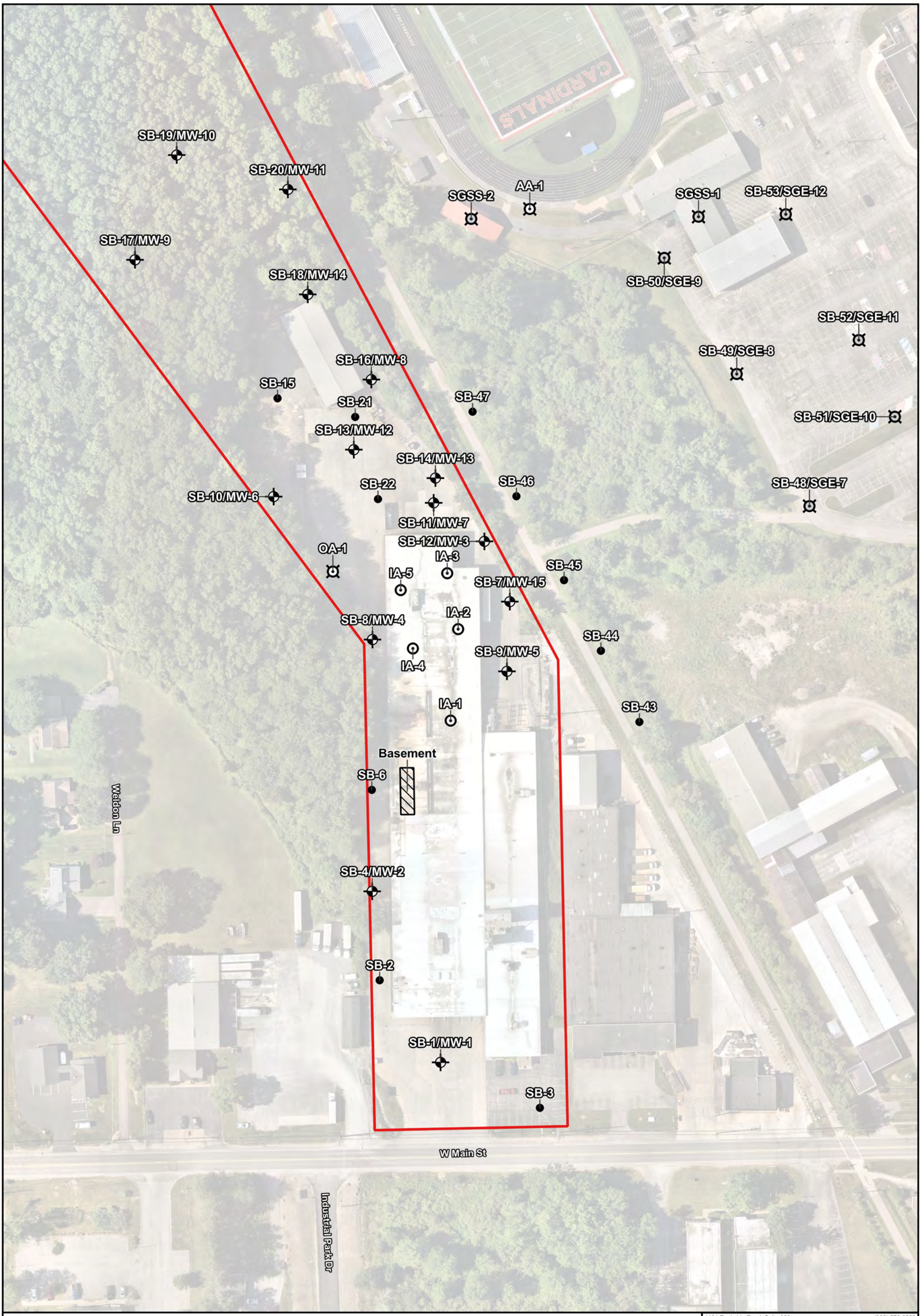
Sincerely,

Brandon C. Lewis, CP, CHMM
Regional Director, Ohio Offices

Bryant Hoffer, LPG, CHMM
Senior Manager

FIGURES

Figure 1 – Historical Investigation – Site & Adjacent Properties
Figure 2 – Historical Investigations – Adjacent Ditch, Wetland, and Sawmill Creek Locations
Figure 3 – Historical Investigations – Sawmill Creek Downstream Locations
Figure 4 - Solid Waste Management Units (SWMU) Locations from 1993 Preliminary Assessment / Visual Site Inspection
Figure 5A – Site Plan showing AOCs
Figure 5B – Site Plan showing AOCs – Sawmill Creek
Figure 6- Cross Section Location Map
Figure 6A – Cross Section A-A'
Figure 6B – Cross Section B-B'
Figure 6C – Cross Section C-C'
Figure 7 – Site Plan showing Proposed Adjacent Ditch Sample Locations
Figure 8 – Site Plan showing Proposed Wetland Sample Locations
Figure 9 - Site Plan showing Proposed Sawmill Creek Sample Locations
Figure 10 - Site Plan showing Proposed Biological Sampling Locations
Figure 11 – Site Plan showing Proposed Perched Water Sample Locations
Figure 12 – Site Plan showing Proposed Sitewide Groundwater Sample Locations
Figure 13 – Site Plan showing Proposed Building 1 Sample Locations



Subject Property
Existing Monitoring Well Locaiton
Existing Soil Boring Location
Existing Indoor Air Location
Existing Abient Air / Outdoor Air Location
Existing Sub Slab Soil Gas Locaiton

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation
Canfield

Historical Investigation -
Site & Adjacent Properties

460 West Main Street
Canfield, Ohio 44406

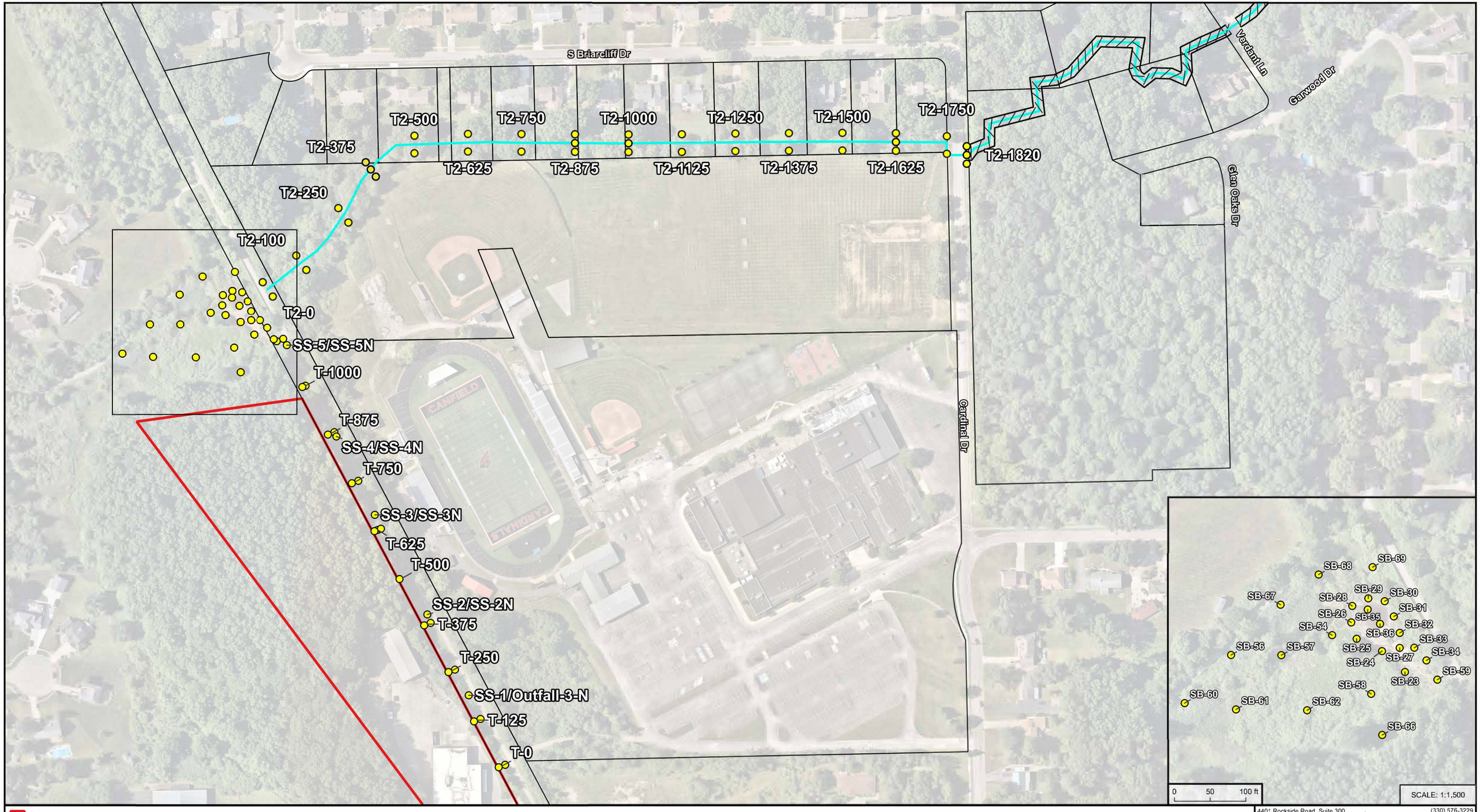
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4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229

August Mack
ENVIRONMENTAL

PROJECT NO.: JZ0412.372	DATE: 08/04/2025
	SCALE: 1:1,250
FIGURE: 1	CREATED BY: CC



Subject Property
Parcel Boundary
No Access
Sawmill Creek
Previous Sample Location

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation - Canfield

Historical Investigations -
Adjacent Ditch, Wetland, and Sawmill Creek

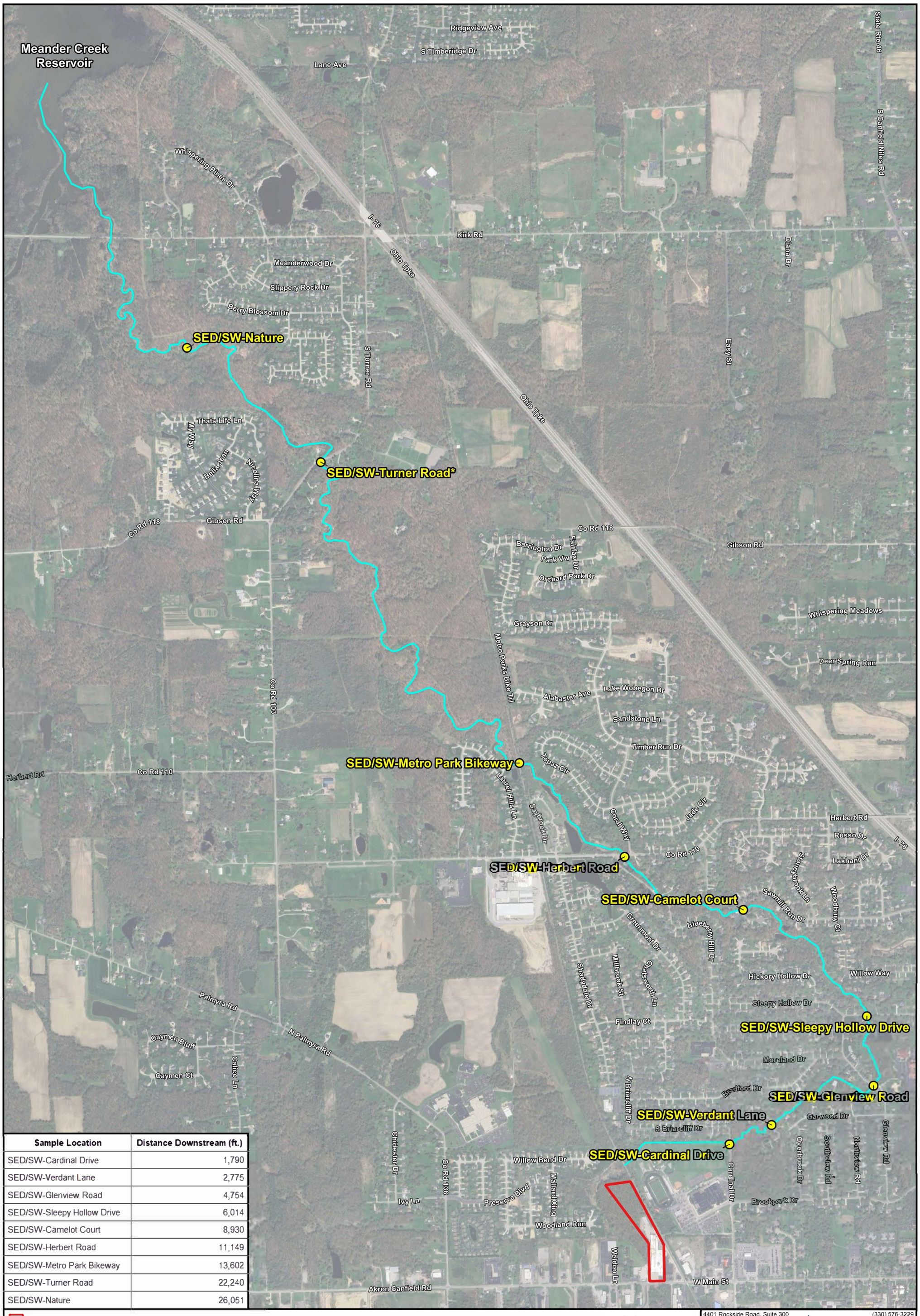
460 West Main Street
Canfield, Ohio 44406

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4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JZ0412.372	DATE: 08/07/2025
FIGURE: 2	SCALE: 1:2,500
	CREATED BY: CC



Sample Location	Distance Downstream (ft.)
SED/SW-Cardinal Drive	1,790
SED/SW-Verdant Lane	2,775
SED/SW-Glenview Road	4,754
SED/SW-Sleepy Hollow Drive	6,014
SED/SW-Camelot Court	8,930
SED/SW-Herbert Road	11,149
SED/SW-Metro Park Bikeway	13,602
SED/SW-Turner Road	22,240
SED/SW-Nature	26,051

Subject Property
Sawmill Creek
Sediment and Surface Water Sample Location

* = Creek bed was only bedrock, and no sediment was present to sample at Turner Road

Note: Distance downstream is measured from the intersection of Sawmill Creek Tributary and Mill Creek Metro Park Bikeway, north of the Site.

Google Satellite Imagery:
April 26, 2024

Material Sciences Corporation Canfield

Historical Locations - Sawmill Creek Downstream Locations

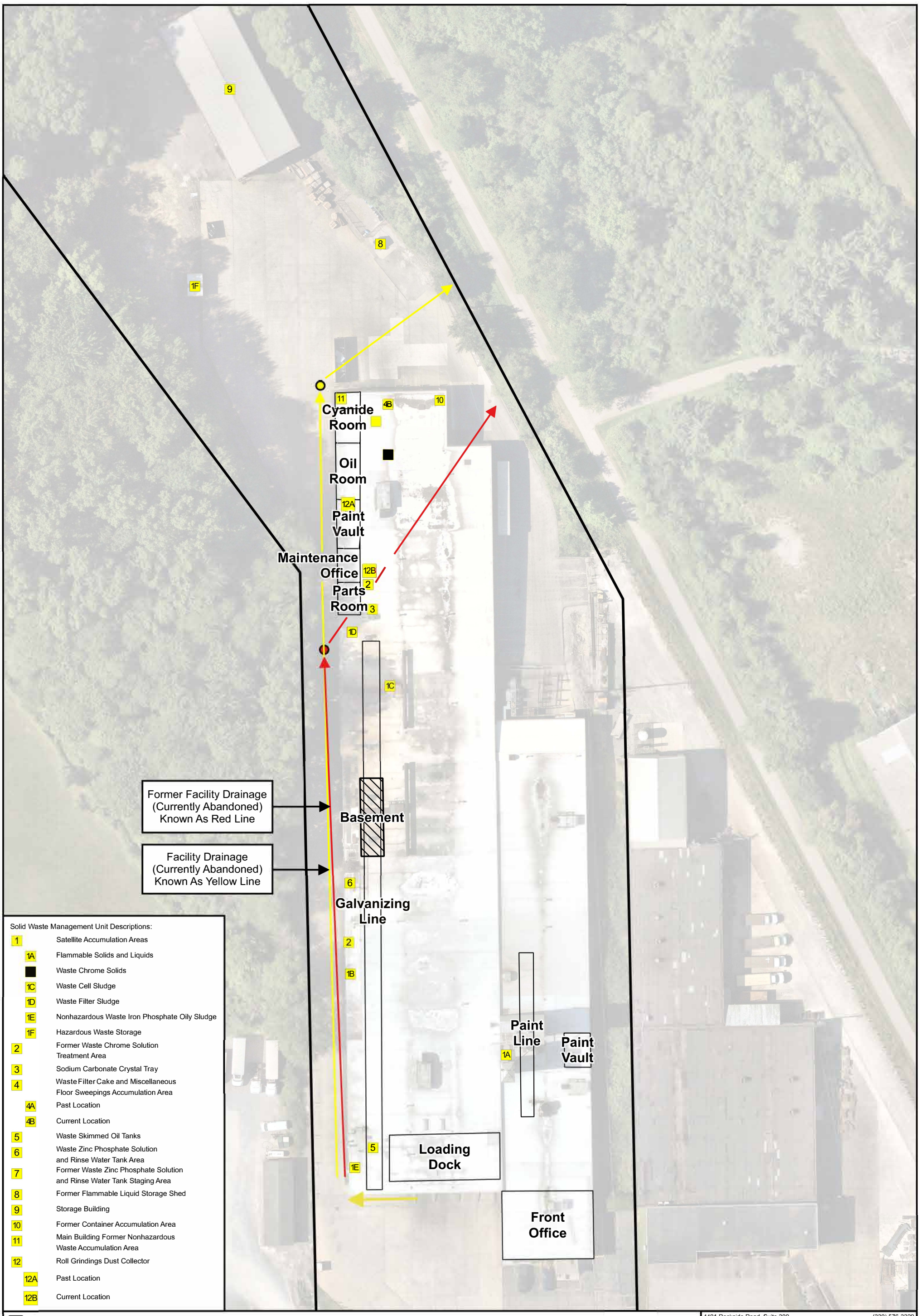
460 West Main Street
Canfield, Ohio 44406

N

0 750 1,500 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JZ0412.372
DATE: 08/04/2025
SCALE: 1:16,000
FIGURE: 3
CREATED BY: CC



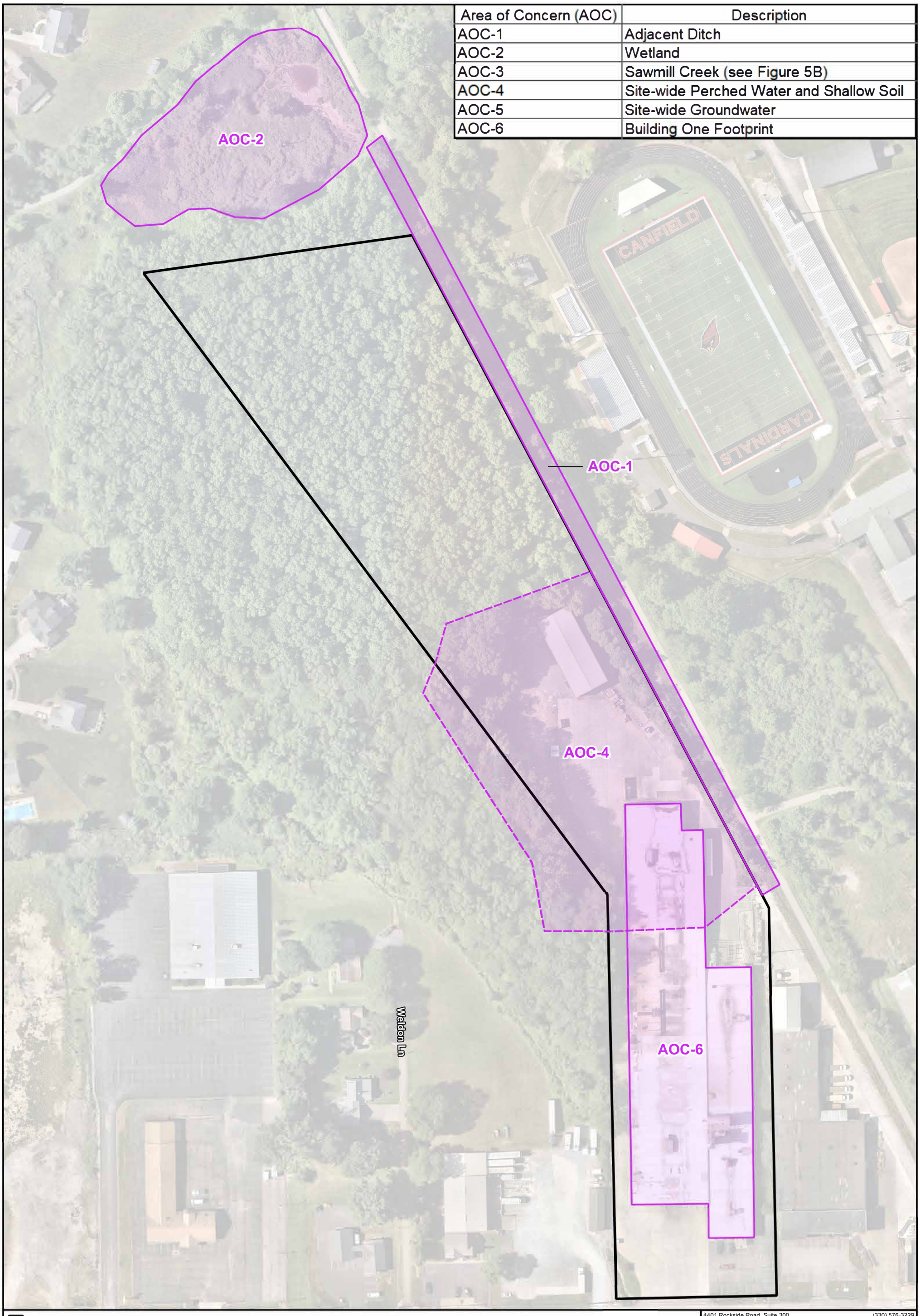
Material Sciences Corporation
Canfield
Solid Waste Management Unit (SWMU) Locations from 1993 Preliminary Assessment / Visual Site Inspection

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Canfield, Ohio 44406

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PROJECT NO.: JZ0412.372	DATE: 08/04/2025
FIGURE: 4	SCALE: 1:750
	CREATED BY: CC

Area of Concern (AOC)	Description
AOC-1	Adjacent Ditch
AOC-2	Wetland
AOC-3	Sawmill Creek (see Figure 5B)
AOC-4	Site-wide Perched Water and Shallow Soil
AOC-5	Site-wide Groundwater
AOC-6	Building One Footprint



Subject Property
Area of Concern
Area of Concern (Extents Estimated)

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Areas of Concern

460 West Main Street
Canfield, Ohio 44406

N

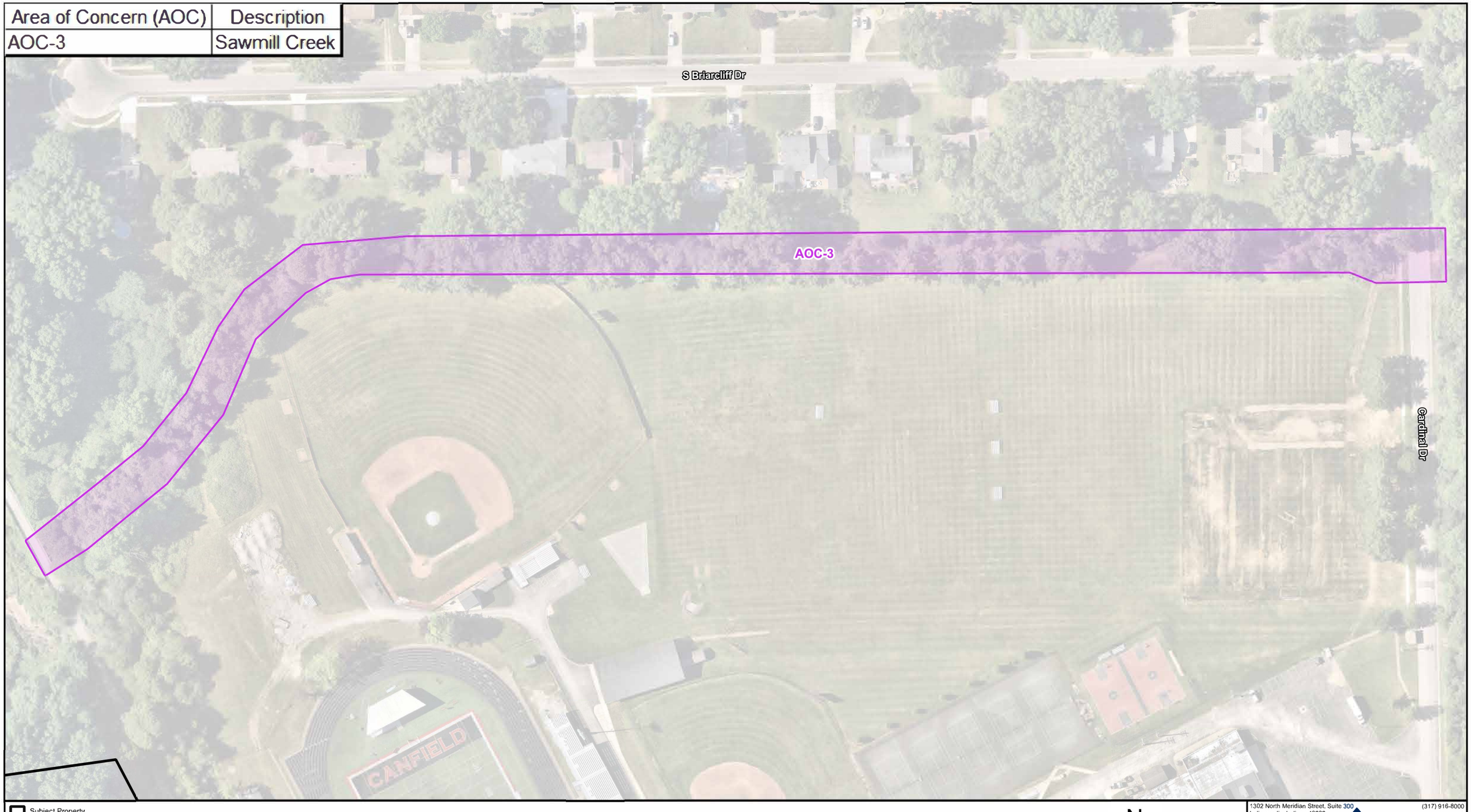
0 50 100 ft

Nearmap Aerial Imagery:
June 15, 2024

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Independence, Ohio 44131
(330) 576-3229
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PROJECT NO.: JZ0412.372	DATE: 08/05/2025
	SCALE: 1:1,500
FIGURE: 5A	CREATED BY: CC

Area of Concern (AOC)	Description
AOC-3	Sawmill Creek



Subject Property
Area of Concern

Nearmap Aerial Imagery:
June 15, 2024

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Areas of Concern

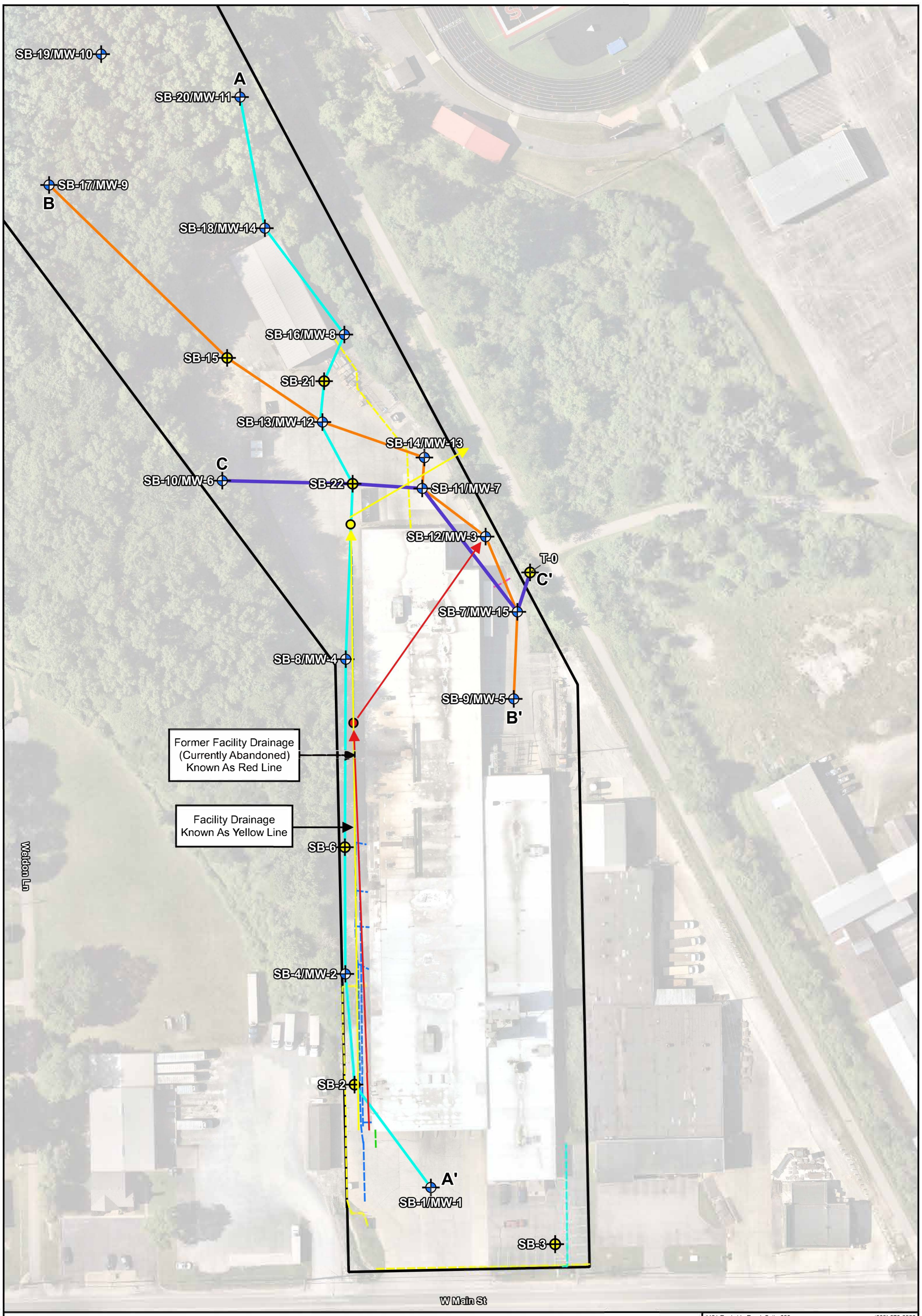
460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202
(317) 916-8000
August Mack ENVIRONMENTAL

PROJECT NO.: JZ0412.372	DATE: 08/05/2025
FIGURE: 5B	SCALE: 1:1,250
	CREATED BY: CC



Subject Property
MH-R (Manhole Red)
MH-Y (Manhole Yellow)
Soil Boring / Monitoring Well
Soil Boring

Utilities:
Gas Line
Sanitary Line
Storm Line
Unknown Line
Water Line

Cross Section Locations:
A-A'
B-B'
C-C'

Nearmap Aerial Imagery: June 15, 2024

Material Sciences Corporation Canfield

Cross Section Location Map

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

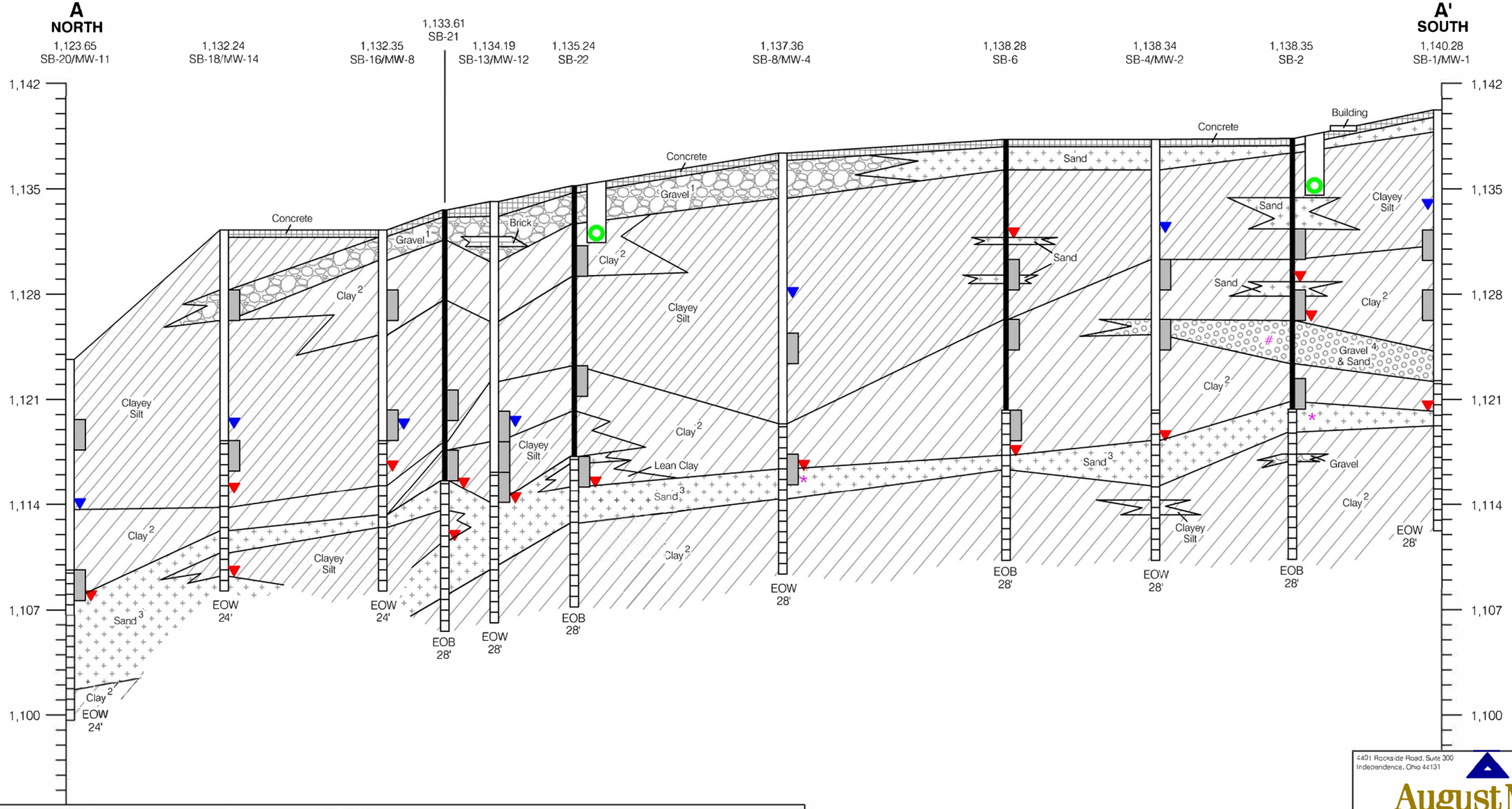
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Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JZ0412.372	DATE: 08/04/2025
	SCALE: 1:1,000
FIGURE: 6	CREATED BY: CC

Forest | Building | Pavement | Building | Pavement

Horizontal Scale: 1" = 85'

Vertical Scale: 1" = 7'
(Feet above mean sea level)



LEGEND

- = Soil Boring
- = Well Screen Interval
- EOB = End of Boring
- EOW = End of Well
- = Former Drainage Line
- = Soil Sample Location
- = Saturated Unit Observed During Soil Boring Installation
- = 11/11/2024 Monitoring Well Groundwater Gauging Level

1 = Consists of Gravel & Clayey Gravel.
2 = Consists of Silty Clay & Lean Clay.
3 = Consists of Clayey Sand, Sand, & Clayey Silt few sand.*
4 = Consists of Clayey Sand, Sand, Gravel, & Clayey Slit few gravel.#

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August Mack ENVIRONMENTAL

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460 West Main Street
Canfield, OH 44406

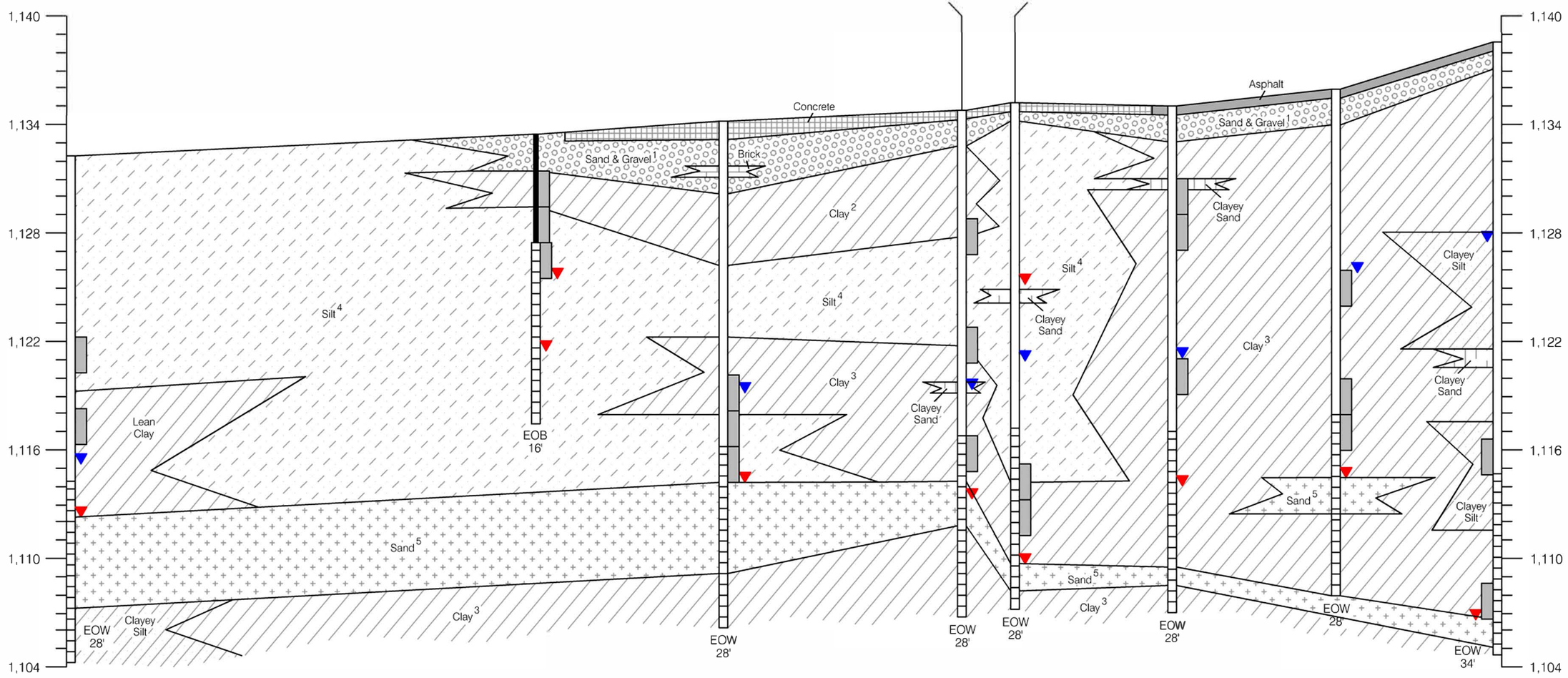
Cross Section A - A'

DATE: 03/13/2025	FILENAME: O:\2024\Projects\JY2388\Figures\CS_Base.dwg	
DRAWN BY: BA	MODIFIED BY: BA	PROJECT NO.: JZ0412.372
GEO REF: NA	SCALE: Scale As Shown	FIGURE: 6A

Forest | Gravel | Pavement

Horizontal Scale: 1" = 55'

Vertical Scale: 1" = 6'
(Feet above mean sea level)



LEGEND

- = Soil Boring
- = Well Screen Interval
- EOB = End of Boring
- EOW = End of Well
- = Former Drainage Line
- = Soil Sample Location
- = Saturated Unit Observed During Soil Boring Installation
- = 11/11/2024 Monitoring Well Groundwater Gauging Level

1 = Consists of Gravel, Clayey Gravel, Sand, & Clayey Sand.
2 = Consists of Silty Clay & No Recovery.
3 = Consists of Silty Clay & Lean Clay.
4 = Consists of Slit & Clayey Slit.
5 = Consists of Sand & Clayey Sand.

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Independence, Ohio 44131
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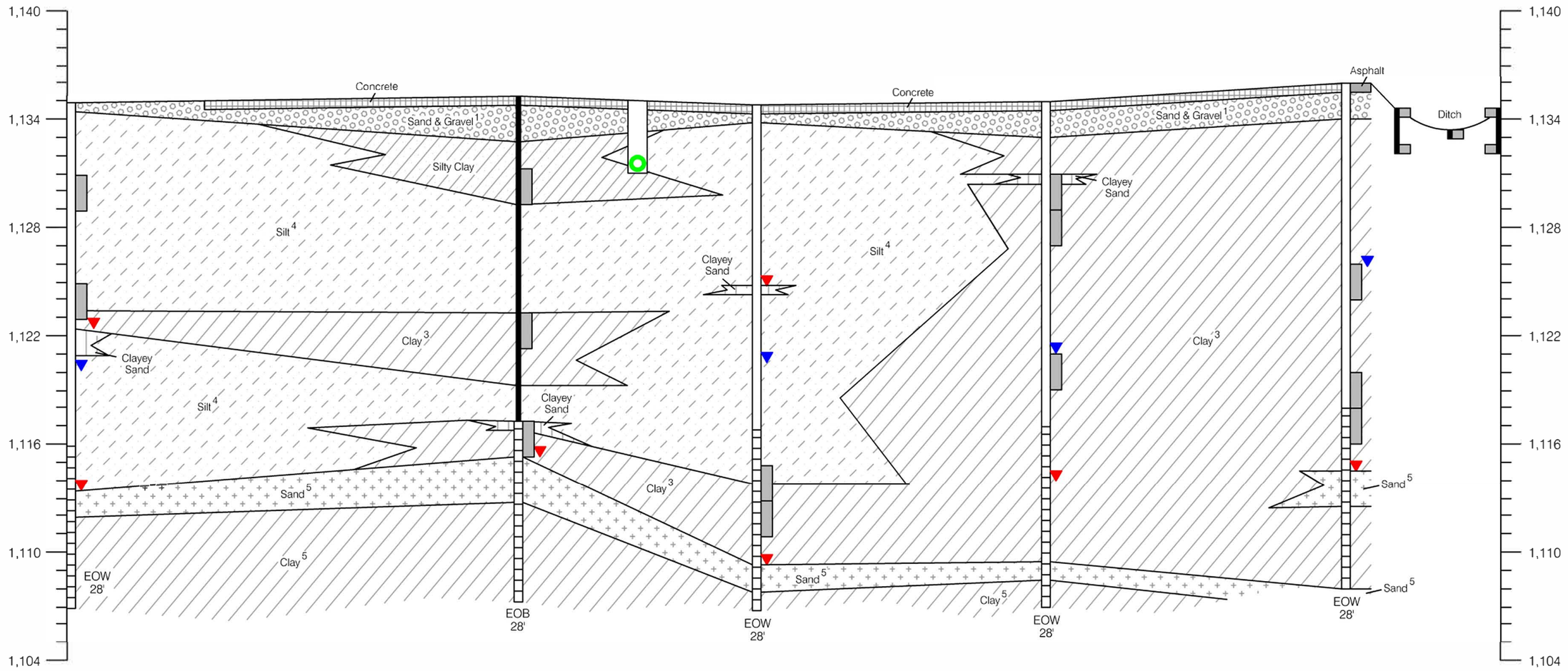
Cross Section B - B'

DATE: 03/13/2025	FILENAME: O:\2024\Projects\JY2388\Figures\CS_Base.dwg	
DRAWN BY: BA	MODIFIED BY: BA	PROJECT NO.: JZ0412.372
GEO REF: NA	SCALE: Scale As Shown	FIGURE: 6B

Grass | Pavement | Grass/Ditch

Horizontal Scale: 1" = 30'

Vertical Scale: 1" = 6'
(Feet above mean sea level)



LEGEND

- = Soil Boring
- = Well Screen Interval
- EOB = End of Boring
- EOW = End of Well
- = Former Drainage Line
- = Soil Sample Location
- = Saturated Unit Observed During Soil Boring Installation
- = 11/11/2024 Monitoring Well Groundwater Gauging Level

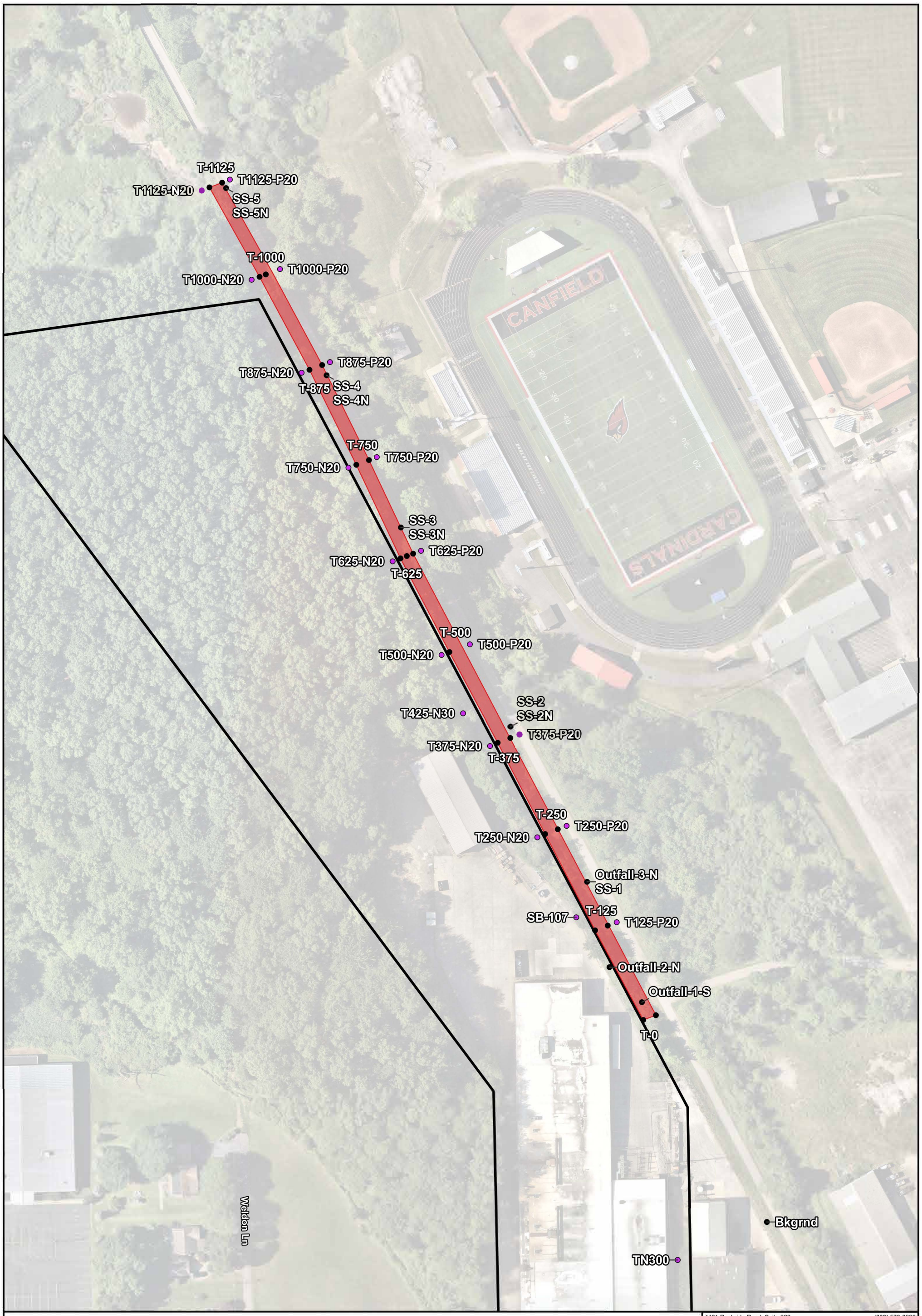
1 = Consists of Sand, Gravel, Clayey Sand & Sandy Gravel.
2 = Consists of Clay & No Recovery.
3 = Consists of Silty Clay & Lean Clay.
4 = Consists of Slit & Silty Clay.
5 = Consists of Sand & Clayey Sand.

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460 West Main Street
Canfield, OH 44406

Cross Section C - C'

DATE: 03/13/2025	FILENAME: O:\2024\Projects\JY2388\Figures\CS_Base.dwg	
DRAWN BY: BA	MODIFIED BY: BA	PROJECT NO.: JZ0412.372
GEO REF: NA	SCALE: Scale As Shown	FIGURE: 6C



Subject Property

Ditch Excavation Area

Proposed Soil Boring Location

Previous Soil Sample Location

"N"/"P" = N/P notation in a transect Location ID indicates negative or positive offset distance in feet (westerly or easterly, respectively) from the centerline of the ditch facing downstream.

"N" notation in the transect ID indicatesupstrea distance from T0, the Outfall

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation
Canfield

Adjacent Ditch Sampling

460 West Main Street
Canfield, Ohio 44406

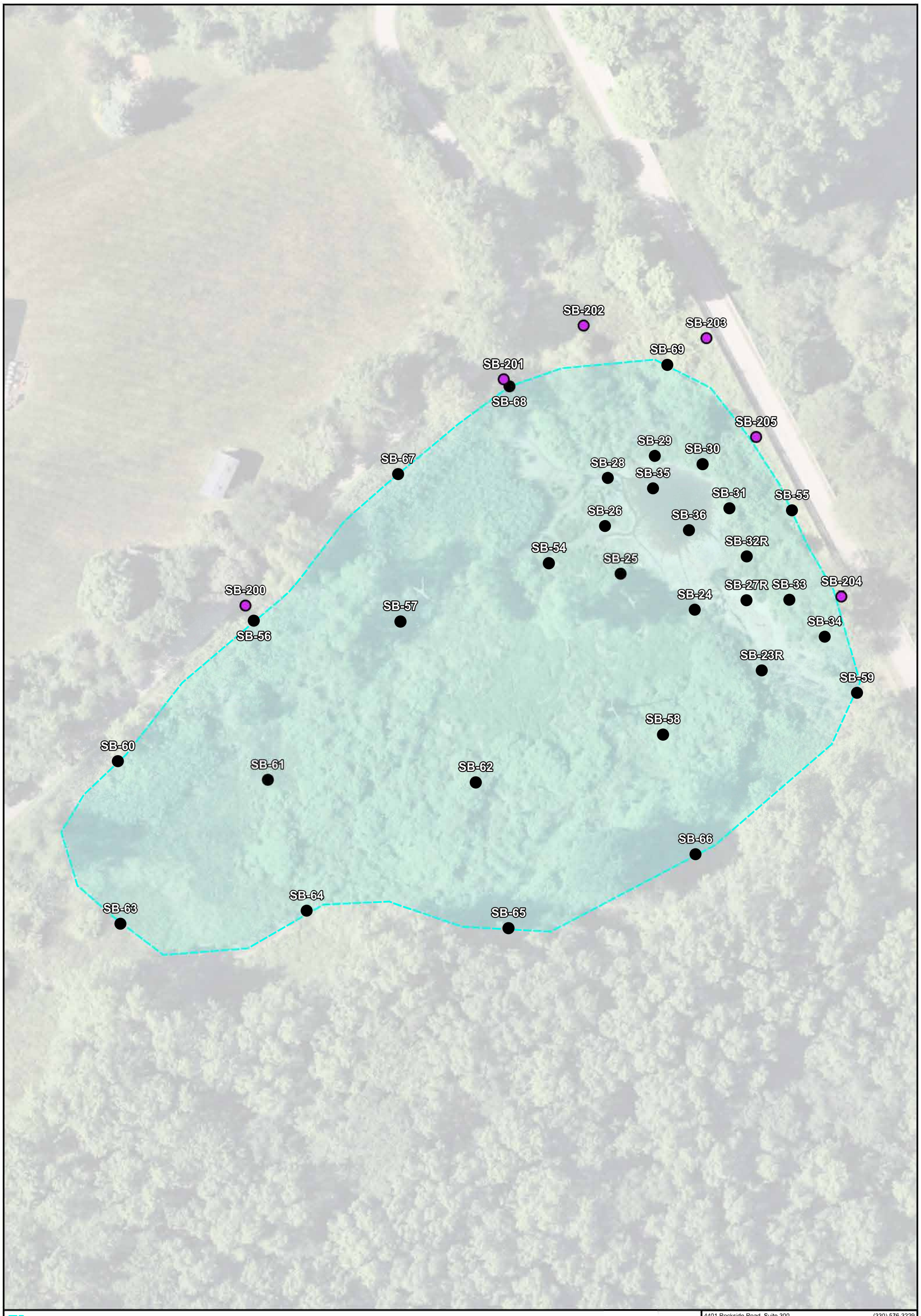
N

0 50 100 ft

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Independence, Ohio 44131
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PROJECT NO.: JZ0412.372	DATE: 08/08/2025
	SCALE: 1:1,250
FIGURE: 7	CREATED BY: CC



Wetland Area
Proposed Soil Boring Location
Previous Soil Sample Locaiton

Nearmap Aerial Imagery:
June 15, 2024

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Canfield

Site Plan Showing Proposed Wetland Sample Locations

460 West Main Street
Canfield, Ohio 44406

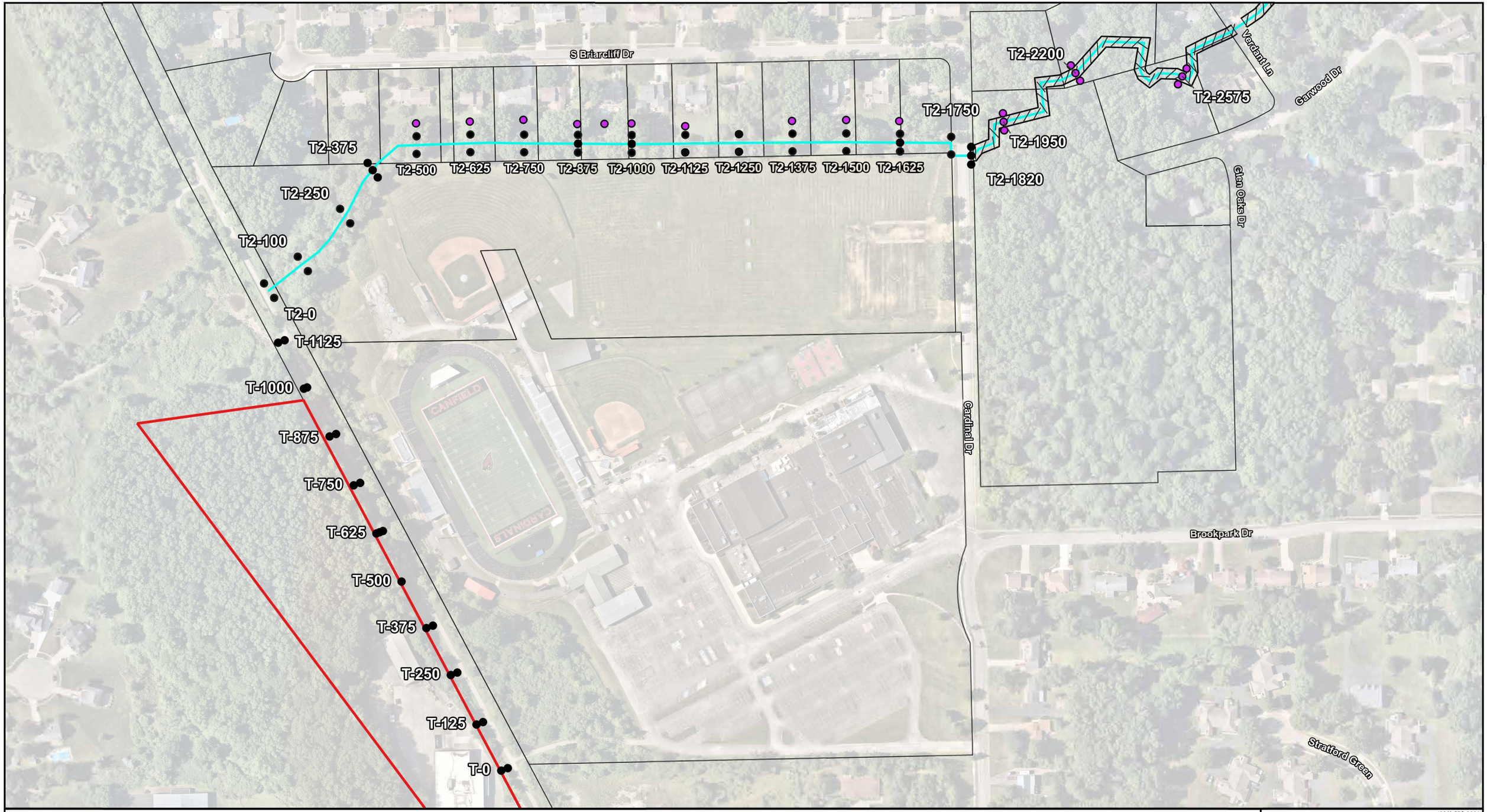
N

0 25 50 ft

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PROJECT NO.: JZ0412.372	DATE: 09/17/2025
	SCALE: 1:500
FIGURE: 8	CREATED BY: CC



Subject Property
Parcel Boundary
No Access
Sawmill Creek
Proposed Soil Boring Location
Previous Soil Sample Location
T-##: Transect ID Number

Nearmap Aerial Imagery:
June 15, 2024

Note: Final sampling locations based on access to third parties and clearing all underground utilities.

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Site Plan Showing Proposed Sawmill Creek Sample Locations

460 West Main Street
Canfield, Ohio 44406

N

0 100 200 ft

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Independence, Ohio 44131
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PROJECT NO.: JZ0412.372	DATE: 10/09/2025
	SCALE: 1:2,500
FIGURE: 9	CREATED BY: CC



Subject Property
Sawmill Creek
Habitat & Biological Survey Location

Google Satellite Imagery:
April 26, 2024

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Site Plan Showing
Biological Sample Locations

460 West Main Street
Canfield, Ohio 44406

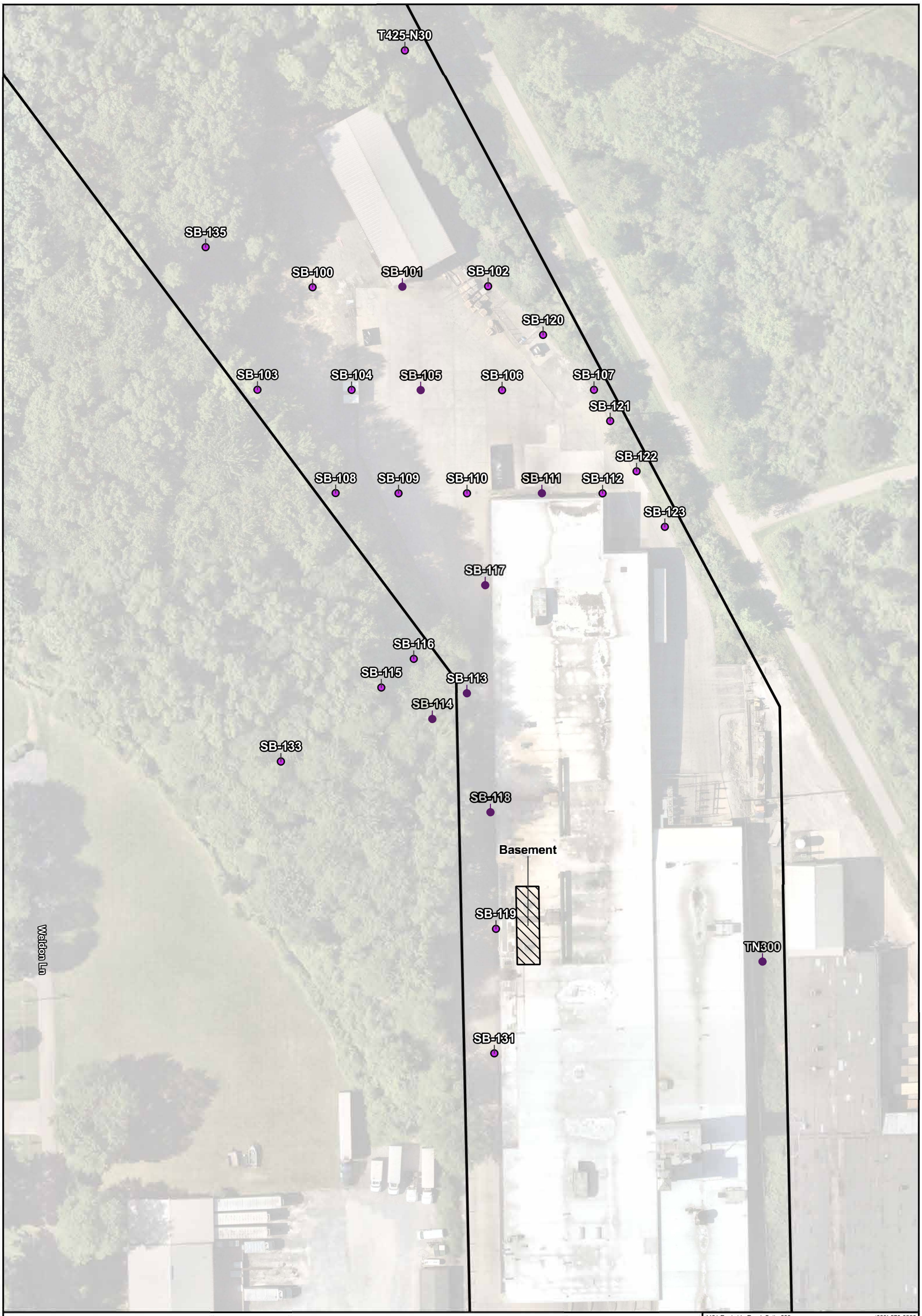
N

0 750 1,500 ft

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Independence, Ohio 44131
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PROJECT NO.: JZ0412.372	DATE: 08/12/2025
FIGURE: 10	SCALE: 1:16,000
	CREATED BY: CC



Subject Property

Proposed Soil Boring

Material Sciences Corporation
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Site Plan Showing Proposed Perched Water Sample Locations

460 West Main Street
Canfield, Ohio 44406

N

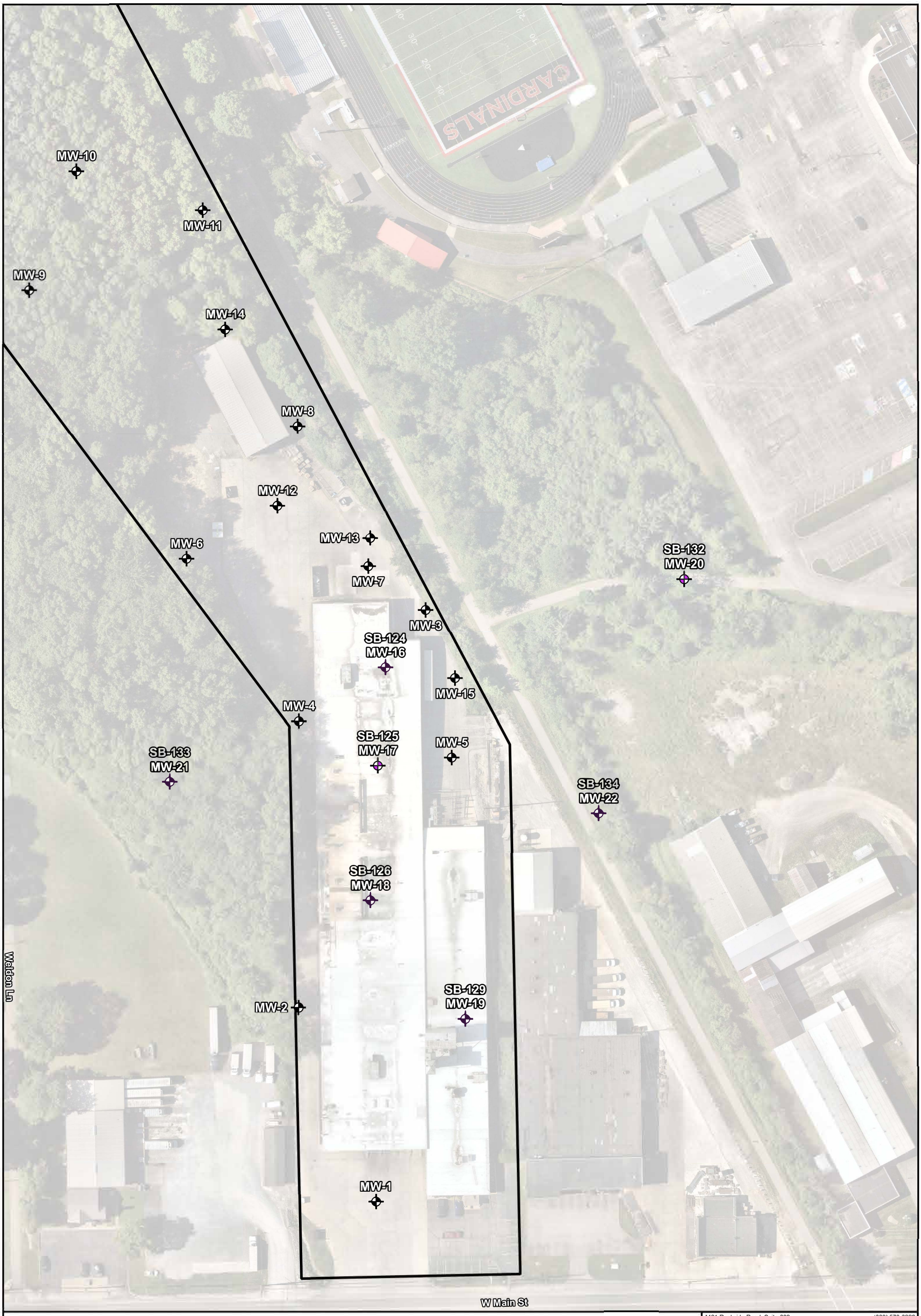
0 25 50 ft

Nearmap Aerial Imagery:
June 15, 2024

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Independence, Ohio 44131
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PROJECT NO.: JZ0412.372	DATE: 08/11/2025
FIGURE: 11	SCALE: 1:750
	CREATED BY: CC



Subject Property
Proposed Monitoring Well
Existing Monitoring Well

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation
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Site Plan Showing Proposed Sitewide Groundwater Sample Locations

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

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PROJECT NO.: JZ0412.372	DATE: 08/08/2025
	SCALE: 1:1,100
FIGURE: 12	CREATED BY: CC

SB-124/MW-16

SB-130

SB-125/MW-17

Basement

SB-127

SB-126/MW-18

Former Facility Drainage Pipe
(Currently Abandoned)
Known As Red Line

Facility Drainage Pipe
(Currently Abandoned)
Known As Yellow Line

SB-131

SB-128

SB-129/MW-19

Weldon Ln

W Main St

Industrial Park Dr

Subject Property
Proposed Sample Location
MH-R (Manhole Red)
MH-Y (Manhole Yellow)

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation
Canfield

Site Plan Showing Proposed Building One Sample Locations

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

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Independence, Ohio 44131
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PROJECT NO.: JZ0412.372	DATE: 08/01/2025
	SCALE: 1:1,250
FIGURE: 13	CREATED BY: CC

ATTACHMENTS

Attachment A - Conceptual Site Model
Attachment B – Safety Data Sheet – Sodium Cyanide
Attachment C – Sampling and Analysis Plan Tables
Attachment D - Level I and Level II Ecological Risk Assessments
Attachment E - Integral's Biological Sampling Scope of Work
Attachment F – Standard Operating Procedures
Attachment G – Quality Assurance Project Plan

ATTACHMENT A

CONCEPTUAL SITE MODEL

CONCEPTUAL SITE MODEL

The following describes the Conceptual Site Model (CSM) based on information currently available for the Material Sciences Corporation (MSC) facility and surrounding areas. A CSM flow diagram, which identifies receptors and potential exposure pathways, and the status of each pathway is included as **Exhibit A**. This information may be updated based on new data or information that is generated during the RFI investigation.

Sources and Extent of Known Contamination

Soil

As of August 2025, 368 soil samples have been collected since the initial release discovery in July 2024 with the purpose of investigating and delineating soil impacts both on and off-Site. The ISI investigation included large analyte suites (volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), metals, and cyanides), with numerous analytes detected, not all associated with MSC operations. Arsenic was widely detected both on and off-Site, however, arsenic is not used in the metal plating process and there is no evidence of historical use of arsenic at the Site. In addition to the fact that there is no indication of current/historical use of arsenic at the Site, concentrations are generally within typical background levels for the State of Ohio. As such, arsenic has been eliminated as a contaminant of concern (COC). Based on the facility's historical Site usage and metal galvanizing/coating processes, the primary COCs for the Site are Cyanide, Zinc, Hexavalent Chromium, and TCE and degradation by-products. Site-related soil impacts have been detected exceeding Industrial Regional Screening Levels (RSLs) on-Site and exceeding Residential and Industrial RSLs off-Site.

On-Site

On-site soil impacts present above Industrial RSLs include cyanide in one (1) boring location (SB-12B) 4-6 feet below grade (ft bg) and TCE in two (2) deep soil samples from borings SB-8 and SB-9, greater than 20 ft bg at depths approximating the groundwater interface. Additional data is needed to evaluate concentrations of COCs in shallow soils on-Site and beneath the building footprint.

Benzo(a)pyrene was detected above Industrial RSLs in boring SB-18 (4-6 ft bg), which is adjacent to the former railroad and was the only on-site boring to contain a polynuclear aromatic hydrocarbon (PAH) above an RSL.

Adjacent Ditch

Site related COCs exceed Residential and Industrial RSLs throughout the ditch. A fence was installed between the Adjacent Ditch and Mill Creek Metroparks Bikeway (bike path) to prevent contact with impacts. Interim measures (IMs) completed for the Adjacent Ditch included removal of the most heavily impacted soil in the upper 6-inches of the ditch and lining the ditch to cover the remaining impacts, which separated stormwater flow within the ditch from potential subsurface water impacts and eliminated the direct contact potential of the ditch soils to both human and ecological sensitive receptors.

Wetland

Site related COCs in soil exceeded Residential and Industrial RSLs throughout the Wetland. Additional characterization is needed to delineate impacts both horizontally and vertically. To prevent direct contact with impacts, IMs included installation of fencing around the Wetland. A wetlands delineation, along with an Ecological Risk Assessment have been conducted and were submitted to the Ohio EPA under a separate cover.

Sawmill Creek

Site related COCs in soil exceed Residential RSLs throughout Sawmill Creek. Additional characterization is needed to delineate impacts vertically and further downstream.

The potential exists for a complete exposure route via crop uptake in residential gardens along Sawmill Creek, due to historical creek flooding. August Mack is actively working to secure access agreements for additional sampling. Ecological Risks are currently being evaluated and will be submitted to the Ohio EPA under a separate cover.

Groundwater

As of August 2025, 50 groundwater samples were collected from a combination of 30 temporary groundwater sampling points and 15 monitoring wells. VOCs, SVOCs, Metals, and cyanide have been detected in groundwater at the Site.

Several COCs that were detected in groundwater above Groundwater Protection Standards (GWPSs) in temporary sampling points were not above GWPSs in the associated permanent well. Naphthalene in MW-5, dissolved lead in MW-2, and cyanide in MW-3 each had a single detection above GWPS. TCE is present in groundwater above GWPS near the central Site building and off-Site to the east. The extent of TCE in groundwater is depicted on **Exhibit B**. Additional delineation is needed to define the extent of TCE impacts in groundwater both horizontally and vertically.

Surface Water

Surface water samples have been collected from the Adjacent Ditch, Wetland, and Sawmill Creek. Primary COCs were detected in surface water samples collected from the Adjacent Ditch, Wetland, and Sawmill Creek, with only the Adjacent Ditch samples exceeding Non-Drinking Surface Water Human Health Criteria. A fence was installed between the Adjacent Ditch and bike path to prevent contact with impacts and the ditch liner IM separated stormwater flow within the ditch from potential subsurface water impacts and eliminated the surface water contact with ditch soils.

Prior to the ditch liner IM being completed, stormwater that encountered subsurface impacts has been collected and contained on-Site to prevent additional contaminant migration into the wetlands and Sawmill Creek. In June 2025, Ohio EPA approved the release of stormwater to flow to Sawmill Creek, and the preliminary Ditch IM Operation and Maintenance (O&M) Plan and the Ditch IM Monitoring Plan have been followed.

Soil Gas

As of August 2025, 12 exterior soil gas (SGe) samples and two sub-slab soil gas (SGss) samples have been collected. Six SGe samples were collected on-Site near the TCE groundwater plume. The remaining six SGe samples and the two SGss samples were collected off-Site on the Canfield High School (CHS) property located northeast of the Site.

Chlorinated volatile organic compounds (cVOCs) were not detected above U.S. EPA Residential or Industrial Near-Source Soil Gas and Sub-Slab Air Vapor Intrusion Screening Levels (VISLs) in all on-Site and off-Site samples.

Indoor Air

Based on TCE impacts in groundwater, five indoor air (IA) samples were collected from the northern portion of Building One. IA samples were below laboratory reporting limits indicating this exposure pathway is currently incomplete.

IA samples were proposed on the CHS property in the TCE IM Work Plan; however, the IA samples could not be collected due to canister malfunctions. Although the IA samples on the CHS property could not be collected, additional sampling is not warranted due to SGe and SGss results that were below applicable VISLs.

Contamination Transport/Migration Pathways

Potential migration pathways include the following:

- Groundwater
- Migration of vapors from contaminated soil or groundwater to indoor air
- Surface Water
- Basement in Building One (recently relined)
- Former stormwater drainpipes (recently capped at the outfalls and plugged with flowable fill)
- Surfacing perched water (actively being captured)
- Crop uptake in residential gardens

Tentative Exposure Pathways

Exposure pathways must consist of a receptor which represents a population that could be exposed to contamination, a point of exposure where the contamination can contact the receptor, and an exposure route (e.g., inhalation or direct contact) such that the contamination can enter the receptor. If any one of the three are not present, an exposure pathway is considered incomplete.

Exposure Receptors

The MSC Site has been an industrial property since the early 1950s and is anticipated to remain industrial. The following possible exposure receptors have been identified for the Site:

- On-Site workers (commercial/industrial and construction workers)
- Visitors/trespassers
- On-Site ecological receptors

- Off-Site residents
- Off-Site workers (commercial/industrial and construction workers)
- Off-Site recreators
- Off-Site ecological receptors

Risks to on-Site and off-Site ecological receptors are currently being evaluated in the pending ecological risk assessment, and results will be provided in a separate submittal to the Ohio EPA.

Exposure Points and Media

Tentative exposure points and medium include:

- Surface soil (0 to 2 ft bg) direct contact
- Surfacing perched water direct contact
- Subsurface soil (deeper than 2 ft bg) direct contact
- Groundwater direct contact
- Vapors in indoor air
- Surface water direct contact

A depth of 0 to 10 ft bg point of compliance will be used when evaluating direct contact with residential soils. For the commercial/industrial worker scenario, 0 to 2 ft bg will be used for evaluating direct contact. A depth of 0 to 15 ft bg point of compliance will be used when evaluating direct contact with soil for construction workers.

Exposure Routes

Tentative exposure routes include:

1. Surface soil direct contact – inhalation/ingestion/dermal contact/crop uptake
2. Surfacing perched water direct contact - dermal contact
3. Subsurface soil direct contact – inhalation/ingestion / dermal contact
4. Groundwater direct contact – ingestion/dermal contact
5. Vapor - inhalation
6. Surface water direct contact - ingestion/dermal contact
7. Ecological - benthic invertebrates, birds, and mammals

It is noted that institutional or engineering controls may be employed to prevent exposure by any of these potential exposure routes.

CSM

A CSM was developed to evaluate the potential risk associated with contamination at the Site. The CSM describes the pathways by which a COC is transported from a source to a receptor. Based on the data collected during previous investigation activities (i.e., Site geology, COC concentrations, COC distribution, and current and future land use), potential exposure pathways and receptors were evaluated.

Complete exposure pathways require four components:

(1) A source and mechanism of chemical release,
(2) A retention or transport medium,
(3) A point of potential human contact with the contaminated medium (referred to as the exposure point), and
(4) An exposure route (how the material gets into the body) at the contact point (U.S. EPA, 1989).

Each of these components were evaluated to determine if complete exposure pathways exist for surface soil, subsurface soil, perched water, groundwater, vapor intrusion, and surface water.

The pathways by which human receptors could contact contamination are discussed below. For each, the potential pathways are characterized to be:

- "**Incomplete**": human and/or ecological receptors are not exposed to COCs;
- "**Potentially Complete**": no current exposure to COCs, but the potential for future exposure exists which is being monitored;
- **"Complete, but under control"**: meaning that the potential for exposure to COCs exists, but controls are in place to prevent unacceptable risk from occurring;
- "**Complete**": meaning that the potential for exposure to COCs exists and no current controls are in place.

A CSM flow diagram, which identifies human receptors and potential exposure pathways, and the status of each pathway is included as **Exhibit A**. This information may be updated based on new data or information that is generated during the investigation.

Risks to on-Site and off-Site ecological receptors are currently being evaluated in the pending risk assessment, and results will be provided in a separate submittal to the Ohio EPA.

Exposure Pathway 1 – Surface Soil Direct Contact (includes ingestion, dermal and inhalation)

- Resident
  - Off-Site Sawmill Creek = Complete
    - Surface/shallow soil impacts exceeding Residential RSLs are present in Sawmill Creek (which adjoin residential and school properties).
    - Additional delineation is needed in Sawmill Creek.
    - Additional sampling to evaluate crop uptake potential in residential gardens is warranted.
    - Plans include adding signs adjacent to Sawmill Creek, which warns against consumption and recreational use due to potentially polluted water.
    - Ecological assessment efforts and additional investigation are necessary prior to commencing any potential remedial work in Sawmill Creek.
- Recreators
  - Off-Site Adjacent Ditch and Wetland = Complete, but under control
    - Surface/shallow soil impacts exceeding Residential RSLs are present in the Adjacent Ditch and Wetland (which adjoin the bike path).
    - Additional delineation is needed in the Wetland and Adjacent Ditch.
    - To prevent exposure, a fence was erected between the Adjacent Ditch and the bike path and around the Wetland. Additionally, a liner was installed in the Adjacent Ditch.
    - Ecological assessment efforts and additional investigation are necessary prior to commencing any potential remedial work in the wetland.
    - Recreator RSLs have not been developed.
  - Off-Site Sawmill Creek = Complete
    - Surface/shallow soil impacts exceeding Residential RSLs are present in Sawmill Creek (which adjoin residential and school properties).
    - Additional delineation is needed in Sawmill Creek.
    - Future plans include adding signs adjacent to Sawmill Creek, which warns against consumption and recreational use due to potentially polluted water.
    - Ecological assessment efforts and additional investigation are necessary prior to commencing any potential remedial work in Sawmill Creek.
    - Recreator RSLs have not been developed.

- Commercial/Industrial Worker
  - On-Site = Potentially Complete
    - No impacts have been identified on-Site in the upper 2 ft bg. However, no laboratory data is available.
    - Known impacts are deeper than the point of compliance (2 ft bg) and covered with pavement and/or gravel
    - Additional investigation is needed to determine concentrations of COCs in shallow (0-2 ft bg) soil and determine the concentrations of COCs within the building footprint.
    - No Soil Management Plan (SMP) is in place.
- Construction /Excavation Worker
  - On-Site = Potentially Complete
    - No impacts have been identified on-Site in the upper 2 ft bg. However no laboratory data is available.
    - COCs in soil on-Site in the upper 15-feet exceed Industrial RSLs, however, known impacts are covered with pavement and/or gravel.
    - Additional investigation is needed to determine concentrations of COCs in shallow (0-2 ft bg) soil and determine the concentrations of COCs within the building footprint.
    - No SMP is in place.
  - Off-Site = Complete
    - Surface soil off-Site exceeds Industrial RSLs within the Adjacent Ditch, Wetland, and Sawmill Creek
    - Any soil disturbing site work (liner placement, excavations, sampling, etc.) was/is being performed by trained environmental professionals following appropriate protocols and personnel protective equipment (PPE).
    - Additional delineation is needed in the Wetland and Sawmill Creek.
    - To prevent exposure, a fence was erected between the Adjacent Ditch and the bike path and around the Wetland. Additionally, a liner was installed in the Adjacent Ditch.
    - Future plans include adding signs adjacent to Sawmill Creek, which warns against consumption and recreational use due to potentially polluted water.
    - A site-specific construction/excavation worker RSL may be developed to further evaluate this exposure pathway.
- Trespasser/Visitors
  - On-Site = Potentially Complete
    - No impacts have been identified on-Site in the upper 2 ft bg. However, no laboratory data is available.
    - Known impacts are deeper than the point of compliance (2 ft bg) and covered with pavement and/or gravel.

- Additional investigation is needed to determine concentrations of COCs in shallow (0-2 ft bg) soil and determine the concentrations of COCs within the building footprint.
- A fence exists around the northern portion of the Site, which prevents access to trespassers/visitors.
- The duration and exposure frequency of contact with soils would be greatly reduced for a trespasser/visitor to the Site.

Exposure Pathway 2 – Surfacing Perched Water Direct Contact (includes dermal)

- Recreator
  - Off-Site = Complete, but under control
    - Impacted perched water is known to surface in the off-Site Adjacent Ditch.
    - Sumps and access points are used to capture the perched water in the ditch.
    - A liner was installed which separates stormwater flow within the ditch from perched water upwelling.
    - To prevent exposure, a fence was erected between the Adjacent Ditch and Bikeway.
- Commercial/Industrial Workers
  - On-Site = Complete, but under control
    - Impacted perched water is known to surface at the Site.
    - Daily Site walks are conducted to inspect for surfacing perched water.
    - Pooled perched water is captured for handling and proper disposal.
  - Off-Site = Complete, but under control
    - Impacted perched water is known to surface to the adjacent property directly west of the Site.
    - Daily Site walks are conducted to inspect for surfacing perched water.
    - Pooled perched water is captured for handling and proper disposal.
- Construction/Excavation Workers
  - On-Site = Complete, but under control
    - Impacted perched water is known to surface at the Site.
    - Daily Site walks are conducted to inspect the Site for surfacing perched water.
    - Perched water that surfaces is captured for handling and proper disposal or treatment.
    - Site work (daily inspections, water recovery, water treatment, etc.) is being performed by trained environmental professionals following appropriate protocols and PPE.
  - Off-Site = Complete, but under control
    - Impacted perched water is known to surface in the off-Site Adjacent Ditch.
    - Sumps and access points are used to capture the perched water in the ditch.
    - A liner was installed which separates stormwater flow within the ditch from potential subsurface water impacts.
    - Any soil disturbing site work (liner placement, excavations, sampling, etc.) was/is being performed by trained environmental professionals following appropriate protocols and PPE.

- Trespasser/Visitor
  - On-Site = Complete, but under control
    - Impacted perched water is known to surface at the Site.
    - Daily Site walks are conducted to inspect the Site for surfacing perched water.
    - Perched water that surfaces is captured for handling and proper disposal or treatment.
    - A fence exists around the northern portion of the Site, which prevents access to trespassers/visitors.

Exposure Pathway 3 – Subsurface Soil Direct Contact (includes ingestion, dermal, and inhalation)

- Resident
  - Off-Site = Potentially Complete
    - Soil impacts exceeding Residential RSLs are present in the Adjacent Ditch, Wetland, and Sawmill Creek which adjoin residential properties.
    - Vertical delineation is needed to evaluate subsurface soil.
    - To prevent exposure, a fence was erected between the Adjacent Ditch and the bike path and around the Wetland. Additionally, a liner was installed in the Adjacent Ditch.
    - Future plans include adding signs adjacent to Sawmill Creek, which warns against consumption and recreational use due to potentially polluted water.
    - Ecological assessment efforts and additional investigation are necessary prior to commencing any potential remedial work in the wetland and Sawmill Creek.
- Recreators
  - Off-Site = Potentially Complete
    - Soil impacts are present in the Adjacent Ditch, Wetland, and Sawmill Creek, these features are near paved trails and sports fields.
    - Vertical delineation is needed to evaluate subsurface soil.
    - To prevent exposure, a fence was erected between the Adjacent Ditch and the bike path and around the Wetland. Additionally, a liner was installed in the Adjacent Ditch.
    - Future plans include adding signs adjacent to Sawmill Creek, which warns against consumption and recreational use due to potentially polluted water.
    - Recreator RSLs have not been developed.
- Commercial/Industrial Workers
  - On-Site = Complete, but under control
    - Subsurface soil impacts are deeper than the point of compliance (2 ft bg) and covered with pavement and/or gravel
    - Additional investigation is needed to determine the concentrations of COCs within the building footprint.
    - Future plans include remediation and/or controls (e.g., Soil Management Plan) to prevent unacceptable risk from occurring.
  - Off-Site = Potentially Complete
    - No off-Site subsurface soil impacts have been identified on adjacent Industrial/Commercial properties.
    - No data available for the unnamed intermittent drainage to Sawmill Creek located to the west of the Site.

- Construction/Excavation Workers
  - On-Site = Complete, but under control
    - COCs in soil on-Site in the upper 15-feet exceed Industrial RSLs, however, known impacts are covered with pavement and/or gravel.
    - Future plans include remediation and/or controls (e.g., Soil Management Plan) to prevent unacceptable risk from occurring.
    - A site-specific construction/excavation worker RSL may be developed to further evaluate this exposure pathway.
  - Off-Site = Potentially Complete
    - Soil impacts exceeding Industrial RSLs are present in the Adjacent Ditch, Wetland, and Sawmill Creek.
    - Any soil disturbing site work (liner placement, excavations, sampling, etc.) was/is being performed by trained environmental professionals following appropriate protocols and PPE.
    - Vertical delineation is needed to evaluate subsurface soil.
    - To prevent exposure, a fence was erected between the Adjacent Ditch and the bike path and around the Wetland. Additionally, a liner was installed in the Adjacent Ditch.
    - Future plans include adding signs adjacent to Sawmill Creek, which warns against consumption and recreational use due to potentially polluted water.
    - Ecological assessment efforts and additional investigation are necessary prior to commencing any potential remedial work in the Wetland and Sawmill Creek.
    - A site-specific construction/excavation worker RSL may be developed to further evaluate this exposure pathway.
- Trespasser/Visitor
  - On-Site = Complete, but under control
    - Subsurface soil impacts on-Site are covered by pavement and/or gravel and the duration and exposure frequency of contact with soils would be greatly reduced for a trespasser/visitor to the Site.
    - A fence exists around the northern portion of the Site, which prevents access to trespassers/visitors.

Exposure Pathway 4 – Groundwater Direct Contact (includes ingestion/dermal)

- Resident
  - Off-Site = Potentially Complete
    - Groundwater impacts have not been fully delineated.
    - No water wells were identified on adjoining properties.
    - Saturated zone beneath the Site was encountered 15-25 ft bg, which is deeper than the potential exposure point for residents (<10 ft bg)
    - The Site is located within a Source Water Protection Area. The public water supply for Canfield (and several other municipalities in the area) is sourced from surface water (Meander Creek Reservoir).
- Recreator
  - Off-Site = Incomplete
    - No water wells were identified on adjoining properties
    - Saturated zone is deeper than the potential exposure point for Recreators (<2 ft bg)
- Commercial/Industrial Worker
  - On-Site = Complete, but under control
    - Although COCs exceed GWPS on-Site, groundwater is not used for potable purposes on-Site
    - The saturated zone is deeper than the potential exposure point for a commercial/industrial worker (<2 ft bg)
    - Groundwater monitoring is being performed by trained environmental professionals following appropriate protocols and utilizing PPE.
  - Off-Site = Potentially Complete
    - Although groundwater impacts have not been fully delineated, no commercial/industrial properties adjoin the Site in the downgradient direction.
    - Groundwater impacts need further delineation to the east and west.
    - There are no water wells on adjacent properties.
    - The saturated zone is deeper than the potential exposure point for a commercial/industrial worker (<2 ft bg)
- Construction /Excavation Worker
  - On-Site = Complete, but under control
    - The saturated zone beneath the Site was typically encountered 15-25 ft bg, which is deeper than the potential exposure point for construction/excavation workers (<15 ft bg).
    - Groundwater monitoring is being performed by trained environmental professionals following appropriate protocols and utilizing PPE.
    - The exposure pathway will be managed in the future by remediation and/or use of a SMP
  - Off-Site = Potentially Complete

        - Groundwater impacts have not been fully delineated.
        - There are no water wells on adjacent properties.
- Trespasser/Visitors
    - On-Site = Incomplete
        - Groundwater is not currently used for potable purposes on-Site.
        - Groundwater monitoring wells are secured with bolted-in flush mounted well boxes.
        - Exposure to groundwater to a visitor/trespasser is unlikely.

Exposure Pathway 5 – Vapor Inhalation

- Residents
  - Off-Site = Potentially Complete
    - Soil gas samples collected on-Site and off-Site on the adjacent school grounds were below Residential VISLs.
    - TCE impacted groundwater has not been fully delineated off-Site to the east and west.
- Recreators
  - Off-Site = Incomplete
    - No buildings are associated with the nearby paved trail and outdoor sports fields
- Commercial/Industrial Worker
  - On-Site = Incomplete
    - Indoor air samples collected from Building One (main industrial building) were below laboratory reporting limits for VOCs.
    - Soil gas samples collected on-site were below Residential and Industrial VISLs for VOCs.
    - Free cyanide was identified in one on-Site monitoring well (MW-13) at concentrations that exceed the U.S. EPA Industrial VISL. Cyanide contamination appears to be delineated to within the Site boundary.
    - Cyanide is an active ingredient utilized as part of MSCs work process. The presence and magnitude of cyanide vapor potentially within Building 1 would be managed under OSHA exposure rules regardless of vapor intrusion potential.
  - Off-Site = Potentially Complete
    - Soil gas samples collected on and off-site were below Residential and Industrial VISLs for VOCs.
    - Groundwater VOC impacts have not been fully delineated off-Site to the east and west. Known impacts are downgradient of off-Site industrial properties, therefore vapor intrusion is unlikely.
    - Groundwater cyanide impacts are defined to within the Site boundaries.
- Construction Workers/Excavation Worker
  - On-Site = Incomplete
    - Soil gas samples collected on-Site were below Residential and Industrial VISLs for VOCs.
    - Any active site work that disturbs soils is being performed by environmental professionals with appropriate training and PPE.

        - Appropriate measures will be in place, including a SMP, to ensure no unacceptable exposures in the future.
    - Off-Site = Potentially Complete
        - Soil gas samples collected on and off-Site were below Residential and Industrial VISLs for VOCs.
        - TCE impacted groundwater has not been fully delineated off-Site to the east and west.
- Trespasser/Visitors
    - On-Site = Incomplete
        - Indoor air samples collected from Building One were below laboratory reporting limits for VOCs.
        - Soil gas samples collected on-Site were below Residential and Industrial VISLs for VOCs.
        - Depending on the groundwater results of the expanded monitoring well network, further VI assessments may be necessary, which will be guided by the groundwater plume extents.

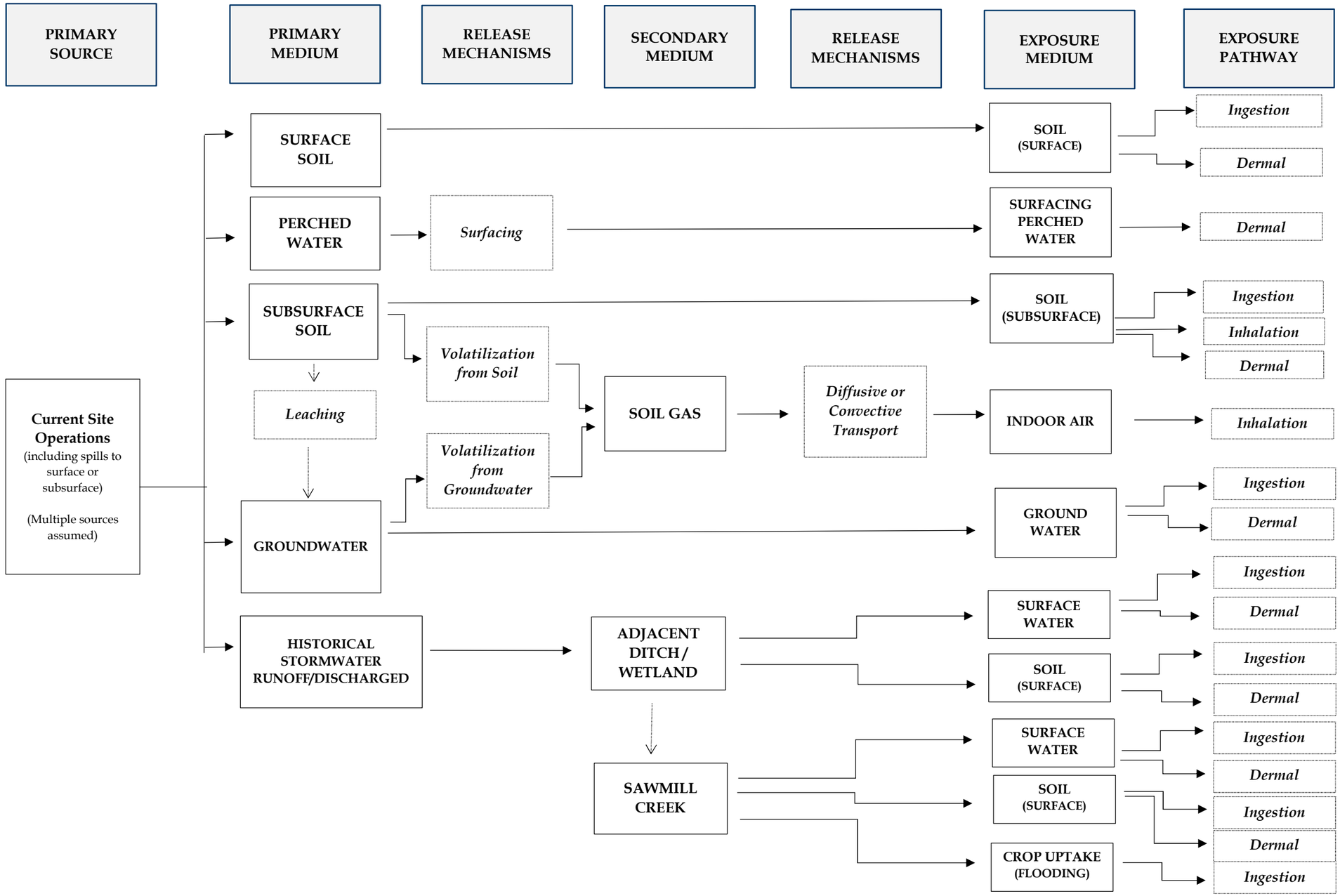
Exposure Pathway 6 – Surface Water (includes ingestion/dermal)

- Off-Site Adjacent Ditch and Wetland
  - Recreator = Complete, but under control
    - Site-related COCs in surface water samples from the Adjacent Ditch exceeded Non-drinking Surface Water Human Health Criteria.
    - To prevent exposure, a fence was erected between the Adjacent Ditch and bike path and around the Wetland.
    - Former drainpipes that discharged stormwater to the Adjacent Ditch were grouted and capped at the ditch to prevent further discharge.
    - Surface water in the Adjacent Ditch was captured to prevent drainage to the Wetland and a liner was installed in the Adjacent Ditch to separate stormwater from on top of the liner from impacts beneath the liner.
  - Construction Workers/Excavation Worker = Complete, but under control
    - Site-related COCs in surface water samples from the Adjacent Ditch exceeded surface water comparative standards associated with human exposure.
    - Former drainpipes that discharged stormwater to the Adjacent Ditch were grouted and capped at the ditch to prevent further discharge.
    - Surface water in the Adjacent Ditch was captured to prevent discharge to the Wetland and a liner was installed in the Adjacent Ditch to separate stormwater from on top of the liner from impacts beneath the liner.
    - Site work (liner placement, excavations, sampling, etc.) was/is being performed by trained environmental professionals following appropriate protocols and PPE.
- Off-Site Sawmill Creek
  - Resident = Incomplete
    - Site-related COCs in surface water samples collected from Sawmill Creek were below Non-drinking Surface Water Human Health Criteria.
  - Recreator = Incomplete
    - Site-related COCs in surface water samples collected from Sawmill Creek were below Non-drinking Surface Water Human Health Criteria.
  - Construction Workers/Excavation Worker = Incomplete

- Site-related COCs in surface water samples collected from Sawmill Creek were below Non-drinking Surface Water Human Health Criteria.

EXHIBIT A

CONCEPTUAL SITE MODEL LINE DIAGRAM



On-Site Receptors			Off-Site Receptors			
C/I Wrkr	C/E Wrkr	Trespasser or Visitor	Resident	C/I Wrkr	C/E Wrkr	Recreator
O	O	O	See Off-Site Ditch, Wetland, and Creek Areas below			
O	O	O				
Θ	Θ	Θ	NA	Θ	Θ	Θ
Θ	Θ	Θ	O	O	O	O
Θ	Θ	Θ	O	O	O	O
Θ	Θ	Θ	O	O	O	O
--	--	--	O	O	O	–
Θ	Θ	--	O	O	O	--
Θ	Θ	--	O	O	O	--
Not Applicable (Off-Site)			NA	NA	Θ	Θ
			NA	NA	Θ	Θ
			NA	NA	Θ	Θ
			NA	NA	Θ	Θ
			--	NA	--	--
			--	NA	--	--
			●	NA	●	●
			●	NA	●	●
			O	NA	NA	NA

LEGEND:

● = Exposure Pathway Complete

Θ = Exposure Pathway Complete, but under Control

O = Exposure Pathway Potentially Complete (no current exposure to COCs, but the potential for future exposure exists, which is being monitored)

"--" = Exposure Pathway Incomplete

NA = Exposure Pathway not applicable

Abbreviations & Notes

C/I Wrkr = Commercial and/or Industrial Worker; C/E Wrkr= Construction and/or Excavation Worker

The construction worker to groundwater exposure pathway assumes exposure to contaminated groundwater via trenching or other construction activity.

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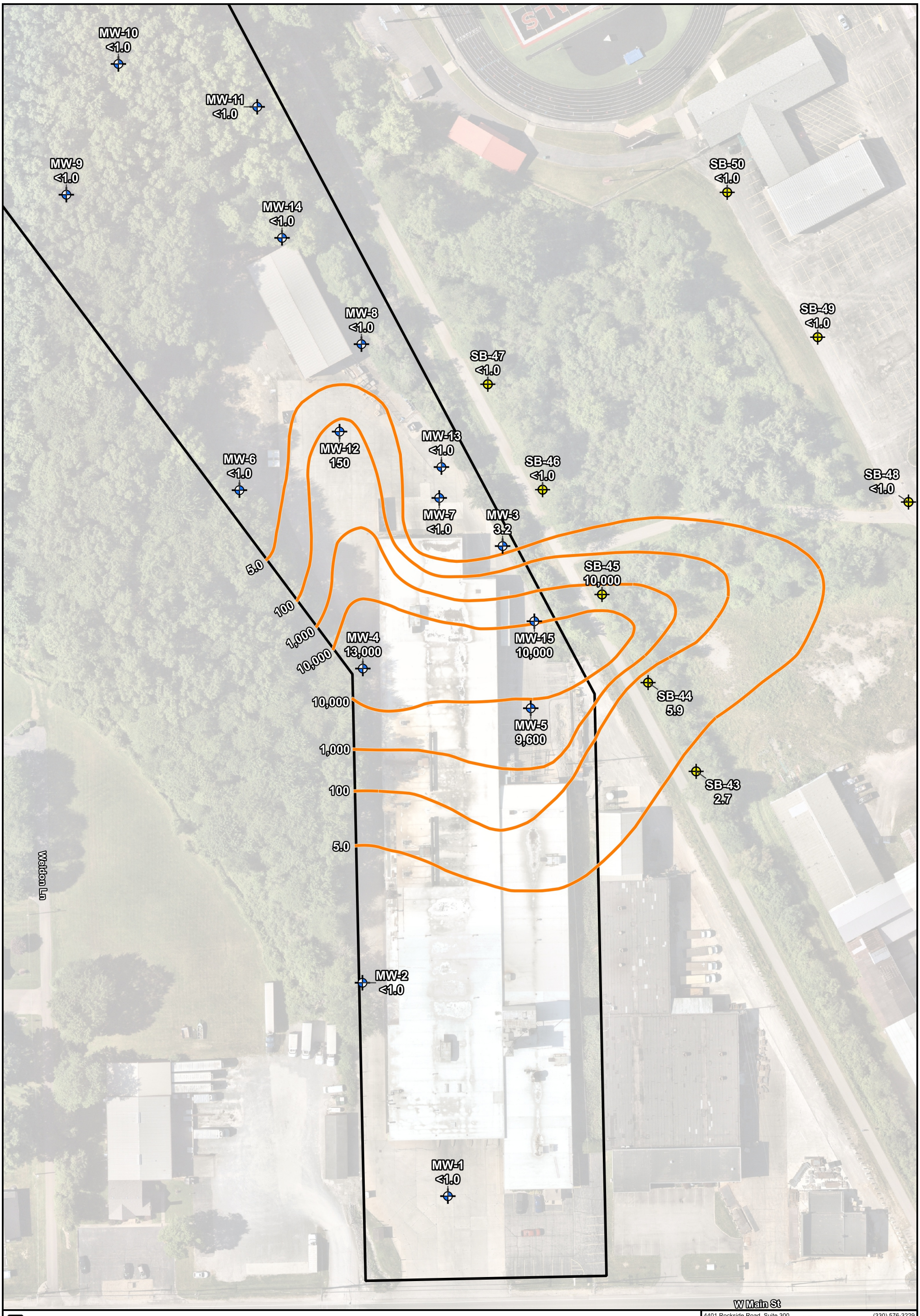
EXHIBIT A

Conceptual Site Model Line Diagram – Current Conditions

Material Sciences Corporation

EXHIBIT B

TCE EXTENTS IN GROUNDWATER



Subject Property
Monitoring Well
Soil Boring
U.S. EPA 2024 GWPS (5.0 ug/L)

* Analytical Data from November 2024 and February 2025 was used in creation.

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation
Canfield

TCE Groundwater Extent Map

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229

August Mack
ENVIRONMENTAL

PROJECT NO.: JZ0412.372	DATE: 07/30/2025
	SCALE: 1:1,000
EXHIBIT: B	CREATED BY: CC

ATTACHMENT B

SODIUM CYANIDE SAFETY DATA SHEET

SECTION 1: Identification of the substance and of the company

1.1 Product identifier

Name:	**Sodium Cyanide**
Identification number:	Index number 006-007-00-5 CAS number: 143-33-9
Registration number:	01-2119480141-49-0005

1.2 Relevant identified uses of the substance or mixture and uses advised against

Intended use:	Synthesis of Chemical and Pharmaceutical Intermediates Formulation of Chemical Products Cleaning and Degreasing in Metal Finishing Industries Depressing Agent Extraction Agent of Precious Metals Recycling of Precious Metals Electroplating Metal Hardening
Not recommended use:	Production of weapons and narcotics Fertilizers Fishing Germicide Pest control Consumer use This list is only informative and therefore not exhaustive.

1.3 Details of the supplier of the safety data sheet

Manufacturer:	**Lučební závody Draslovka a.s. Kolín**
Registered office:	Havlíčkova 605, 280 02 Kolín, Česká republika
Company ID:	46 35 73 51
Telephone:	+420 321 335 281
Competent person responsible:	sds@draslovka.cz

1.4 Emergency telephone number

National Poison Information Service; City Hospital, Birmingham B187QH, United Kingdom
+44 121 507 4123

Toxikologické informační středisko**,** Na Bojišti 1, Praha, CZ
(continuously) +420-224919293
+420-224915402
Information for Health Risks - acute poisoning people and animals

The toxicological center is different according to the country of use.

SECTION 2: Hazards identification

Classification of the substance:	The substance **is** classified as dangerous according to Regulation EC No 1272/2008.	
Dangerous health effects:	Fatal if swallowed, in contact with skin or if inhaled. Causes damage to organs (thyroid gland) through prolonged or repeated exposure; oral, dermal, inhalation. Causes skin irritation. Causes serious eye irritation.	
Dangerous environmental effects:	Very toxic to aquatic life with long lasting effects	

2.1 Classification of the substance or mixture

Classification according to (EC) 1272/2008:	Codes for hazard classes and categories and Hazard statement Codes	Met. Corr. 1, H290 Acute Tox. 1, H300 + H310 + H330 Skin Irrit. 2; H315 Eye Irrit. 2; H319 STOT RE 1, H372 Aquatic Acute 1, H400 Aquatic Chronic 1, H410
Specific concentration limits (SCL) and M-factor	SCL: not stated	M-factor: 10

2.2 Label elements

Name: Sodium cyanide CAS number: 143-33-9

	Hazard pictogram(s):		
	Signal word:	DANGER	
	Hazard statement(s):	H290 H300 + H310 + H330 H315 H319 H372 H410	May be corrosive to metals. Fatal if swallowed, in contact with skin or if inhaled. Causes skin irritation. Causes serious eye irritation. Causes damage to organs (thyroid gland) through prolonged or repeated exposure; oral, dermal, inhalation. Very toxic to aquatic life with long lasting effects.
	Precautionary statement(s):	P270 P273 P280 P301+P310 P303 + P361 + P353 P304+P340 P403+P233	Do not eat, drink or smoke when using this product. Avoid release to the environment. Wear protective nitrile gloves, protective clothing and eye protection. IF SWALLOWED: Immediately call a doctor. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Store in a well-ventilated place. Keep container tightly closed.
	Additional labelling information:	EUH 032	Contact with acids liberates very toxic gas (hydrogen cyanide)
2.3	**Other hazards**		
	Substance is not classified as PBT or vPvB; on the date of SDS creation the substance is not on the Candidate list of SVHC.		

SECTION 3: Composition/information on ingredients

3.1 Substances

The major component identifier:	Name.	Sodium Cyanide	Content:	min 98 % wg
	Identification number:	Index number	CAS number	C&L inventory number
		006-007-00-5	143-33-9	not yet
The chemical identity of impurities conducive to at classification	Name	Sodium Carbonate	Content:	max 0.8 % wg
	Identification number	Index number	CAS number	C&L inventory number
		011-005-00-2	497-19-8	not yet
	Name	Sodium Hydroxide	Content:	0,06 - 0,8 % wg
	Identification number	Index number	CAS number	C&L inventory number
		011-002-00-6	1310-73-2	not yet

SECTION 4: First aid measures

4.1 Description of first aid measures

Inhalation:	Remove exposed person to fresh air. If not breathing ensure airway is clear and commence cardiopulmonary resuscitation (CPR). Avoid mouth to mouth contact and use eg. mouth to mask ventilation with one way valve, sacs for artificial lung ventilation, etc. to exhaust victim's exhaled air away from rescuer. Commence administration of oxygen as soon as possible. Administration of oxygen should be maintained until transfer to the care of a paramedic or doctor. **Obtain medical help immediately!**

	Skin contact:	Immediately remove contaminated clothing. Wash contaminated skin with large quantities of (preferably lukewarm) water. If poisoning symptoms appear, follow the above instructions for inhalation exposure. **Obtain medical help immediately!**
	Eye contact:	Immediately flush eyes with large quantities of water for 10-15 minutes. While flushing, keep eyelids open even by using force. **Obtain medical help immediately!**
	Ingestion:	**Obtain medical help immediately!** Ingestion of even small amounts is likely to be fatal unless treated rapidly.
4.2	**Most important symptoms and effects, both acute and delayed**	
	Inhalation:	Weakness, difficult breathing, headache, dizziness, cherry-red skin; during prolonged inhalation for 30 minutes nausea, vomiting, palpitations
	Skin contact:	Nausea, anxiety, vomiting, cherry-red skin
	Eye contact:	Redness and burning eyes, nausea, anxiety, vomiting, cherry-red skin
	Ingestion:	Weakness, difficult breathing, headache, dizziness, cherry-red skin
4.3	**Indication of any immediate medical attention and special treatment needed** **Speed is essential! Obtain medical help immediately!** Protect yourself and any casualty from further exposure during providing first aid (can be affected also the protective clothing). Wear specified PPE until test confirms no further risk from exposure. Each group of operators must be equipped with a first-aid box, should any poisoning occur and the following items: - Antidote (Not all antidotes are internationally recommended. Consult your National Poison Control Centre for guidance.) Administration by a doctor! - Resuscitator (bag valve mask) -Oxygen	

SECTION 5: Firefighting measures

5.1	**Extinguishing media**	
	Suitable extinguishing media	Non-combustible substance, fire- fighting measures are necessary to adapt according to conditions around. Powder, dry extinguishing agent, minimum water content.
	Unsuitable extinguishing media:	Direct water stream, foam, carbon dioxide because of the possibility of toxic hydrogen cyanide release.
5.2	**Special hazards arising from the substance or mixture** During heating or in the case of fire there is possibility of toxic gases formation, mainly hydrogen cyanide (HCN). During contact with water leads to the release of hydrogen cyanide (HCN).	
5.3	**Advice for firefighters** Protective chemical wear (EN 340, EN 464, EN 465, EN 466, EN 943) and self-contained breathing apparatus (EN 137).	

SECTION 6: Accidental release measures

6.1	**Personal precautions, protective equipment and emergency procedures** In case of accident it is necessary to wear a face mask with a B2 filter to ensure protection against HCN or equivalent (only in case of self-preservation); higher content requires the use of a self-contained breathing apparatus (EN 137) and protective chemical wear (EN 340, EN 464, EN 465, EN 466, EN 943).
6.2	**Environmental precautions** Do not rinse the spilled product with water. Prevent further leakage. Restrict the area. Prevent penetration of the substance into soil, water, sewerage. In case the substance gets into waterway or reservoir, inform consumers, cease their operation and use of water. Inform the competent local authorities.
6.3	**Methods and material for containment and cleaning up** Remove the spilt dust (granules, tablets) mechanically with caution; remove it along with the contaminated soil and hand it over to authorized person to dispose.
6.4	**Reference to other sections** PPE see Section 8

SECTION 7: Handling and storage

7.1	**Precautions for safe handling** Ensure good exhaustion of the dust. Make sure that the workplace is ventilated and exhausted properly. Open the packaging units carefully and handle them with care.
7.2	**Conditions for safe storage, including any incompatibilities**

	To be stored separately in original sealed packaging units in dry, cool, locked storerooms. The storage area must be free of acids and substances entering in acidic reactions, as they carry the risk of releasing strongly toxic hydrogen cyanide.
7.3	**Specific end use(s)** See Exposure Scenario

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

***) according to national legislation of target country**

Name of substance (component(s)):	CAS	Eight hours mg/m³	Short-term mg/m³	Note
sodium cyanide	143-33-9	*)	*)	

Occupational exposure limit values according to Directives 39/2000/EC and 15/2006/EC

Name of substance (component(s)):	CAS	Eight hours mg/m³ TWA	Short-term mg/m³ STEL	Note
sodium cyanide	143-33-9	---	---	

DNEL	3.03 mg/kg bw/day (acute dermal) 9.4 mg/m³ (acute inhalation) 0.102 mg/kg bw/day (chronic dermal) 0.72 mg/m³ (chronic inhalation)
PNEC	1 µg/l (freshwater) 0.2 µg/l (marine water) 3.2 µg/l (intermittent releases) 50 µg/l (STP) 4 µg/kg sediment dw (sediment freshwater) 0.8 µg/kg sediment dw (sediment marine water) 7 µg/kg soil dw (soil)

8.2 Exposure controls

Workplace should be equipped with a face mask (EN 136) with type B2 filter or equivalent (e.g. combined filter A2B2E2K2P3) (EN 14 387 + A1).

Personal protective equipment:

Respiratory protection:	Filter half-mask (EN 149 + A1)			
Eye protection:	Face shield or goggles (EN 166)			
Hand protection:	Rubber gloves (e.g. KCL 732)	Thickness	Material	Time of Penetration
		0.4 mm	nitrile	> 480 min
	Basic employee training in combination with specific activity training (e.g. procedure for glove removal and disposal) for tasks where dermal protection is necessary.			
Skin protection:	Protective work clothes (EN 13688), protective boots (ISO 20 346).			

Environmental exposure control:

see Exposure Scenarios (attachment nr.1)

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance	solid
Odour:	Waiver
Odour threshold:	Waiver
pH (at 20°C):	Waiver
Melting point/freezing point (°C):	561.7
Initial boiling point and boiling range (°C):	1500 at 1013 hPa
Flash point (°C):	Waiver
Evaporation rate:	Waiver
Flammability (solid, gas):	non flammable
Flammability: or explosive limits upper (% vol.): lower (% vol.):	non explosive
Vapour pressure:	0.1 kPa at 800 °C The vapour pressure of sodium cyanide is negligible.
Vapour density:	Waiver

	Relative density:	1.595 at 20°C
	Solubility:	370 g/L at 20 °C
	Partition coefficient n-octanol/water:	Log Kow (Pow): -0.25 at 20 °C
	Auto-ignition temperature:	Waiver
	Decomposition temperature:	Waiver
	Viscosity:	Waiver
	Explosive properties:	Non explosive
	Oxidising properties:	No
9.2	**Other information**	
	none	

SECTION 10: Stability and reactivity

10.1 Reactivity
Reaction with acids releases toxic hydrogen cyanide

10.2 Chemical stability
In a dry clean environment protected from air humidity.

10.3 Possibility of hazardous reactions
In contact with water and acids releases hydrogen cyanide, which creates explosive mixture with air.

10.4 Conditions to avoid
Acids. Its reactions with acids produce highly toxic hydrogen cyanide. It is extremely hygroscopic. In contact with water, it hydrolyzes to produce hydrogen cyanide.

10.5 Incompatible materials
Acids and water.

10.6 Hazardous decomposition products
Hydrogen cyanide – highly toxic gas

SECTION 11: Toxicological information

11.1 Information on toxicological effects

a) ***Acute toxicity***
LD50 (oral, rat): 5 mg/kg bw
LD50 (dermal, rabbit): 11.8 mg/kg bw (wet skin; for dry skin 130 mg/kg bw)
LC50 (inhalation, 4 hrs, estimate for human): 103 mg/m³ air

b) Skin corrosion/irritation
Due to high acute toxicity tests for skin irritation are not relevant.

c) Serious eye damage/irritation
Due to high acute toxicity tests for eye irritation are not relevant.

d) Respiratory or skin sensitisation
Due to high acute toxicity tests for respiratory or skin sensitisation are not relevant.

e) Germ cell mutagenicity
Based on available data, the classification criteria are not met.

f) Carcinogenicity
Based on available data, the classification criteria are not met.
There is insufficient evidence from chronic and subchronic animal studies, and from genetic testing and human surveys, to support classification of cyanide salts as carcinogens

g) Reproductive toxicity
Based on available data, the classification criteria are not met.
The results of reproductive toxicity studies indicate that cyanide compounds are not teratogens or reproductive toxicants

h) Specific target organ toxicity (STOT)– single exposure
Based on available data, the classification criteria are not met.

i) Specific target organ toxicity (STOT)– repeated exposure
route: oral: NOAEL: 1.02 mg/kg bw/day Target organs: glandular: thyroids
route: inhalation: NOAEC: 3.75 mg/m³ Target organs: glandular: thyroids

j) Aspiration hazard
Due to high acute toxicity tests are not relevant.

SECTION 12: Ecological information

12.1 Toxicity

Fish

Data from multiple short-term fish toxicity studies were reviewed by ECETOC Task Force, including LC50 values from fifteen freshwater fish species and four marine fish species. A more conservative analysis was provided by a species sensitivity distribution of six freshwater species and one marine species, restricted to short-term studies with flow-through conditions and the lowest LC50 per species. From this SSD, an HC5 of 26 µg CN^-/l was determined, which corresponded well with the lowest LC50 of 27 µg CN^-/l. The HC5 was assumed to apply to both freshwater and marine species, with respect to evidence that marine species are not more sensitive than freshwater species

Algae

The EC50/LC50 values in freshwater and saltwater algae were reviewed by the ECETOC Task Force. Data from a small range of static studies providing EC50 values from three freshwater algae, one marine alga and one macrophyte was reviewed by the ECETOC Task Force, from studies lasting from 24 h to 32 d in duration. None of the studies were confirmed to have complied with GLP guidelines. The lowest freshwater EC50 was from a 24 h study of a Chlorococcales species (45 µg CN^-/l).; the lowest saltwater EC50 was reported from Nitzschia closterium (57 µg CN^-/l).

Daphnia

The lowest reliable LC50 for *Daphnia* was 39.8 µg CN^-/l. This value was in the range of the 48-hour LC50 value at 20 °C for *Daphnia pulex* reported by Cairns of 110 µg CN^-/l, and is very close to the acute LC50/EC50 for all aquatic organisms of 50 µg/l derived by ECETOC.

An HC5 for free cyanide of 15 µg CN^-/l was derived from an SSD representing 21 freshwater and marine crustacea; the SSD included two LC50/EC50 values of 1 µg CN^-/l and 3 µg CN^-/l reported in *Daphnia pulex* at a water temperature of 25 °C. The mean LC50 from two short-term studies of the marine crab *Cancer irroratus* was 5 µg CN^-/l. The LC50/EC50 value for all other species was above 30 µg CN^-/l; the results reported for *Cancer irroratus* do not appear to be indicative of cyanide sensitivity to marine invertebrates in general. Thus, the acute LC50/EC50 for all aquatic organisms is protective of most of the saltwater invertebrate species

Bacteria

The ECETOC Task Force identified a mean EC50 from an international ring test conducted by Strotmann and Pagga from 17 laboratories assaying growth inhibition in activated sludge; the mean EC50 was 4.9 mg CN^-/l. This value was similar to a 30-minute EC50 reported from an activated sludgee respiration inhibition assay, conducted in accordance with the guideline (proposed ISO growth inhibition assay as described in Annex I to Strotmann and Pagga, 1996), of 2.3 mg CN^-/l (Strotmann, 1992).

The NOEC was the lowest from range of toxicity tests to bacteria and cyanobacteria, protozoa and fungi as reviewed by the ECETOC Task Force. The lowest NOEC was 0.007 mg CN^-/l.

12.2 Persistence and degradability

Hydrolysis half-life: 6.8 d at 30 °C

12.3 Bioaccumulative potential

BCF: 3.162

12.4 Mobility in soil

Data not available

12.5 Results of PBT and vPvB assessment

According to CSR substance does not fulfill criteria as PBT nor vPvB.

12.6 Other adverse effects

Data not available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

a) Possible hazards in disposing of the substance and contaminated packaging

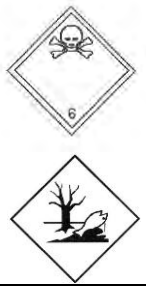
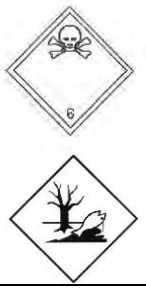
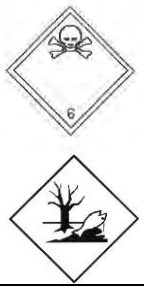
Disposing of NaCN:

Solid residue is handed over to authorised person for thermal liquidation.

Waste catalogue code 060311* – solid salts and solutions containing cyanides

Liquid residue and rinse water alkalized with calcium hydroxide or sodium (potassium) hydroxide to pH 8 to 10 with an admixture of iron sulfate/iron sulfate heptahydrate (ten times the detected content of CN^-) are transformed to ferrocyanide ([Fe(CN)6]4-) and are filtrated. The pasty mixture is then mixed with coal or another absorbing agent and together with filter material it is handed over to authorised person for professional liquidation

		Waste catalogue code 150202* – absorbents contaminated by dangerous substances meant for thermal liquidation. It is possible to dispose of liquid residue absorbed into soil using solution of potassium permanganate, sodium hypochlorite or hydrogen peroxide or it is handed over to authorized person for professional liquidation. **Waste catalogue code 170505* – dredging spoil containing dangerous substances** **Disposing of contaminated packaging:** PE bags and plastic package inserts to be handed over to authorised person for thermal liquidation Waste catalogue code **150110 –** packaging containing residues of or contaminated by dangerous substances Metal packaging contaminated by cyanide must be rinsed properly and the water containing cyanide is then reclaimed as described above. Cleaned metal packagings are handed over to an authorised person for recycling. In case of surface or ground water contamination, immediately inform local fire unit and environmental authorities.
	b)	Physical/chemical properties that may affect waste treatment See above
	c)	Avoiding waste disposal through sewerage Avoid release of contaminated water to sewerage
	d)	Special precautions for any recommended waste treatment See above

SECTION 14: Transport information				
14.1	**UN number**			
	1689			
14.2	**UN proper shipping name**			
	ADR	SODIUM CYANIDE, SOLID		
	RID	SODIUM CYANIDE, SOLID		
	IMDG:	SODIUM CYANIDE, SOLID		
	ICAO/IATA:	SODIUM CYANIDE, SOLID		
14.3	**Transport hazard class(s)**			
	ADR	*RID*	*IMDG:*	*ICAO/IATA:*
	6.1	*6.1*	6.1	*6.1*
	Classification			
	ADR	*RID*		
	T5	*T5*		
14.4	**Packing group**			
	ADR	*RID*	*IMDG:*	*ICAO/IATA:*
	I	*I*	I	*I*
	Hazard Identification No. (Kemler)			
	ADR			
	66			
	Labels			
	ADR	*RID*	*IMDG:*	*ICAO/IATA:*
				
	Note			
	ADR	*RID*	*IMDG:*	*ICAO/IATA:*
			EmS: F-A, S-A	PAO: 666 CAO: 673
14.5	**Environmental hazards**			
	ADR, RID, ICAO / IATA: Yes, substance hazardous to environment | IMDG Code: Yes, marine pollutant			
14.6	**Special precautions for user**			
	Not necessary.			

14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code**
	Not transported.

SECTION 15: Regulatory information	
15.1	**Safety, health and environmental regulations/legislation specific for the substance or mixture** Regulation EC 1907/2006 (REACH) as amended Regulation EC 1272/2008 (CLP) as amended Directive 2008/98 / EC on waste, as amended and valid national legislation.
15.2	**Chemical safety assessment** See: Chemical Safety Report

SECTION 16: Other information

a) The changes in case of a revised safety data sheet

Changes are marked by underlining and highlighting.

The Safety Data Sheet was changed in compliance with main registrant's Chemical Safety Report dated 27.11. 2018.

b) A key or legend to abbreviations and acronyms

Met.Corr. 1	Corrosive to metals, category 1
Acute Tox. 1	Acute toxicity, category 1
Skin Irrit. 2	Skin Irritation, category 2
Eye Irrit. 2	Serious eye Irritation, category 2
STOT RE 1	Specific target organ toxicity – repeated exposure, category 1
Aquatic Acute 1	Toxic to aquatic life, category 1
Aquatic Chronic 1	Toxic to aquatic life, with long-lasting effects, category 1
DNEL	Derived no effect level
PNEC	Predicted no effect concentration
EN	European norm
ISO	International Organization for Standardization
CAS	Chemical Abstract Service
REACH	European Community Regulation on chemicals and their safe use (EC 1907/2006)
STP	Wastewater treatment plant
LD50	Lethal dose killing 50 % of tested population
LC50	Lethal concentration killing 50 % of tested population
EC50	Effective concentration for 50 % of tested population
HC5	Dangerous concentration for 5% of tested population
NOAEL	No observable adverse effect level
NOAEC	No observable adverse effect concentration
LOEL	Lowest observed effect level
NOEC	Non-observed measured concentration
PBT	Persistent bioaccumulative toxic chemical
vPvB	Very persistent and very bioaccumulative chemical
BCF	Bioconcentration factor
GLP	Good laboratory practice
ADR	European agreement concerning the international carriage of dangerous goods by road
RID	International rule for transport of dangerous goods by railway
IMDG	International rule for transport of dangerous goods by sea
ICAO/IATA	Rules for transport by air

c) Key literature references and sources for data

See Section 15.1

d) List of relevant hazard statements and/or precautionary statements

H290	May be corrosive to metals.
H300 + H310 + H330	Fatal if swallowed, in contact with skin or if inhaled.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H372	Causes damage to organs (thyroid gland) through prolonged or repeated exposure; oral, dermal, inhalation.

		H400	Very toxic to aquatic life
		H410	Very toxic to aquatic life with long lasting effects
		EUH 032	Contact with acids liberates very toxic gas (hydrogen cyanide).
		P270	Do not eat, drink or smoke when using this product.
		P273	Avoid release to the environment
		P280	Wear protective nitrile gloves, protective clothing and eye protection.
		P301+P310	IF SWALLOWED: Immediately call a doctor.
		P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
		P303+P361+ P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
		P403+P233	Store in a well-ventilated place. Keep container tightly closed
	e)	Training appropriate for workers SDS and training for manipulation with dangerous and flammable substances.	
	f)	More information The substance is a subject of harmonised classification according to Annex VI Regulation 1272/2008/ES. Disclaimer The information stated in this SDS is given in good faith and considered correct but it is not presented as completely exhaustive and can be used as a lead only. Information in this document is based on the contemporary state of our knowledge and concern the product with regard to relevant safety regulations. It does not represent a guarantee of the product qualities. Lučební závody Draslovka a.s. Kolín does not bear responsibility for any damage resulting from handling or coming into contact with the above mentioned product.	

ATTACHMENT C

SAMPLING AND ANALYSIS PLAN TABLES

SAMPLING AND ANALYSIS PLAN
ADJACENT DITCH AREA

Location ID	Location Type	Media	Sample Depths (ft bg)	Max # of Soil Samples	Proposed Analyzed Parameters: Soil				Proposed GW Parameters: VOCs, CrVI, Free/Tot CN, Diss/Tot Zn	Rationale
					CrVI	Free CN	Total CN	Zinc		
			Subtotals:	60	15	60	60	36		
TN300	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	3	3	3	3	1	Used to address OH EPA Comment #13d regarding evaluating potential shallow soil contamination upstream in the alley east of Building 1.
T125-P20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	3	NA	Used to delineate CN/Zn impacts on east side of ditch. West side of ditch will be evaluated via SB-107 as part of the perched water investigation. CrVI is already delineated. Addresses OH EPA Comment #17.
SB-107	Adjacent Ditch/ Shallow Soil	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	3	3	3	3	See Table 4	Used to delineate CN/Zn impacts on east side of ditch. West side of ditch will be evaluated via SB-107 as part of the perched water investigation. CrVI is already delineated. Addresses OH EPA Comment #17. Also analyzed for VOCs and soil pH.
T250-P20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	3	NA	Used to delineate CN/Zn impacts on east and west sides of ditch. CrVI is already delineated. Addresses OH EPA Comment #17. Collect DUP at T250-N20.
T250-N20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	3	NA	
T375-P20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	3	NA	Used to delineate CN/Zn impacts on east and west sides of ditch. CrVI is already delineated. Addresses OH EPA Comment #17. Collect MS/MSD at T375-N20.
T375-N20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	3	NA	
T425-N30	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	3	3	3	3	1	Used to address OH EPA Comment #13a regarding perched water surfacing on the west side of the ditch with an orange-colored, iridescent biological sheen. Collect DUP.
T500-P20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	3	NA	Used to delineate CN/Zn impacts on east and west sides of ditch. CrVI is already delineated. Addresses OH EPA Comment #17.
T500-N20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	3	NA	
T625-P20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	3	3	3	3	NA	Used to delineate CN/Zn impacts on east and west sides of ditch. CrVI is not delineated in this area. Addresses OH EPA Comment #17. Collect DUP at T625-N20.
T625-N20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	3	3	3	3	NA	
T750-P20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	NA	NA	Used to delineate CN impacts on east and west sides of ditch. CrVI and Zn are delineated in this area. Addresses OH EPA Comment #17. Collect MS/MSD at T750-N20.
T750-N20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	NA	NA	
T875-P20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	NA	NA	Used to delineate CN impacts on east and west sides of ditch. CrVI and Zn are delineated in this area. Addresses OH EPA Comment #17. Collect DUP at T875-N20.
T875-N20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	NA	NA	

SAMPLING AND ANALYSIS PLAN
ADJACENT DITCH AREA

Location ID	Location Type	Media	Sample Depths (ft bg)	Max # of Soil Samples	Proposed Analyzed Parameters: Soil				Proposed GW Parameters: VOCs, CrVI, Free/Tot CN, Diss/Tot Zn	Rationale
					CrVI	Free CN	Total CN	Zinc		
			Subtotals:	60	15	60	60	36		
T1000-P20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	NA	NA	Used to delineate CN impacts on east and west sides of ditch. CrVI and Zn are delineated in this area. Addresses OH EPA Comment #17.
T1000-N20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	NA	NA	
T1125-P20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	NA	NA	Used to delineate CN impacts on east and west sides of ditch. CrVI and Zn are delineated in this area. Addresses OH EPA Comment #17. Collect DUP & MS/MSD at T1125-N20.
T1125-N20	Adjacent Ditch	Soil	0.0-0.5; 2.0-2.5; 4.0-4.5	3	NA	3	3	NA	NA	

Abbreviations and Notes:

CN = Cyanide
CrVI = Hexavalent Chromium
ftbg = feet below grade
MCMB = Mill Creek Metroparks Bikeway
NA = Not Applicable
Zn = Zinc

"N"/"P" = N/P notation in a transect Location ID indicates negative or positive offset distance in feet (westerly or easterly, respectively) from the centerline of the ditch facing downstream. "N" notation in the transect ID indicates upstream distance from T0, the outfall.
Borings to the east of the ditch are proposed to be installed between the ditch and the MCMB.

TABLE 2

SAMPLING AND ANALYSIS PLAN
WETLAND AREA

Location ID	Location Type	Media	Sample Depths (ft bg)	Max # of Samples	Proposed Analyzed Parameters: Soil				Rationale
					CrVI	Free CN	Total CN	Zinc	
			Subtotals:	30	20	20	20	10	
SB-200	**Wetland**	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	NA	CrVI identified in SB-56 at 1.0-2.0 ftbg. Boring placed at the interface of the wetland and MCMB-Trail.
SB-201	**Wetland**	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	NA	CrVI identified in SB-68 at 0.5-1.0 ftbg. Boring placed at the interface of the wetland and MCMB-Trail. Collect 1 DUP sample here.
SB-202	**Wetland**	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	NA	NA	NA	CrVI identified in SB-69 at 2.0-3.0 ftbg. Boring placed at the interface of the wetland and MCMB-Trail for westerly delineation.
SB-203	**Wetland**	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	NA	NA	NA	CrVI identified in SB-69 at 2.0-3.0 ftbg. Boring placed at the interface of the wetland and MCMB for easterly delineation. Collect 1 DUP sample and 1 MS/MSD Sample here.
SB-204	**Wetland**	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	NA	5	5	5	Zinc identified in SB-33 & SB-34 at 0.0-0.5 ftbg. Boring placed at the interface of the wetland and MCMB for easterly delineation.
SB-205	**Wetland**	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	NA	5	5	5	Zinc identified in SB-30 & SB-33 at 0.0-0.5 ftbg. Boring placed at the interface of the wetland and MCMB for easterly delineation. Collect DUP

Abbreviations

CN = Cyanide

CrVI = Hexavalent Chromium

ftbg = feet below grade

MCMB = Mill Creek Metroparks Bikeway

MCMB-Trail = Walking path connecting the MCMB and Mallard Crossing

SAMPLING AND ANALYSIS PLAN
SAWMILL CREEK DATA GAPS

Location ID	Location Type	Location Details	Media	Sample Depths (ft bg)	Max # of Samples	Proposed Parameters: Soil:				Rationale
						Free CN	Total CN	CrVI	Zinc	
				Subtotals:	45	45	45	45	45	
T2-1950	Downstream	North Bank	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	5	Horizontally and vertically delineate downstream impacts. Deeper intervals may be placed on hold pending shallower results.
	Downstream	Stream Center	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	5	
	Downstream	South Bank	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	5	
T2-2200	Downstream	North Bank	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	5	
	Downstream	Stream Center	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	5	
	Downstream	South Bank	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	5	
T2-2575	Downstream	North Bank	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	5	
	Downstream	Stream Center	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	5	
	Downstream	South Bank	Sediment	0.0-0.5; 0.5-1.0; 1.0-2.0; 2.0-3.0; 3.0-4.0	5	5	5	5	5	

Abbreviations and Notes:
CN = Cyanide
CrVI = Hexavalent Chromium
ft bg = feet below grade

TABLE 4

SAMPLING AND ANALYSIS PLAN
AOC-4 PERCHED WATER INVESTIGATION

Location ID	Location Type	Media	Target Boring Depth (ft bg)	Sample Depths (ft bg)	Proposed # of Soil Samples	Proposed # of Water Samples	Proposed Analyzed Parameters: Soil							Proposed Analyzed Parameters: Water									Rationale
							Field		Laboratory					Field			Laboratory							
							Field PID Screen	Field pH Screen	VOCs	Total CN	Free CN	CrVI	Zinc	pH	Diss. Free CN (Field)	Diss. Zinc (Field)	pH (Field)	VOCs	CrVI	Diss. CN	Diss. Free CN	Total Zinc	Diss. Zinc	pH	
Subtotals:			150'		29	30	30		29	29	29	29	29	29	25	25	25	6	6	6	6	6	6	6	
SB-100	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	Vertically and horizontally delineate impacts and characterize shallow perched water.
SB-101	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-102	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-103	**On-Site**	Soil & Perched Water	5	Soil: 0.0-0.5 2.0-2.5; 4.0-4.5 GW: 0.0-5.0	3	1	At 2-ft Intervals		3	3	3	3	3	3	1	1	1	NA	NA	NA	NA	NA	NA	NA	Vertically and horizontally delineate impacts in area of ephemeral stream.
SB-104	**On-Site**	Soil & Perched Water	5	Soil: 0.0-0.5 2.0-2.5; GW: 0.0-5.0	2	1	At 2-ft Intervals		2	2	2	2	2	2	1	1	1	NA	NA	NA	NA	NA	NA	NA	Used to determine the presence or absence of a release from Building 3 to shallow soils as well as characterize shallow perched water.
SB-105	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	Vertically and horizontally delineate impacts and characterize shallow perched water.
SB-106	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-107	**On-Site**	Soil & Perched Water	5	Soil: 0.0-0.5 2.0-2.5; 4.0-4.5 GW: 0.0-5.0	3	1	At 2-ft Intervals		3	3	3	3	3	3	1	1	1	NA	NA	NA	NA	NA	NA	NA	Vertically and horizontally delineate impacts and characterize shallow perched water. Also used to delineate impacts in soil to the west of the ditch transect T125.
SB-108	**On-Site**	Soil & Perched Water	5	Soil: 0.0-0.5 2.0-2.5; 4.0-4.5 GW: 0.0-5.0	3	1	At 2-ft Intervals		3	3	3	3	3	3	1	1	1	NA	NA	NA	NA	NA	NA	NA	Vertically and horizontally delineate impacts in area of ephemeral stream.
SB-109	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	Vertically and horizontally delineate impacts and characterize shallow perched water.
SB-110	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-111	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-112	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	

TABLE 4

SAMPLING AND ANALYSIS PLAN
AOC-4 PERCHED WATER INVESTIGATION

Location ID	Location Type	Media	Target Boring Depth (ft bg)	Sample Depths (ft bg)	Proposed # of Soil Samples	Proposed # of Water Samples	Proposed Analyzed Parameters: Soil							Proposed Analyzed Parameters: Water									Rationale
							Field		Laboratory								Laboratory								
							Field PID Screen	Field pH Screen	VOCs	Total CN	Free CN	CrVI	Zinc	pH	Diss. Free CN (Field)	Diss. Zinc (Field)	pH (Field)	VOCs	CrVI	Diss. CN	Diss. Free CN	Total Zinc	Diss. Zinc	pH	
Subtotals:			150'		29	30	30		29	29	29	29	29	29	25	25	25	6	6	6	6	6	6	6	
SB-113	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	Vertically and horizontally delineate impacts and characterize shallow perched water in low-lying area with upwelling west of Building One.
SB-114	**Off-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-115	**Off-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-116	**Off-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-117	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	Vertically and horizontally delineate impacts and characterize shallow perched water.
SB-118	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-119	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-120	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-121	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-122	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-123	**On-Site**	Perched Water	5	GW: 0.0-5.0	0	1	At 2-ft Intervals		NA	NA	NA	NA	NA	NA	1	1	1	NA	NA	NA	NA	NA	NA	NA	
SB-135	**On-Site**	Soil & Perched Water	5	Soil: 0.0-0.5 2.0-2.5; 4.0-4.5 GW: 0.0-5.0	3	1	At 2-ft Intervals		3	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1	Boring location specifically addresses OH EPA Comment #13b regarding an ephemeral ditch receiving surface runoff.

SAMPLING AND ANALYSIS PLAN
AOC-4 PERCHED WATER INVESTIGATION

Location ID	Location Type	Media	Target Boring Depth (ft bg)	Sample Depths (ft bg)	Proposed # of Soil Samples	Proposed # of Water Samples	Proposed Analyzed Parameters: Soil								Proposed Analyzed Parameters: Water										Rationale
							Field		Laboratory						Field			Laboratory								
							Field PID Screen	Field pH Screen	VOCs	Total CN	Free CN	CrVI	Zinc	pH	Diss. Free CN (Field)	Diss. Zinc (Field)	pH (Field)	VOCs	CrVI	Diss. CN	Diss. Free CN	Total Zinc	Diss. Zinc	pH	
Subtotals:			150'		29	30	30		29	29	29	29	29	29	25	25	25	6	6	6	6	6	6	6	
SB-CF-150	**On-Site**	Soil & Perched Water	5	Soil: 0.0-0.5 2.0-2.5; 4.0-4.5 GW: 0.0-5.0	3	1	At 2-ft Intervals		3	3	3	3	3	3	NA	NA	NA	1	1	1	1	1	1	1	Boring advanced in the heart of the shallow perched water plume based on field delineation. Used to confirm source level concentrations.
SB-CF-151	**On-Site**	Soil & Perched Water	5	Soil: 0.0-0.5 2.0-2.5; 4.0-4.5 GW: 0.0-5.0	3	1	At 2-ft Intervals		3	3	3	3	3	3	NA	NA	NA	1	1	1	1	1	1	1	Borings advanced on the periphery of the field delineated perched water contamination to provide laboratory confirmation of delineation in soil and shallow perched water.
SB-CF-152	**On-Site**	Soil & Perched Water	5	Soil: 0.0-0.5 2.0-2.5; 4.0-4.5 GW: 0.0-5.0	3	1	At 2-ft Intervals		3	3	3	3	3	3	NA	NA	NA	1	1	1	1	1	1	1	
SB-CF-153	**On-Site**	Soil & Perched Water	5	Soil: 0.0-0.5 2.0-2.5; 4.0-4.5 GW: 0.0-5.0	3	1	At 2-ft Intervals		3	3	3	3	3	3	NA	NA	NA	1	1	1	1	1	1	1	
SB-CF-154	**On-Site**	Soil & Perched Water	5	Soil: 0.0-0.5 2.0-2.5; 4.0-4.5 GW: 0.0-5.0	3	1	At 2-ft Intervals		3	3	3	3	3	3	NA	NA	NA	1	1	1	1	1	1	1	

Abbreviations and Notes:
Diss. = Dissolved
CN = Cyanide
CrVI = Hexavalent Chromium
ftbg = feet below grade
GW = groundwater
OH EPA = Ohio Environmental Protection Agency
SB-CF = Confirmatory Soil Boring

TABLE 5
SAMPLING AND ANALYSIS PLAN
SITEWIDE GROUNDWATER

Location ID	Location Type	Top of Well Screen (ft amsl)	Bottom of Well Screen (ft amsl)	# of Water Samples	Proposed Parameters: Water						Rationale
					CVOCs	Free CN	Total CN	CrVI	Zinc & Lead	Diss. Zinc & Lead	
			Subtotals:	17	17	17	17	17	17	17	
MW-1	Groundwater	1124.2	1114.2	1	1	1	1	1	1	1	Existing monitoring well network used to establish groundwater contamination extents, potentiometric surface, and groundwater flow direction.
MW-2	Groundwater	1122.5	1112.5	1	1	1	1	1	1	1	
MW-3	Groundwater	1117.7	1107.7	1	1	1	1	1	1	1	
MW-4	Groundwater	1119.6	1109.6	1	1	1	1	1	1	1	
MW-5	Groundwater	1121.0	1111.0	1	1	1	1	1	1	1	
MW-6	Groundwater	1119.3	1109.3	1	1	1	1	1	1	1	
MW-7	Groundwater	1117.5	1107.5	1	1	1	1	1	1	1	
MW-8	Groundwater	1119.8	1109.8	1	1	1	1	1	1	1	
MW-9	Groundwater	1119.4	1109.4	1	1	1	1	1	1	1	
MW-10	Groundwater	1117.8	1107.8	1	1	1	1	1	1	1	
MW-11	Groundwater	1113.8	1103.8	1	1	1	1	1	1	1	
MW-12	Groundwater	1118.9	1108.9	1	1	1	1	1	1	1	
MW-13	Groundwater	1118.8	1108.8	1	1	1	1	1	1	1	
MW-14	Groundwater	1116.6	1106.6	1	1	1	1	1	1	1	
MW-15	Groundwater	1119.0	1109.0	1	1	1	1	1	1	1	
MW-16	Groundwater	TBD (GW Interface)	TBD (GW Interface)	1	1	1	1	1	1	1	Monitoring wells proposed to be installed within Building One footprint to characterize the nature and extent of contaminated groundwater.
MW-17	Groundwater	TBD (GW Interface)	TBD (GW Interface)	1	1	1	1	1	1	1	

TABLE 5
SAMPLING AND ANALYSIS PLAN
SITEWIDE GROUNDWATER

Location ID	Location Type	Top of Well Screen (ft amsl)	Bottom of Well Screen (ft amsl)	# of Water Samples	Proposed Parameters: Water						Rationale
					CVOCs	Free CN	Total CN	CrVI	Zinc & Lead	Diss. Zinc & Lead	
			Subtotals:	17	17	17	17	17	17	17	
MW-18	**Groundwater**	TBD (GW Interface)	TBD (GW Interface)	1	1	1	1	1	1	1	Monitoring wells proposed to be installed within Building One footprint to characterize the nature and extent of contaminated groundwater.
MW-19	**Groundwater**	TBD (GW Interface)	TBD (GW Interface)	1	1	1	1	1	1	1	
MW-20	**Groundwater**	TBD (GW Interface)	TBD (GW Interface)	1	1	1	1	1	1	1	Monitoring well proposed to be installed east of Building One to characterize the nature and extent of contaminated groundwater.
MW-21	**Groundwater**	TBD (GW Interface)	TBD (GW Interface)	1	1	1	1	1	1	1	Monitoring well proposed to be installed west of Builiding One to characterize the nature and extent of contaminated groundwater.
MW-22	**Groundwater**	TBD (GW Interface)	TBD (GW Interface)	1	1	1	1	1	1	1	Monitoring well proposed to be installed southeast of Building One to characterize the nature and extent of contaminated groundwater.

Abbreviations and Notes:

Diss. = Dissolved
CN = Cyanide
CrVI = Hexavalent Chromium
CVOCs = Chlorinated Volatile Organic Compounds (TCE, 1,1-DCE, cDCE, tDCE, VC)
ft amsl = feet above mean sea level
GW = groundwater
TBD = To Be Determined based on field conditions

TCE = Trichloroethene
1,1-DCE = 1,1-Dichloroethene
cDCE = cis-1,2-dichloroethene
tDCE = trans-1,2-dichloroethene
VC = vinyl chloride

TABLE 6

SAMPLING AND ANALYSIS PLAN
BUILDING ONE INVESTIGATION

Location ID	Location Type	Media	Target Boring Depth (ft bg)	Sample Depths (ft bg)	Max # of Soil Samples	Max # of Water Samples	Proposed Analyzed Parameters: Soil					Proposed Analyzed Parameters: Water							Rationale
							CVOCs	Free CN	Total CN	CrVI	Zinc	CVOCs	Free CN	Total CN	CrVI	Zinc	Diss. Zinc	Field pH	
				Subtotals:	20	4	20	20	20	20	20	3	3	3	4	4	4	4	
SB-124 (MW-16)	**Building One Footprint**	Surface and Subsurface Soil	28	0.0-2.0; High pH/PID	2	NA	2	2	2	2	2	NA	NA	NA	NA	NA	NA	NA	Vertically and horizontally delineate impacts, characterize shallow soils, and characterize groundwater contamination within the Building One footprint.
SB-125 (MW-17)	**Building One Footprint**	Surface and Subsurface Soil	28	0.0-2.0; High pH/PID	2	NA	2	2	2	2	2	NA	NA	NA	NA	NA	NA	NA	
SB-126 (MW-18)	**Building One Footprint**	Surface and Subsurface Soil	28	0.0-2.0; High pH/PID	2	NA	2	2	2	2	2	NA	NA	NA	NA	NA	NA	NA	
SB-127(-GW)	**Building One Footprint**	Surface and Subsurface Soil & Grab GW	28	0.0-2.0; High pH/PID GW: At Interface	2	1	2	2	2	2	2	1	1	1	1	1	1	1	
SB-128(-GW)	**Building One Footprint**	Surface and Subsurface Soil & Grab GW	28	0.0-2.0; High pH/PID GW: At Interface	2	1	2	2	2	2	2	1	1	1	1	1	1	1	
SB-129 (MW-19)	**Building One Footprint**	Surface and Subsurface Soil	28	0.0-2.0; High pH/PID	2	NA	2	2	2	2	2	NA	NA	NA	NA	NA	NA	NA	
SB-130(-GW)	**Building One Footprint**	Surface and Subsurface Soil & Grab GW	28	0.0-2.0; High pH/PID GW: At Interface	2	1	2	2	2	2	2	1	1	1	1	1	1	1	Vertically and horizontally delineate impacts, characterize shallow perched water and shallow soil, characterize groundwater contamination, and characterize potential contamination from SWMU-2 area.
SB-131	**Building One Footprint**	Surface and Subsurface Soil	5	0.0-2.0; High pH/PID GW: 0.0-0.5	2	1	2	2	2	2	2	1 (Full List VOC)	1 (Diss. Only)	1 (Diss. Only)	1	1	1	1	
SB-132 (MW-20)	**East of Buiding One**	Surface and Subsurface Soil	28	High pH/PID	1	NA	1	1	1	1	1	NA	NA	NA	NA	NA	NA	NA	Evaluate soils from monitoring well installation for waste characterization and disposal.
SB-133 (MW-21)	**West of Building One**	Surface and Subsurface Soil	28	0.0-2.0; High pH/PID	2	NA	2	2	2	2	2	NA	NA	NA	NA	NA	NA	NA	Evaluate shallow soil contamination and monitoring well installation spoils for waste characterization and disposal.
SB-134 (MW-22)	**Southeast of Buiding One**	Surface and Subsurface Soil	28	High pH/PID	1	NA	1	1	1	1	1	NA	NA	NA	NA	NA	NA	NA	Evaluate soils from monitoring well installation for waste characterization and disposal.

Abbreviations and Notes:
Diss. = Dissolved
CN = Cyanide
CrVI = Hexavalent Chromium
CVOCs = Chlorinated Volatile Organic Compounds (TCE, 1,1-DCE, cDCE, tDCE, VC)
ft bg = feet below grade
GW = groundwater
PID = Photoionization Detector
SWMU = Solid Waste Management Unit

TCE = Trichloroethene
1,1-DCE = 1,1-Dichloroethene
cDCE = cis-1,2-dichloroethene
tDCE = trans-1,2-dichloroethene
VC = vinyl chloride

ATTACHMENT D

LEVEL I AND LEVEL II ECOLOGICAL RISK ASSESSMENTS

Level I Ecological Risk Assessment

Material Sciences Corporation Parcel and Adjacent Wetland, Canfield, Ohio

Prepared for

August Mack Environmental
7830 North Central Drive, Suite B
Lewis Center, OH 43035

Prepared by

Integral Consulting Inc.
8742 E. Washington, # 115
Chagrin Falls, OH 44022

May 2025

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ACRONYMS AND ABBREVIATIONS

August Mack	August Mack Environmental
EPA	U.S. Environmental Protection Agency
Integral	Integral Consulting Inc.
MAD Scientist	MAD Scientist Associates LLC
MSC	Material Sciences Corporation
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
ORAM	Ohio Rapid Assessment Method
RCRA	Resource Conservation and Recovery Act
RSL	regional screening level
USFWS	U.S. Fish and Wildlife Service

1 INTRODUCTION

Integral Consulting Inc. (Integral) has prepared this Level I ecological risk assessment on behalf of August Mack Environmental (August Mack) for the Material Sciences Corporation (MSC) parcel and adjacent wetland in Canfield, Ohio (Figures 1 and 2). The MSC parcel is located at 460 West Main St. The adjacent wetland is located north of the facility on parcels owned by the Mill Creek Metroparks. For the purposes of this Level I ecological risk assessment, the term "site" refers to the MSC parcel and the term "assessment area" refers to the MSC parcel and a portion of the adjacent wetland (Figure 3).

MSC operates a metal plating facility that specializes in electro galvanizing, chemical coating, and painting. In July 2024, an incident occurred at the site that prompted additional investigation and interim remediation of chemicals along the Adjacent Ditch.[1]

This Level I ecological risk assessment has been conducted to support the investigation and remediation efforts in the assessment area. A Level I ecological risk assessment is a scoping level assessment that is used to evaluate whether significant ecological resources are present (or could be present) in the assessment area and whether site releases of chemicals have occurred. This report follows the Ohio Environmental Protection Agency (Ohio EPA) guidance and report outline (Ohio EPA 2018).

[1] https://www.mscresponse.com/

2 EXISTING DATA SUMMARY

In accordance with Ohio EPA guidance (Ohio EPA 2018), this assessment was based on existing data, including the August Mack *Initial Site Investigation Report* (August Mack 2024), assessment area photos, aerial imagery, and a site visit, which included a habitat evaluation and a wetland delineation.

2.1 ASSESSMENT AREA LOCATION

The MSC site is located in Mahoning County at 460 West Main Street, Canfield, Ohio (centered at 41.027837, –80.777932) and is bordered to the north and east by the Mill Creek Metroparks bikeway, to the west by Hometown Produce Company and the Mill Creek Metroparks property, and to the south by Route 224 Main Street (Figure 3). The 13.4-acre assessment area includes a 4.9-acre facility/engineered area, approximately 6 acres of terrestrial forested habitat, approximately 0.3 acres of scrub shrub habitat, approximately 0.6 acres of stream, and approximately 1.6 acres of wetland habitat (Figure 4).

2.2 SITE HISTORY

The MSC Canfield facility building was constructed in 1950 for the Life Time Products Corporation, Coated Steel Division (Ohio EPA and MSC 2024). Manufacturing operations included surface coating, machining, spray painting, and metal fabricating (Ohio EPA and MSC 2024). In the 1950s or 1960s, the facility became known as Canfield Steel, which was purchased by Pittsburgh Steel Corporation in 1968 to form the Pittsburgh-Canfield Corporation. The facility was acquired in 2013 by New Star Metals, a predecessor to MSC.[2] The facility is still operational.

2.3 LAND AND WATER USES

The developed portions of the assessment area are approximately 4.9 acres of the southern portion of the site that includes facility buildings, paved parking areas, and gravel access areas. The southern building is used for offices and for production. The northern building is used for storage. Trucks use the docking area in the southwestern portion of the property.

Approximately 6 acres of the site consist of undeveloped forested upland habitat. The upland habitat within the assessment area abuts the Hometown Produce Company and additional forested upland habitat owned by Mill Creek Metroparks to the west of the assessment area.

[2] The facility also previously operated as the Canfield Coating Company.

Two ditches are present on the MSC parcel—the unnamed ditch to the west of the facility and Adjacent Ditch to the east of the facility. Water from both ditches flows north to a wetland and feeds into Sawmill Creek. The water level in the wetland is controlled by a gated culvert that allows water to pass under the bikeway into Sawmill Creek. A Level I ecological risk assessment for the Sawmill Creek is presented separately.

MSC does not expect changes to land or water uses in the assessment area.

2.4 KNOWN OR SUSPECTED HAZARDOUS SUBSTANCE RELEASES

In 1992, the U.S. Environmental Protection Agency (EPA) issued a preliminary assessment/ visual site inspection assessment report in response to a permit application. Of the 12 solid waste management units identified, EPA recommended that the former waste chromate solution treatment area undergo closure under the Resource Conservation and Recovery Act (RCRA). Documentation was not available to indicate the solid waste management unit locations, potential overlap with the current assessment area, or any implemented actions.

In 2008, Ohio EPA reached a settlement with Canfield Metal Coating Corporation for past hazardous waste violations and issued an administrative consent order[3] for violations that occurred at 460 West Main Street in Canfield. The settlement included a $10,300 penalty paid to the state's hazardous waste cleanup fund and the Ohio EPA Clean Diesel School Bus Program.

In 2024, MSC and state and local agencies responded to a report of the release of process fluids into Adjacent Ditch. MSC, the Ohio EPA, and the Cardinal Joint Fire Department collected and contained the fluid as part of an emergency response. However, during the emergency response, the responders observed conditions that indicated some fluid had leaked from the facility over a period of several years and required additional emergency response actions. As part of the emergency response, Ohio EPA approved a plan to line the adjacent ditch to prevent contact of surface water with impacted sediments.

2.5 CHEMICALS OF INTEREST

August Mack conducted groundwater, soil,[4] and surface water sampling in 2024 to investigate the nature and extent of chemicals present in the site and assessment area. Sample-specific results are presented in Attachment A and in the *Initial Site Investigation Report* (August Mack 2024). Surface water and soil data from August Mack (2024) indicated that primary chemicals

[3] https://dam.assets.ohio.gov/image/upload/epa.ohio.gov/Portals/32/pdf/Signed%20DFFO.web.Canfield%20Metal%20Coating%20Corp.%2009.03.08.pdf

[4] The initial sampling classified all solids samples as soil. However, for the purposes of the ecological risk assessment, solids within the wetland and ditch areas are considered to be sediment.

of concern in the assessment area were cyanide, zinc, hexavalent chromium, and trichloroethene, as follows:

- **Soil/Sediment**[5]
  - Hexavalent chromium and zinc in sediment within the Adjacent Ditch exceeded the EPA residential regional screening level (RSL).
  - Total cyanide in sediment within the Adjacent Ditch exceeded the EPA industrial RSL.
  - Total cyanide and zinc in the wetland sediment exceeded the EPA residential RSL.
  - Arsenic in Adjacent Ditch sediment and wetland sediment exceeded residential and/or industrial RSLs, but has not historically been used at the site and concentrations are generally consistent with background concentrations.
  - Other chemicals in Adjacent Ditch that exceeded the 2024 EPA residential RSLs for soil were benzo[*a*]pyrene and benzo[*b*]fluoranthene.
  - Other chemicals in the Adjacent Ditch and/or the wetland that exceeded the 2024 EPA industrial RSLs for soil were benz[*a*]anthracene, benzo[*a*]pyrene, benzo[*b*]fluoranthene, dibenz[*a,h*] anthracene, cadmium, and lead.
  - High pH (8.3 to 11.7) was measured within the Adjacent Ditch.
- **Surface Water**
  - Zinc in the Adjacent Ditch exceeded the Ohio River Basin Human Health Tier 1 Criteria for non-drinking surface water.
  - Other chemicals that exceeded Ohio River Basin Human Health Tier 1 Criteria for non-drinking surface water were mercury, benz[*a*]anthracene, benzo[*a*]pyrene, benzo[*b*]fluoranthene, benzo[*k*]fluoranthene, and indeno[1,2,3-*cd*]pyrene.

2.6 THREATENED AND ENDANGERED SPECIES

Integral requested information from the U.S. Fish and Wildlife Service (USFWS) and Ohio Department of Natural Resources (ODNR) on the presence and distribution of threatened and/or endangered species in the assessment area. The information obtained from this request is included in Attachment B.[6]

Based on the information received, the assessment area is located within the range of four federally listed species: tricolored bat (*Perimyotis subflavus*, state endangered), northern long-

[5] These data were not compared to ecological toxicity benchmarks in August Mack (2024).

[6] The ODNR environmental review has not been received at the time of this report.

eared bat (*Myotis septentrionalis*, federally threatened and state endangered), Indiana bat (*M. sodalis*, federally and state endangered), and little brown bat (*M. lucifugus*, state endangered). USFWS has previously stated that Indiana bats are assumed to be present in Ohio during the summer wherever suitable habitat occurs unless a presence/absence survey has been performed to document their absence (USFWS 2007).

In addition to the four bat species, the monarch butterfly (*Danaus plexippus*) is a candidate federally listed species that may be present in the area.

3 SITE VISIT SUMMARY

Integral and MAD Scientist Associates LLC (MAD Scientist) conducted a site visit on November 21, 2024. Integral identified type and extent of habitat, species present in the assessment area or in the vicinity, and/or signs of ecological use. A photo log is included as Attachment C, and the Ecological Scoping Checklist is provided in Attachment D. MAD Scientist conducted a wetland delineation and an assessment of wetland quality using the Ohio Rapid Assessment Method (ORAM, version 5.0) from Ohio EPA (2001). The wetland delineation report is included as Attachment E.

3.1 ECOLOGICAL AND HABITAT FEATURES

Approximately 4.9 acres (37 percent) of the assessment area includes developed and engineered areas, which include paved parking lots, facility buildings, and gravel areas. No vegetation or wildlife was observed in this area.

Terrestrial wooded habitat makes up 6 acres (45 percent) of the assessment area. This deciduous forested habitat is dominated by oaks (*Quercus* spp.), hickories (*Carya* spp.), and maples (*Acer* spp.). The mature trees have a typical diameter at breast height of 12 in. During the site visit, squirrels were observed, and deer signs (game paths prints, tree bark scraping at approximately 3 to 4 ft above ground surface indicating rutting) were noted in the forested area. Birds seen or heard during the site visit included American crow, song sparrow, northern cardinal, swamp sparrow, and blue jay.

Near the bikeway, approximately 0.3 acres of scrub shrub habitat (2 percent) is characterized by shrubs, grasses, and poison ivy.

Approximately 1.6 acres (12 percent) of the assessment area is wetland habitat. The wetland was delineated by MAD Scientist on November 21, 2024, and is classified as a palustrine emergent wetland.[7] Water level in the wetland is controlled by a water control structure at the base of the culvert located under the bikeway. The water control structure appears to be located on the Mill Creek Metroparks property. The wetland is dominated by invasive species including stands of *Phragmites australis* and reed canary grass. Other typical wetland vegetation observed included *Carex* species. When present, this vegetation was dense and tall (greater than 5 ft). A shrub buffer along the southeastern edge of the wetland includes red-osier dogwood, bush honeysuckle, and multiflora rose.

Approximately 0.6 acres (4 percent) of the assessment area is a ditch, which, based on shape and alignment, appears to have been straightened. No water was present in the ditch during

[7] The acreage presented in the wetland delineation (Attachment E) is larger than the acreage presented in this report because it includes a large portion of the wetland that is located outside of the assessment area.

the site visit, which occurred after a ditch bypass had been installed as part of the emergency response actions. The area along the bikeway includes grasses and poison ivy.

Vegetation conditions observed in the assessment area were characteristic of the fall season. Because the site visit occurred in late November, many understory trees and emergent vegetation had senesced or died back.

3.2 ECOLOGICALLY IMPORTANT SPECIES/HABITATS

No rare, threatened, or endangered species were observed during the site visit.

The wetland is classified as a category 2 wetland and has an ORAM score of 47 (Attachment E). Category 2 wetlands "…support moderate wildlife habitat, or hydrological or recreational functions," and are "…generally without the presence of, or habitat for, rare, T&E species" (Ohio EPA 2001). During the site visit, Integral observed standing snags and dead trees, which may be suitable habitat for threatened or endangered bat species (see Section 2.6).

3.3 EXPOSURE PATHWAYS

Ecological stressors may potentially be present in soil, surface water, and sediment throughout the assessment area. The evaluation of potential harm is provided in Attachment F.

4 RECOMMENDATIONS

Based upon the known release of hazardous substances that were detected in Adjacent Ditch and the wetland area, Integral recommends a Level II ecological risk assessment to screen for potential risk to ecological receptors.

5 REFERENCES

August Mack. 2024. Initial site investigation report. Material Sciences Corporation. August Mack Environmental. December 12.

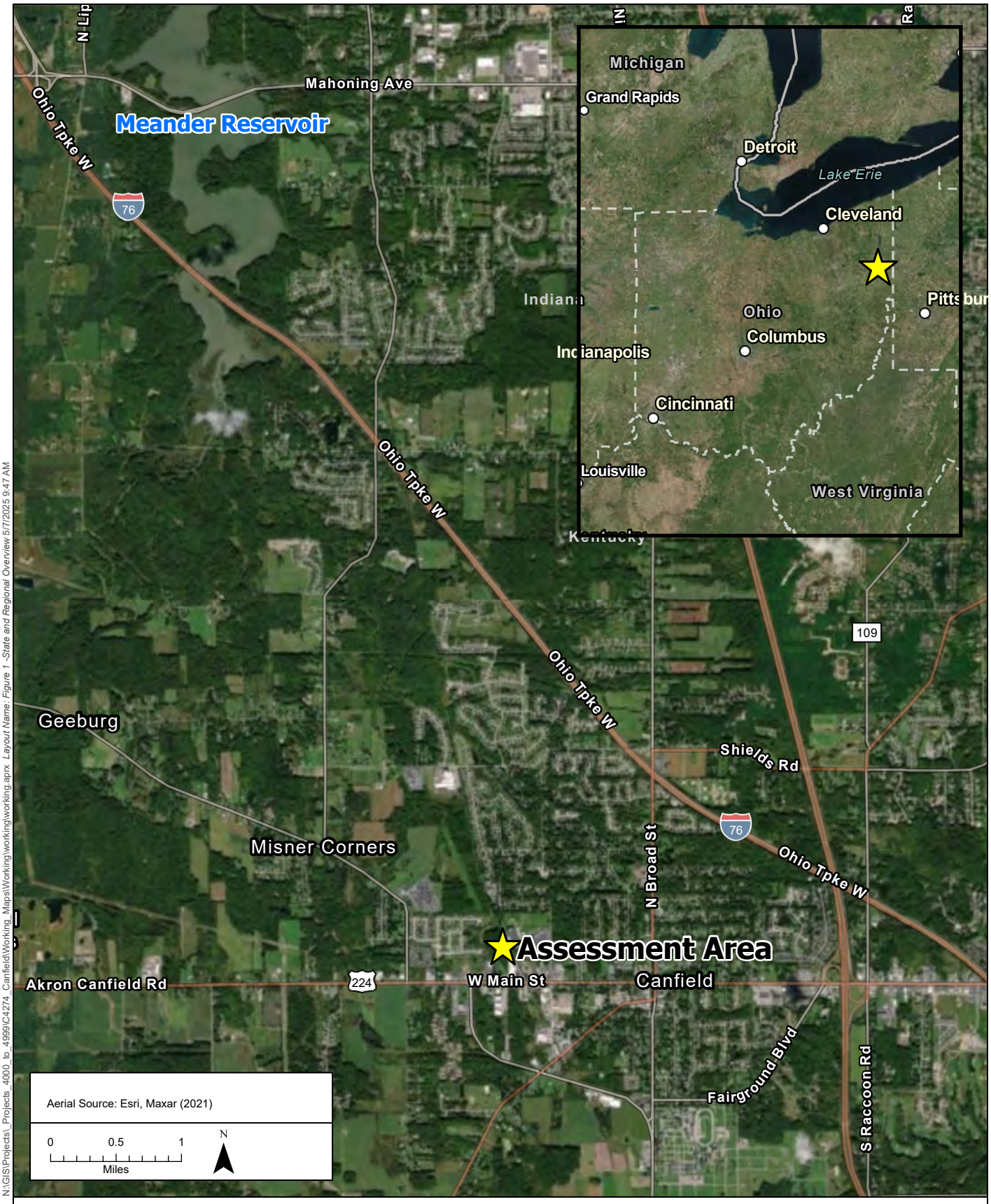
Ohio EPA. 2018. Ecological risk assessment guidance document. Ohio Environmental Protection Agency, Division of Environmental Response and Revitalization Assessment, Remediation and Corrective Action Section. July.

Ohio EPA. 2001. Ohio rapid assessment method for wetlands. Version 5.0 Final. Ohio Environmental Protection Agency. Columbus, Ohio.

Ohio EPA and MSC. 2024. Directors final findings and orders in the matter of Material Sciences Corporation. Ohio Environmental Protection Agency and Material Sciences Corporation. December 31.

USFWS. 2007. Biological opinion on the Ohio Department of Transportation's statewide transportation program for the federally listed endangered Indiana bat (*Myotis sodalis*). Submitted to the Federal Highway Administration. U.S. Fish and Wildlife Service. January 26.

FIGURES



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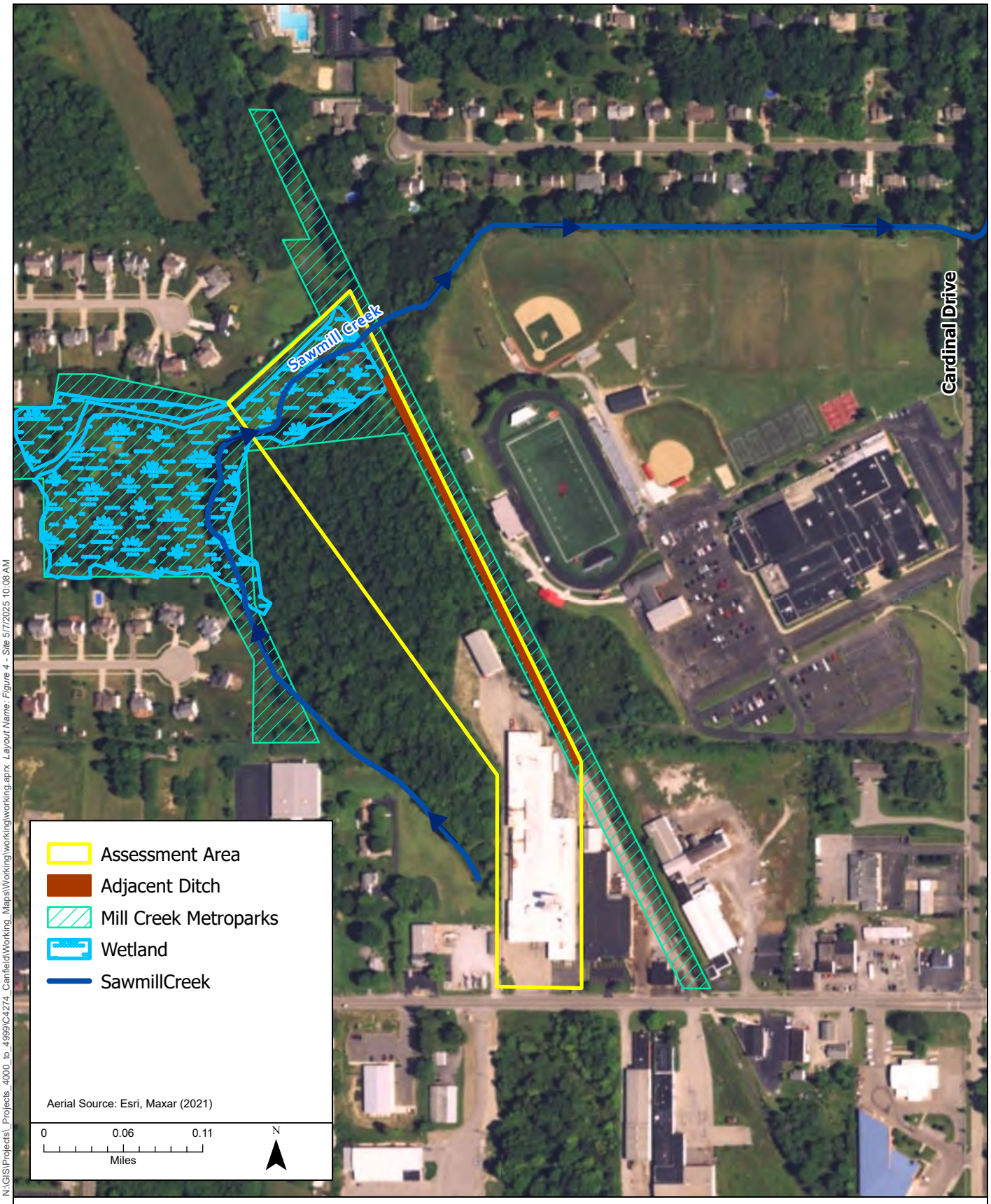
Figure 1. Regional Map of Assessment Area
Canfield, Ohio



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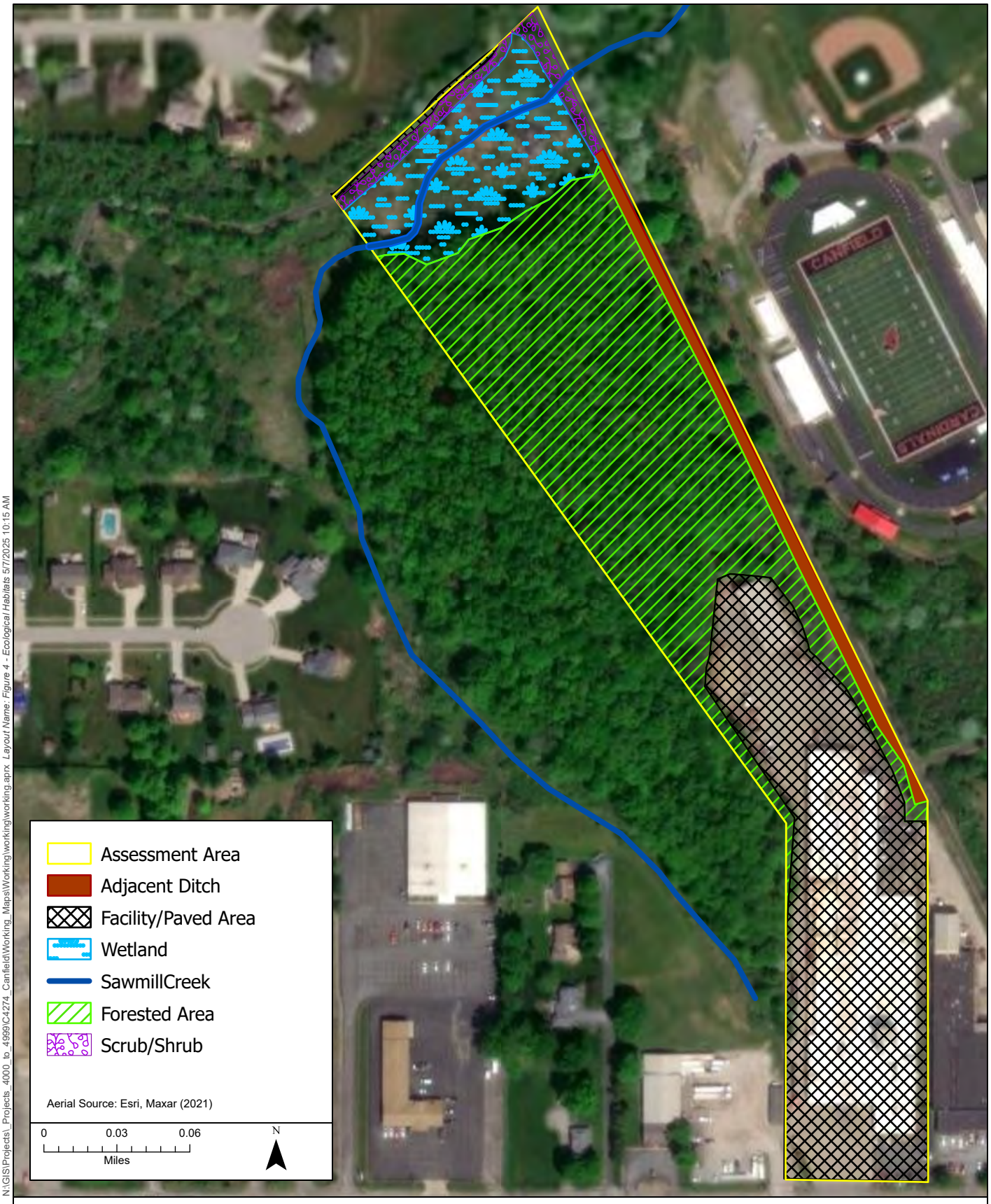
Figure 2. Local Map of Assessment Area and Adjacent Properties
Canfield, Ohio



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Figure 3. Assessment Area Features
MSC Parcel and Wetland
Canfield, Ohio



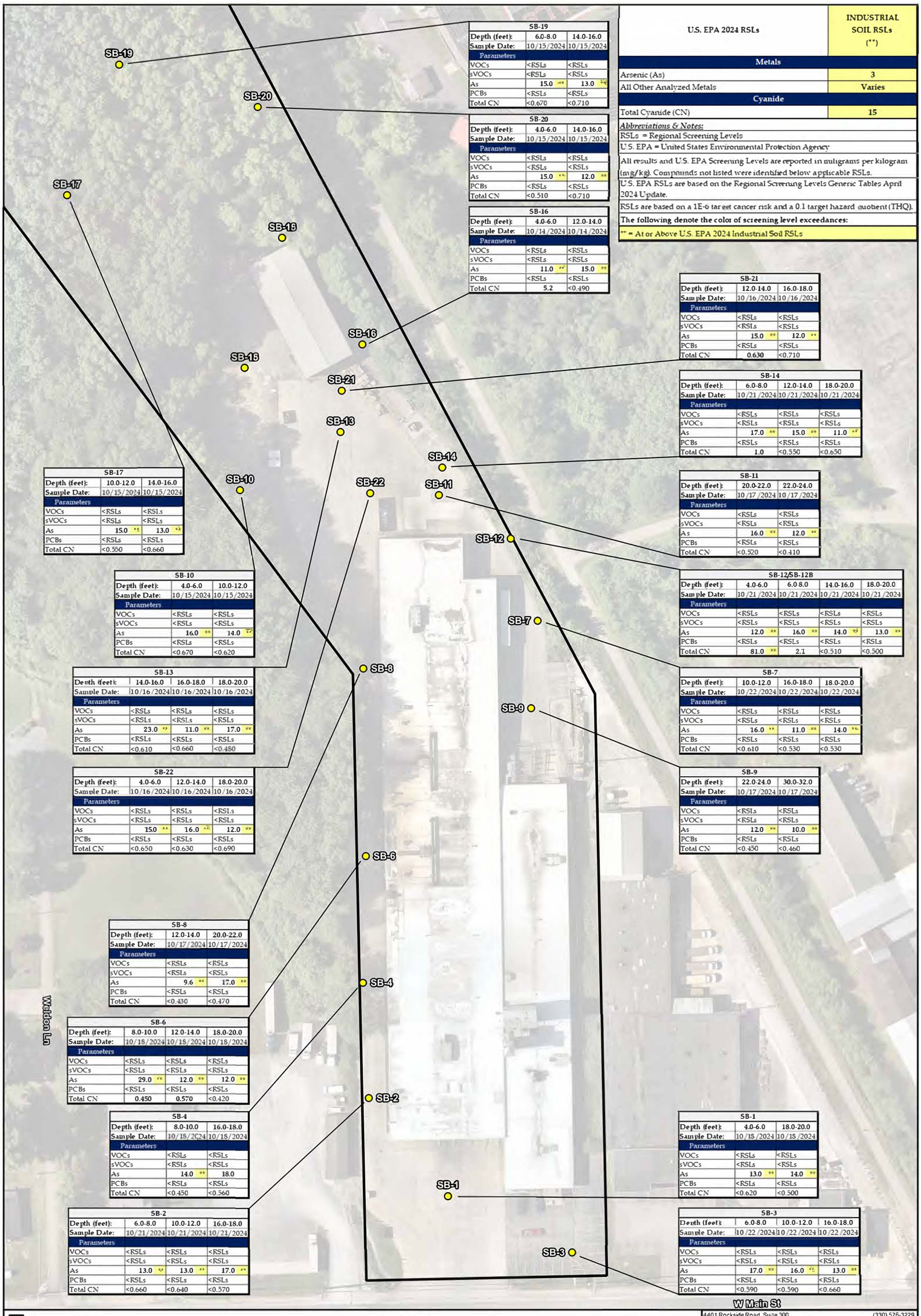
N:\GIS\Projects_Projects_4000_to_4999\C4274_Canfield\Working_Maps\Working\working\working.aprx Layout Name: Figure 4 - Ecological Habitats 5/7/2025 10:15 AM

integral consulting inc.

Figure 4. Ecological Habitats within Assessment Area
Canfield, Ohio

Attachment A

Extent of Hazardous Substances in the Assessment Area



SB-19		
Depth (feet):	6.0-8.0	14.0-16.0
Sample Date:	10/15/2024	10/15/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	15.0 **	13.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.670	<0.710

SB-20		
Depth (feet):	4.0-6.0	14.0-16.0
Sample Date:	10/15/2024	10/15/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	15.0 **	12.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.510	<0.710

SB-16		
Depth (feet):	4.0-6.0	12.0-14.0
Sample Date:	10/14/2024	10/14/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	11.0 **	15.0 **
PCBs	<RSLs	<RSLs
Total CN	5.2	<0.490

U.S. EPA 2024 RSLs	INDUSTRIAL SOIL RSLs (**)
Metals	
Arsenic (As)	3
All Other Analyzed Metals	Varies
Cyanide	
Total Cyanide (CN)	15

Abbreviations & Notes:

RSLs = Regional Screening Levels

U.S. EPA = United States Environmental Protection Agency

All results and U.S. EPA Screening Levels are reported in milligrams per kilogram (mg/kg). Compounds not listed were identified below applicable RSLs.

U.S. EPA RSLs are based on the Regional Screening Levels Generic Tables April 2024 Update.

RSLs are based on a 1E-6 target cancer risk and a 0.1 target hazard quotient (THQ).

The following denote the color of screening level exceedances:

** = At or Above U.S. EPA 2024 Industrial Soil RSLs

SB-21		
Depth (feet):	12.0-14.0	16.0-18.0
Sample Date:	10/16/2024	10/16/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	15.0 **	12.0 **
PCBs	<RSLs	<RSLs
Total CN	0.630	<0.710

SB-14			
Depth (feet):	6.0-8.0	12.0-14.0	18.0-20.0
Sample Date:	10/21/2024	10/21/2024	10/21/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	17.0 **	15.0 **	11.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	1.0	<0.550	<0.650

SB-17		
Depth (feet):	10.0-12.0	14.0-16.0
Sample Date:	10/15/2024	10/15/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	15.0 **	13.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.550	<0.660

SB-11		
Depth (feet):	20.0-22.0	22.0-24.0
Sample Date:	10/17/2024	10/17/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	16.0 **	12.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.520	<0.410

SB-10		
Depth (feet):	4.0-6.0	10.0-12.0
Sample Date:	10/15/2024	10/15/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	16.0 **	14.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.670	<0.620

SB-12/SB-12B				
Depth (feet):	4.0-6.0	6.0 8.0	14.0-16.0	18.0-20.0
Sample Date:	10/21/2024	10/21/2024	10/21/2024	10/21/2024
Parameters				
VOCs	<RSLs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs	<RSLs
As	12.0 **	16.0 **	14.0 **	13.0 **
PCBs	<RSLs	<RSLs	<RSLs	<RSLs
Total CN	81.0 **	2.1	<0.510	<0.500

SB-13			
Depth (feet):	14.0-16.0	16.0-18.0	18.0-20.0
Sample Date:	10/16/2024	10/16/2024	10/16/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	23.0 **	11.0 **	17.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	<0.610	<0.660	<0.480

SB-7			
Depth (feet):	10.0-12.0	16.0-18.0	18.0-20.0
Sample Date:	10/22/2024	10/22/2024	10/22/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	16.0 **	11.0 **	14.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	<0.610	<0.530	<0.530

SB-22			
Depth (feet):	4.0-6.0	12.0-14.0	18.0-20.0
Sample Date:	10/16/2024	10/16/2024	10/16/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	15.0 **	16.0 **	12.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	<0.650	<0.630	<0.690

SB-9		
Depth (feet):	22.0-24.0	30.0-32.0
Sample Date:	10/17/2024	10/17/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	12.0 **	10.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.450	<0.460

SB-8		
Depth (feet):	12.0-14.0	20.0-22.0
Sample Date:	10/17/2024	10/17/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	9.6 **	17.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.430	<0.470

SB-6			
Depth (feet):	8.0-10.0	12.0-14.0	18.0-20.0
Sample Date:	10/18/2024	10/18/2024	10/18/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	29.0 **	12.0 **	12.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	0.450	0.570	<0.420

SB-4		
Depth (feet):	8.0-10.0	16.0-18.0
Sample Date:	10/18/2024	10/18/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	14.0 **	18.0
PCBs	<RSLs	<RSLs
Total CN	<0.450	<0.560

SB-1		
Depth (feet):	4.0-6.0	18.0-20.0
Sample Date:	10/18/2024	10/18/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	13.0 **	14.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.620	<0.500

SB-2			
Depth (feet):	6.0-8.0	10.0-12.0	16.0-18.0
Sample Date:	10/21/2024	10/21/2024	10/21/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	13.0 **	13.0 **	17.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	<0.660	<0.640	<0.570

SB-3			
Depth (feet):	6.0-8.0	10.0-12.0	16.0-18.0
Sample Date:	10/22/2024	10/22/2024	10/22/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	17.0 **	16.0 **	13.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	<0.590	<0.590	<0.660

Subject Property

Soil Sample

Nearmap Aerial Imagery: June 15, 2024

Material Sciences Corporation
Canfield

On-Site Soil Borings - Soil Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372	DATE: 12/12/2024
	SCALE: 1:1,000
FIGURE: 3	CREATED BY: CC

U.S. EPA 2024 RSLs	RESIDENT SOIL RSLs (*)	INDUSTRIAL SOIL RSLs (**)
Semi-Volatile Organic Compounds (sVOCs)		
Benzo(a)pyrene (BaP)	0.11	2
Benzo(b)fluoranthene (BbF)	1.1	21
Dibenz(a,h)anthracene (DBA)	0.11	2
Metals		
Arsenic (As)	0.68	3
Cadmium (Cd)	0.71	10
Chromium (Hexavalent) (Cr(VI))	0.3	6
Lead	200	800
Zinc (Zn)	2,300	35,000
Cyanide		
Total Cyanide (CN)	2.3	15

Abbreviations & Notes:

BRL = Below Laboratory Reporting Limits

RSLs = Regional Screening Levels

U.S. EPA = United States Environmental Protection Agency

Other analyzed compounds not listed were detected at concentrations below applicable RSLs (<RSLs).

Results and U.S. EPA Screening Levels are reported in milligrams per kilogram (mg/kg).

U.S. EPA RSLs are based on the Regional Screening Levels Generic Tables April 2024 Update.

RSLs are based on a 1E-6 target cancer risk and a 0.1 target hazard quotient (THQ)

The following denote the color of screening level exceedances:

* = At or Above U.S. EPA 2024 Resident Soil RSLs

** = At or Above U.S. EPA 2024 Industrial Soil RSLs

SB-35			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.220 *	0.110 *	<0.067
BbF	0.430	0.220	0.074
DBA	0.045	<0.082	<0.067
As	6.9 **	12.0 **	9.2 **
Cd	0.520	0.460	0.250
Cr(VI)	<6.0 E	<0.28	<2.3 E
Pb	29.0	32.0	24.0
Zn	21,000 *	1,500	1,200
Cyanide (Total)	860 **	14.0 *	8.5 *

SB-29			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.110 *	0.120 *	0.019
BbF	0.250	0.260	0.036
DBA	<0.094	<0.077	<0.053
As	7.3 **	9.2 **	5.6 **
Cd	0.500	0.500	0.170
Cr(VI)	<1.6 E	<1.4 E	<1.9 E
Pb	27.0	42.0	14.0
Zn	4,700 *	170	69.0
Cyanide (Total)	450 **	220 **	6.6 *

SB-30			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.230 *	0.066	0.023
BbF	0.420	0.110	0.042
DBA	0.047	<0.057	<0.050
As	7.0 **	9.2 **	8.3 **
Cd	0.430	0.240	0.240
Cr(VI)	<2.8 E	<2.0 E	<0.19
Pb	23.0	370 *	19.0
Zn	22,000 *	300	230
Cyanide (Total)	320 **	28.0 **	24.0 **

SB-31			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.480 *	0.087	0.030
BbF	0.960	0.150	0.057
DBA	0.088	<0.058	<0.073
As	8.2 **	11.0 **	10.0 **
Cd	0.350	0.320	0.140
Cr(VI)	<2.7 E	<2.2 E	<2.5 E
Pb	23.0	31.0	18.0
Zn	9,500 *	600	320
Cyanide (Total)	690 **	37.0 **	17.0 **

SB-28			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.230 *	0.033	0.018
BbF	0.460	0.065	0.031
DBA	0.042	<0.056	<0.049
As	8.7 **	6.6 **	11.0 **
Cd	0.420	0.440	0.064
Cr(VI)	<3.7 E	<1.9 E	<0.17
Pb	28.0	31.0	11.0
Zn	2,300 *	240	45.0
Cyanide (Total)	270 **	9.0 *	6.9 *

SB-26			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.270 *	0.035	<0.050
BbF	0.550	0.055	<0.050
DBA	0.058	<0.058	<0.050
As	12.0 **	6.0 **	7.8 **
Cd	0.480	0.250	0.100
Cr(VI)	<3.5 E	<2.1 E	<0.88 E
Pb	30.0	28.0	9.9
Zn	2,300 *	99.0	60.0
Cyanide (Total)	380 **	20.0 **	9.9 *

SB-36			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.410 *	0.370 *	0.051
BbF	0.820	0.780	0.087
DBA	0.083	0.078	<0.051
As	8.1 **	11.0 **	7.5 **
Cd	0.430	0.380	0.230
Cr(VI)	<2.3 E	<2.1 E	<0.18
Pb	26.0	27.0	21.0
Zn	20,000 *	810	290
Cyanide (Total)	700 **	6.5 *	<6.0 E

SB-32			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.350 *	0.310 *	0.040
BbF	0.750	0.560	0.082
DBA	0.072	0.053	<0.057
As	7.5 **	12.0 **	9.4 **
Cd	0.310	0.370	0.098
Cr(VI)	<2.2 E	<2.1 E	<2.1 E
Pb	25.0	32.0	17.0
Zn	21,000 *	1,700	790
Cyanide (Total)	700 **	260 **	60.0 **

SB-33			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.470 *	0.120 *	<0.048
BbF	1.1 *	0.200	<0.048
DBA	0.097	0.020	<0.048
As	11.0 **	14.0 **	11.0 **
Cd	0.390	0.120	0.078
Cr(VI)	<4.1 E	0.250	<0.17
Pb	29.0	15.0	13.0
Zn	7,600 *	280	190
Cyanide (Total)	390 **	36.0 **	8.1 *

SB-25			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.350 *	0.100	<0.050
BbF	0.690	0.200	<0.050
DBA	0.069	<0.078	<0.050
As	17.0 **	9.8 **	4.1 **
Cd	0.520	0.500	0.048
Cr(VI)	<4.1 E	<1.3 E	<0.90 E
Pb	28.0	40.0	9.4
Zn	16,000 *	380	81.0
Cyanide (Total)	860 **	74.0 **	22.0 **

SB-24			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.590 *	0.130 *	<0.050
BbF	1.3 *	0.250	0.026
DBA	0.140 *	0.027	<0.050
As	7.8 **	10.0 **	7.6 **
Cd	0.310	0.520	0.120
Cr(VI)	<2.3 E	<1.0 E	<0.89 E
Pb	22.0	36.0	10.0
Zn	24,000 *	620	150
Cyanide (Total)	940 **	24.0 **	30.0 **

SB-27			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.300 *	0.280 *	0.018
BbF	0.610	0.460	0.035
DBA	0.066	0.060	<0.051
As	9.3 **	19.0 **	8.8 **
Cd	0.330	0.870 *	0.110
Cr(VI)	13.0 **	<0.22	<0.18
Pb	26.0	83.0	13.0
Zn	7,500 *	1,400	360
Cyanide (Total)	930 **	100 **	100 **

SB-23			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.370 *	0.430 *	<0.049
BbF	0.760	0.800	0.028
DBA	0.068	0.086	<0.049
As	11.0 **	12.0 **	15.0 **
Cd	0.260	0.190	0.051
Cr(VI)	<0.23	<1.0 E	<0.17
Pb	22.0	20.0	13.0
Zn	9,400 *	2,100	260
Cyanide (Total)	600 **	240 **	87.0 **

SB-34			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.610 *	0.035	0.021
BbF	1.1 *	0.065	0.039
DBA	0.120 *	<0.049	<0.047
As	10.0 **	14.0 **	12.0 **
Cd	0.390	0.088	0.120
Cr(VI)	<1.1 E	<0.16	<0.16
Pb	28.0	14.0	13.0
Zn	3,700 *	180	200
Cyanide (Total)	500 **	63.0 **	21.0 **

SB-35 SB-29 SB-30 SB-31 SB-28 SB-26 SB-36 SB-32 SB-25 SB-27 SB-24 SB-33 SB-34 SB-23

Soil Sample

Nearmap Aerial Imagery: June 15, 2024

Material Sciences Corporation Canfield

Surface Water Feature - Soil Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 10 20 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372 | DATE: 12/10/2024

SCALE: 1:250

FIGURE: 5 | CREATED BY: CC

Transect 1125	East Bank			Center	West Bank	
Depth (feet):	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	0.0-0.5	2.0-2.5
Sample Date:	10/03/2024	10/06/2024	10/06/2024	10/03/2024	10/03/2024	10/06/2024
Parameters						
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	0.560	<0.048	<0.047	0.220	0.088	0.018
BaP	0.750 *	<0.048	0.018	0.310 *	0.110 *	0.018
BbF	1.3 *	0.031	0.038	0.640	0.210	0.031
DBA	0.150 *	<0.048	<0.047	0.069	<0.052	<0.049
IP	0.470	0.017	0.015	0.240	0.090	0.015
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	13.0 **	25.0 **	13.0 *^3	9.9 **	11.0 **	14.0 **
Cd	0.320	0.051	0.081	0.260	0.200	0.130
Cr(VI)	<0.200	<0.170	<0.170 E	<2.1 E	<0.18	<0.18
Cu	26.0	19.0	15.0	3.3	11.0	17.0
Zn	740	270	600	4,500 *	660	160
Cyanide (Total)	140 *^3	16.0 *^3	18.0 *^3	570 *^3	66.0 *^3	<17 E

Transect 1100 SS#5/5N		
Depth (feet):	0.0-0.5	2.0-2.5
Sample Date:	07/24/2024	08/08/2024
Parameters		
VOCs	NA	NA
BaA	NA	NA
BaP	NA	NA
BbF	NA	NA
DBA	NA	NA
IP	NA	NA
PCBs	NA	NA
As	16.0 **	13.0 **
Cd	0.610	0.550
Cr(VI)	NA	NA
Cu	16.0	15.0
Zn	530	380
Cyanide (Total)	89.0 *^3	38.0 **

Transect 1000	East Bank	Center			West Bank	
Depth (feet):	0.0-0.5	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	2.0-2.5
Sample Date:	10/03/2024	10/03/2024	10/06/2024	10/06/2024	10/03/2024	10/06/2024
Parameters						
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	0.620	0.060	0.036	0.150	0.110	<0.043
BaP	0.680 *	0.067	0.029	0.130 *	0.140 *	<0.043
BbF	1.3 *	0.120	0.042	0.170	0.220	<0.045
DBA	0.140 *	<0.051	<0.061	0.036	<0.054	<0.045
IP	0.350	0.016	<0.064	0.055	0.110	<0.045
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	9.7 **	15.0 **	28.0 *^5	11.0 **	9.3 **	15.0 *^3
Cd	1.0 *	0.150	0.270	0.067	0.310	0.730
Cr(VI)	<2.2 E	<0.18	<0.22	<0.54 E	<0.180	<0.16
Cu	27.0	1.9	26.0	18.0	15.0	17.0
Zn	140	6.600 *	160	95.0	280	75.0
Cyanide (Total)	29.0 *^3	1.9	11.0 *	21.0 **	370 *^3	6.3 *

U.S. EPA 2024 RSLs	RESIDENT SOIL RSLs (*)	INDUSTRIAL SOIL RSLs (**)
Semi-Volatile Organic Compounds (sVOCs)		
Benzo(a)anthracene (BaA)	1.1	21
Benzo(a)pyrene (BaP)	0.11	2
Benzo(b)fluoranthene (BbF)	1.1	21
Dibenz(a,h)anthracene (DBA)	0.11	2
Indeno(1,2,3-cd)pyrene (IP)	1.1	21
Metals		
Arsenic (As)	0.68	3
Cadmium (Cd)	0.71	10
Chromium (Hexavalent) (Cr(VI))	0.3	6
Copper (Cu)	310	4700
Zinc (Zn)	2,300	35,000
Cyanide		
Total Cyanide (CN)	2.3	15

Abbreviations & Notes:

BRL = Below Laboratory Reporting Limits; PCB = Polychlorinated Biphenyls

RSLs = Regional Screening Levels; VOCs = Volatile Organic Compounds

U.S. EPA = United States Environmental Protection Agency

Other analyzed compounds not listed were detected at concentrations below applicable RSLs (<RSLs)

Results and U.S. EPA Screening Levels are reported in milligrams per kilogram (mg/kg)

U.S. EPA RSLs are based on the Regional Screening Levels Generic Tables April 2024 Update.

RSLs are based on a 1E-6 target cancer risk and a 0.1 target hazard quotient (THQ).

The following denote the color of screening level exceedances:

* = At or Above U.S. EPA 2024 Resident Soil RSLs

** = At or Above U.S. EPA 2024 Industrial Soil RSLs

Transect 875	East Bank			Center	SS#4/SS#4N		West Bank		
Depth (feet):	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5	4.0-4.5
Sample Date:	10/03/2024	10/03/2024	10/03/2024	10/03/2024	07/24/2024	08/08/2024	10/03/2024	10/03/2024	10/06/2024
Parameters									
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	NA	NA	<RSLs	<RSLs	<RSLs
BaA	0.037	<0.048	0.210	0.027	NA	NA	0.270	<0.045	<0.039
BaP	0.038	<0.048	0.170 *	0.017	NA	NA	0.350 *	<0.045	<0.039
BbF	0.056	0.017	0.240	0.029	NA	NA	0.660	0.013	0.014
DBA	<0.047	<0.048	0.038	<0.019	NA	NA	0.069	<0.045	<0.039
IP	0.018	<0.048	0.100	<0.049	NA	NA	0.230	<0.045	<0.039
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	NA	NA	<RSLs	<RSLs	<RSLs
As	9.8 **	20.0 **	11.0 *^3	16.0 **	13.0 *^3	11.0 **	12.0 **	12.0 *^3	14.0 *^3
Cd	0.230	0.078	0.060	<0.53	0.550	0.570	0.380	0.100	<0.46
Cr(VI)	<0.16	<0.17	<0.17	<0.18	NA	NA	<1.0 E	<0.16	<0.14
Cu	15.0	19.0	16.0	11.0	2.8	16.0	31.0	19.0	17.0
Zn	75.0	68.0	66.0	820	10.000 *	440	430	93.0	62.0
Cyanide (Total)	1.4	1.8	14.0 *	170 *^3	1,900 **	79.0 **	23.0 *^3	4.0 *	5.4 *

Transect 750	East Bank			West Bank	
Depth (feet):	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	2.0-2.5
Sample Date:	10/03/2024	10/05/2024	10/05/2024	10/03/2024	10/05/2024
Parameters					
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	0.290	0.035	0.061	0.660	<0.047
BaP	0.400 *	0.031	0.046	0.940 *	<0.047
BbF	0.760	0.050	0.084	1.9 *	0.017
DBA	0.068	<0.050	<0.051	0.130 *	<0.047
IP	0.190	0.018	0.031	0.550	<0.047
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	13.0 **	13.0 *^3	14.0 **	12.0 **	21.0 *^2
Cd	0.440	0.130	0.120	0.540	<0.56
Cr(VI)	<2.3 E	<0.15	<0.15	<2.1 E	<0.16
Cu	27.0	20.0	20.0	24.0	24.0
Zn	420	110	140	1,200	210
Cyanide (Total)	20.0 **	<15 E	<15 E	43.0 *^3	52.0 **

Transect 670 SS#3/SS#3N		
Depth (feet):	0.0-0.5	2.0-2.5
Sample Date:	07/24/2024	08/08/2024
Parameters		
VOCs	NA	NA
BaA	NA	NA
BaP	NA	NA
BbF	NA	NA
DBA	NA	NA
IP	NA	NA
PCBs	NA	NA
As	11.0 **	19.0 **
Cd	0.530	0.460
Cr(VI)	NA	NA
Cu	2.6	17.0
Zn	6.200 *	460
Cyanide (Total)	990 *^3	41.0 **

Transect 500	East Bank	West Bank		
Depth (feet):	0.0-0.5	0.0-0.5	2.0-2.5	4.0-4.5
Sample Date:	10/03/2024	10/03/2024	10/05/2024	10/05/2024
Parameters				
VOCs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	1.5 *	0.470	<0.052	0.046
BaP	2.2 **	0.610 *	<0.052	0.058
BbF	4.3 *	1.4 *	<0.052	0.110
DBA	0.330 *	0.110 *	<0.052	<0.051
IP	1.2 *	0.350	<0.052	0.051
PCBs	<RSLs	<RSLs	<RSLs	<RSLs
As	11.0 **	14.0 *^5	13.0 *^3	11.0 *^3
Cd	0.900 *	0.600	0.110	<0.63
Cr(VI)	<2.2 E	<2.2 E	<0.18	<0.18
Cu	27.0	17.0	11.0	17.0
Zn	3,400 *	2,600 *	600	130
Cyanide (Total)	370 *^3	540 *^3	2.8 *	14.0 *

Transect 625	East Bank			Center			West Bank	
Depth (feet):	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	2.0-2.5
Sample Date:	10/03/2024	10/05/2024	10/05/2024	10/03/2024	10/05/2024	10/05/2024	10/03/2024	10/05/2024
Parameters								
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	0.210	0.039	0.018	<0.14	0.021	<0.045	0.510	0.081
BaP	0.260 *	0.033	0.019	0.060	0.018	0.019	0.790 *	0.083
BbF	0.470	0.060	0.030	0.120	0.150	0.027	1.6 *	0.160
DBA	0.055	<0.051	<0.019	<0.14 E	<0.050	<0.015	0.110 *	0.030
IP	0.190	0.025	<0.019	<0.14	<0.050	0.017	0.470	0.064
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	11.0 *^3	14.0 **	15.0 **	15.0 **	16.0 *^3	17.0 **	14.0 **	17.0 *^3
Cd	0.410	0.160	0.130	0.280	0.310	0.150	0.530	<0.55
Cr(VI)	2.4 *	<0.18	<0.17	<1.9 E	<0.15	0.330 *	<2.1 E	<0.16
Cu	26.0	23.0	28.0	3.7	33.0	18.0	11.0	21.0
Zn	210	230	160	12.000 *	550	860	3,700 *	68.0
Cyanide (Total)	10.0 *	40.0 **	7.3 *	160 **	12.0 *	3.2 *	740 **	78.0 **

Transect 250	East Bank		Center	West Bank		
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	0.0-0.5	2.0-2.5	4.0-4.5
Sample Date:	10/03/2024	10/04/2024	10/03/2024	10/03/2024	10/04/2024	10/04/2024
Parameters						
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	1.6 *	0.170	2.2 *	2.4 *	0.075	0.120
BaP	2.0 *	0.180 *	3.2 **	3.3 **	0.130 *	0.120 *
BbF	4.0 *	0.350	5.3 *	5.6 *	0.120	0.190
DBA	0.260 *	<0.051	0.410 *	0.420 *	<0.053	<0.052
IP	0.800	0.130	1.6 *	1.8 *	0.053	0.081
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	13.0 **	12.0 **	11.0 *^3	13.0 *^3	16.0 **	12.0 **
Cd	0.500	0.250	0.570	0.920 *	0.210	0.350
Cr(VI)	<1.9 E	<0.18	<2.2 E	<2.4 E	<0.19	<0.18
Cu	4.2	22.0	2.5	31.0	8.3	60.0
Zn	4,400 *	430	5,800 *	3,100 *	2,400 *	370
Cyanide (Total)	1,400 **	240 **	710 **	1,300 **	45.0 **	32.0 **

Transect 375	East Bank			SS#2/2N		West Bank		
Depth (feet):	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5	4.0-4.5
Sample Date:	10/03/2024	10/04/2024	10/04/2024	07/24/2024	08/08/2024	10/03/2024	10/04/2024	10/04/2024
Parameters								
VOCs	<RSLs	<RSLs	<RSLs	NA	NA	<RSLs	<RSLs	<RSLs
BaA	2.3 *	0.140	0.400	NA	NA	2.1 *	0.150	0.059
BaP	3.3 **	0.140 *	0.310 *	NA	NA	3.2 *^5	0.150 *	0.063
BbF	4.9 *	0.220	0.440	NA	NA	6.6 *	0.220	0.099
DBA	0.450 *	0.032	0.067	NA	NA	0.420 *	<0.051	<0.052
IP	1.9 *	0.097	0.210	NA	NA	1.7 *	0.110	0.054
PCBs	<RSLs	<RSLs	<RSLs	NA	NA	<RSLs	<RSLs	<RSLs
As	14.0 *^3	15.0 **	14.0 *^3	11.0 **	9.8 *^3	12.0 *^3	12.0 **	14.0 **
Cd	0.790 *	0.210	0.120	0.650	0.550	0.750 *	0.140	0.410
Cr(VI)	<1.3 E	0.280	<0.20	NA	NA	<2.4 E	<0.19	<0.18
Cu	11.0	25.0	20.0	3.2	19.0	12.0	16.0	20.0
Zn	10.000 *	460	330	19,000 *	140	5,200 *	310	630
Cyanide (Total)	1,200 **	<32 E	<36 E	2,500 *^3	14.0 *	1,300 *^3	49.0 **	<38 E

Transect 125	East Bank		Center	West Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	0.0-0.5	2.0-2.5
Sample Date:	10/02/2024	10/03/2024	10/03/2024	10/02/2024	10/04/2024
Parameters					
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	1.2 *	1.3 *	1.9 *	1.4 *	0.420
BaP	1.3 *	1.3 *	2.0 *	1.4 *	0.430 *
BbF	2.1 *	1.8 *	4.2 *	2.3 *	0.580
DBA	0.240 *	0.190 *	0.310 *	0.200 *	0.081
IP	0.850	0.690	1.1 *	0.780	0.220
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	32.0 **	12.0 *^3	12.0 **	11.0 *^5	9.4 *^3
Cd	1.0 *	1.2 *	0.670	0.620	1.9 *
Cr(VI)	<0.97 E	<0.18	<2.1 E	<1.0 E	<0.17
Cu	800 *	22.0	4.7	28.0	20.0
Zn	5,200 *	850	6,700 *	3,100 *	510
Cyanide (Total)	240 **	14.0 *	780 *^5	610 *^3	63.0 *^3

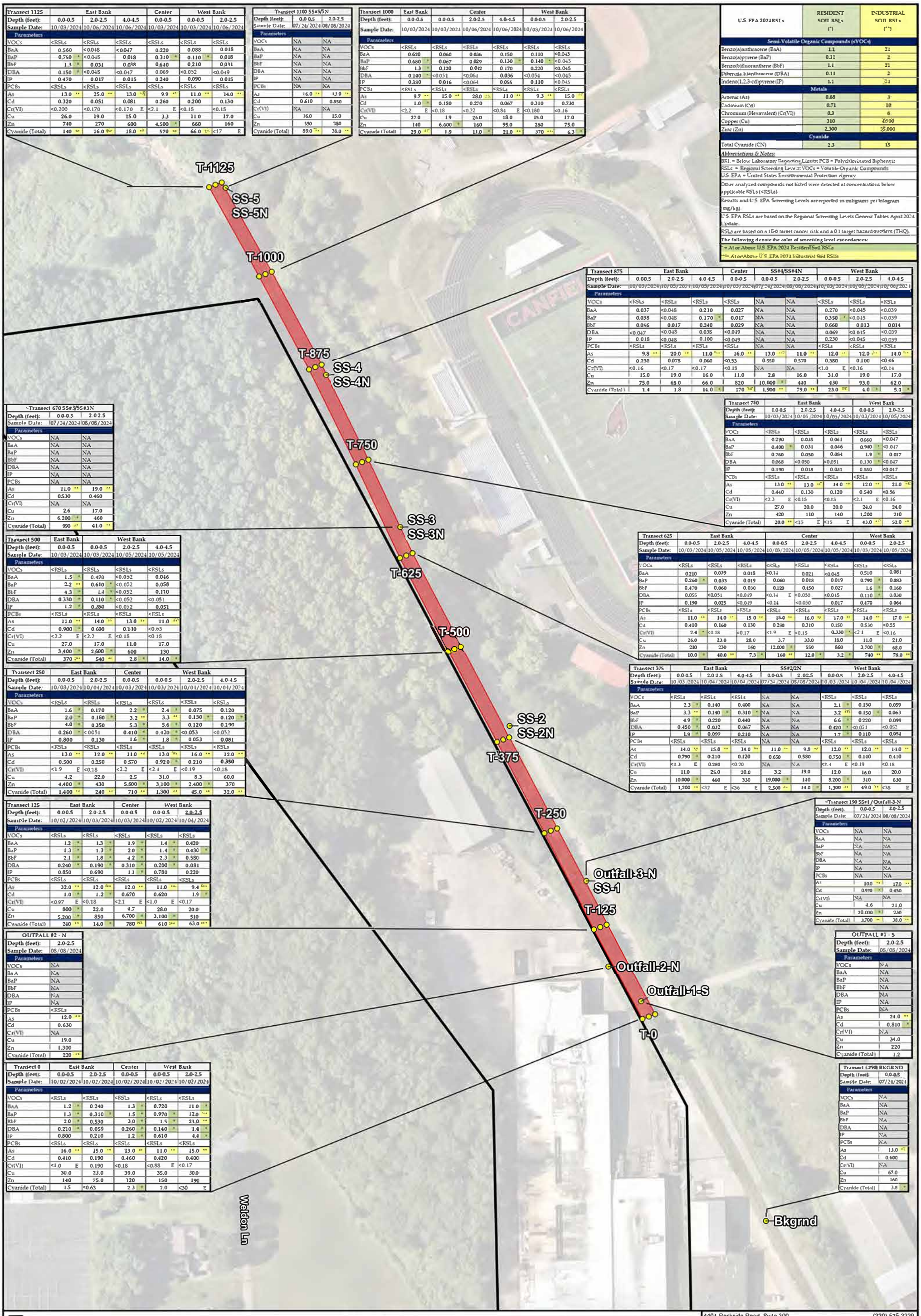
Transect 190 SS#1/Outfall-3-N		
Depth (feet):	0.0-0.5	2.0-2.5
Sample Date:	07/24/2024	08/08/2024
Parameters		
VOCs	NA	NA
BaA	NA	NA
BaP	NA	NA
BbF	NA	NA
DBA	NA	NA
IP	NA	NA
PCBs	NA	NA
As	100 **	17.0 **
Cd	0.920 *	0.450
Cr(VI)	NA	NA
Cu	4.6	21.0
Zn	20.000 *	230
Cyanide (Total)	3,700 **	38.0 **

OUTFALL #2 - N	
Depth (feet):	2.0-2.5
Sample Date:	08/08/2024
Parameters	
VOCs	NA
BaA	NA
BaP	NA
BbF	NA
DBA	NA
IP	NA
PCBs	<RSLs
As	12.0 **
Cd	0.630
Cr(VI)	NA
Cu	19.0
Zn	1,300
Cyanide (Total)	220 **

OUTFALL #1 - S	
Depth (feet):	2.0-2.5
Sample Date:	08/08/2024
Parameters	
VOCs	NA
BaA	NA
BaP	NA
BbF	NA
DBA	NA
IP	NA
PCBs	NA
As	24.0 **
Cd	0.810 *
Cr(VI)	NA
Cu	34.0
Zn	220
Cyanide (Total)	1.2

Transect 0	East Bank		Center	West Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	0.0-0.5	2.0-2.5
Sample Date:	10/02/2024	10/02/2024	10/02/2024	10/02/2024	10/02/2024
Parameters					
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	1.2 *	0.240	1.3 *	0.720	11.0 *
BaP	1.3 *	0.310 *	1.5 *	0.970 *	12.0 *^3
BbF	2.0 *	0.530	3.0 *	1.5 *	23.0 **
DBA	0.210 *	0.059	0.260 *	0.140 *	1.4 *
IP	0.800	0.210	1.2 *	0.610	4.4 *
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	16.0 **	15.0 **	13.0 **	11.0 **	15.0 **
Cd	0.410	0.190	0.460	0.420	0.400
Cr(VI)	<1.0 E	0.190	<0.18	<0.88 E	<0.17
Cu	30.0	23.0	39.0	35.0	30.0
Zn	140	75.0	720	150	190
Cyanide (Total)	1.5	<0.63	2.3 *	2.0	<30 E

Transect 6290 BKGRND	
Depth (feet):	0.0-0.5
Sample Date:	07/24/2024
Parameters	
VOCs	NA
BaA	NA
BaP	NA
BbF	NA
DBA	NA
IP	NA
PCBs	NA
As	13.0 *^3
Cd	0.600
Cr(VI)	NA
Cu	67.0
Zn	160
Cyanide (Total)	3.8 *



Subject Property

Ditch Excavation Area

Soil Sample

Nearmap Aerial Imagery: June 15, 2024

Material Sciences Corporation
Canfield

Adjacent Ditch - Soil Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229

August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372	DATE: 12/11/2024
	SCALE: 1:1,250
FIGURE: 6	CREATED BY: CC

OHIO EPA
NON-DRINKING
SURFACE WATER
HUMAN HEALTH CRITERIA

Semi-Volatile Organic Compounds (sVOCs)	
Benzo(a)anthracene (BaA)	0.013
Benzo(a)pyrene (BaP)	0.0013
Benzo(b)fluoranthene (BbF)	0.013
Benzo(k)fluoranthene (BkF)	0.130
Indeno(1,2,3-cd)pyrene (IP)	0.013
Metals	
Mercury	0.012
Zinc (Zn) (Dissolved [Zn(d)])	26000
Cyanide	
Total Cyanide (CN)	NE
Free Cyanide (CN)	400

Abbreviations & Notes:

NE = Not Established; PCBs = Polychlorinated Biphenyls; VOCs = Volatile Organic Compounds

U.S. EPA = United States Environmental Protection Agency

The higher of the two values between original sample and duplicate sample is posted if a compound exceeds OH EPA Surface Water.

Results and Screening Levels are reported in micrograms per liter (ug/L). Analyzed compounds not listed were not detected above Ohio EPA Surface Water Criteria (<SurfCrit).

Per the U.S. EPA's RSL User's Guide, the chemical abstract services number (CAS#) for total cyanide is based on free cyanide toxicity. Since cyanide speciation was performed as part of Site investigation, the total cyanide OH EPA Surface Water Criteria is listed as NE and free cyanide results are compared to the OH EPA Surface Water Criteria.

The following denote the color of screening level exceedances:

^ = At or Above Ohio EPA Non-Drinking Surface Water Human Health Criteria

Transect 750 Center	
Depth (feet):	Surface
Sample Date:	10/07/2024
Parameters	
VOCs	<SurfCrit
BaA	<0.065
BaP	<0.17
BbF	0.160 ^
BkF	<0.13
IP	<0.13
PCBs	<SurfCrit
Hg	<0.13
Zn	3,200
Zn	2,700
Total CN	840
Free CN	46.0

Transect 500 Center	
Depth (feet):	Surface
Sample Date:	10/07/2024
Parameters	
VOCs	<SurfCrit
BaA	0.250 ^
BaP	0.240 ^
BbF	0.430 ^
BkF	0.160 ^
IP	0.160 ^
PCBs	<SurfCrit
Hg	1.2 ^
Zn	69,000 ^
Zn(d)	19,000
Total CN	2,000
Free CN	94.0

Transect 375 Center /SW-DUP-1	
Depth (feet):	Surface
Sample Date:	10/07/2024
Parameters	
VOCs	<SurfCrit
BaA	0.340 ^
BaP	0.580 ^
BbF	1.3 ^
BkF	0.410 ^
IP	0.540 ^
PCBs	<SurfCrit
Hg	<0.200
Zn	28,000 ^
Zn(d)	970
Total CN	4,900
Free CN	83.0

T-750

T-500

T-375

CANFIELD

Weldon Ln

Subject Property

Surface Water Sample

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation
Canfield

Adjacent Ditch - Surface Water Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229

August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372

DATE: 12/11/2024

SCALE: 1:1,250

FIGURE: 8

CREATED BY: CC

SB-29-SW	
Depth (feet):	Surface
Sample Date:	10/25/2024
Parameters	
VOCs	<SurfCrit
BaA	0.190 ^
BaP	0.320 ^
BbF	0.600 ^
BkF	0.180 ^
IP	0.240 ^
Metals	<SurfCrit
PCBs	<SurfCrit
Total CN	8,100
Free CN	130

SB-36-SW	
Depth (feet):	Surface
Sample Date:	10/25/2024
Parameters	
VOCs	<SurfCrit
BaA	<0.065
BaP	<0.17
BbF	<0.15
BkF	<0.13
IP	<0.13
Metals	<SurfCrit
PCBs	<SurfCrit
Total CN	2,400
Free CN	130

OHIO EPA
NON-DRINKING
SURFACE WATER
HUMAN HEALTH CRITERIA

Semi-Volatile Organic Compounds (sVOCs)	
Benzo(a)anthracene (BaA)	0.013
Benzo(a)pyrene (BaP)	0.0013
Benzo(b)fluoranthene (BbF)	0.013
Benzo(k)fluoranthene (BkF)	0.130
Indeno(1,2,3-cd)pyrene (IP)	0.013
Cyanide	
Total Cyanide (CN)	NE
Free Cyanide (CN)	400

Abbreviations & Notes:

NE = Not Established; PCBs = Polychlorinated Biphenyls; VOCs = Volatile Organic Compounds

U.S. EPA = United States Environmental Protection Agency

Results and Screening Levels are reported in micrograms per liter (ug/L). Analyzed compounds not listed were not detected above Ohio EPA Surface Water Criteria (<SurfCrit).

Per the U.S. EPA's RSL User's Guide, the chemical abstract services number (CAS#) for total cyanide is based on free cyanide toxicity. Since cyanide speciation was performed as part of Site investigation, the total cyanide OH EPA Surface Water Criteria is listed as NE and free cyanide results are compared to the OH EPA Surface Water Criteria.

The following denote the color of screening level exceedances:

^ = At or Above Ohio EPA Non-Drinking Surface Water Human Health Criteria

SB-29
SB-30
SB-28
SB-35
SB-31
SB-26
SB-36
SB-32
SB-25
SB-27
SB-33
SB-24
SB-34
SB-23

Soil Boring Location

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation
Canfield

Surface Water Feature -
Surface Water Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 10 20 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229

August Mack
ENVIRONMENTAL

PROJECT NO.: JY2380.372	DATE: 12/11/2024
	SCALE: 1:250
FIGURE: 9	CREATED BY: CC

Attachment B

Letters to and from USFWS and ODNR, Responding to Queries about Threatened and Endangered Species

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

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Location

Mahoning County, Ohio



Local office

Ohio Ecological Services Field Office

(614) 416-8993
(614) 416-8994

4625 Morse Road, Suite 104
Columbus, OH 43230-8355

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Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office

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of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Indiana Bat Myotis sodalis Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5949	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

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Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider

implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to Bald Eagle Nesting and Sensitivity to Human Activity

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31

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Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey

effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

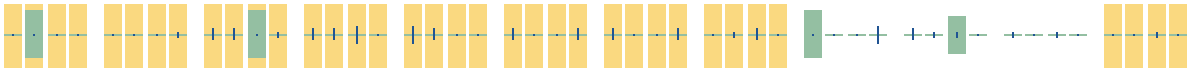
No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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Bald Eagle
Non-BCC
Vulnerable



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

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Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

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NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31
Belted Kingfisher *Megaceryle alcyon* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 15 to Jul 25

Blue-winged Warbler Vermivora cyanoptera This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds May 1 to Jun 30
Bobolink Dolichonyx oryzivorus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
Canada Warbler Cardellina canadensis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Chimney Swift Chaetura pelagica This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Eastern Meadowlark Sturnella magna This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Apr 25 to Aug 31
Red-headed Woodpecker Melanerpes erythrocephalus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rose-breasted Grosbeak Pheucticus ludovicianus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds May 15 to Jul 31
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

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Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (▪)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are

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based on all years of available data, since data in these areas is currently much more sparse.



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Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds

are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);

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2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation

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measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

RIVERINE

R4SBC

NOT FOR CONSULTATION

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

Ohio Department of Natural Resources
Divisions of Wildlife and Natural Areas & Preserves
Ohio Natural Heritage Program
2045 Morse Road Bldg. G-3 • Columbus, OH 43229-6693
Email: NHDRequest@dnr.ohio.gov • Voicemail: 614-265-6818

Ohio Natural Heritage Data Request

DNR 5203 (R0824)

Ohio Natural Heritage Database (ONHD) stand-alone data requests are processed for projects that meet one of these criteria:

- Academic research projects
- Other non-development or non-construction projects

Search results include records for state and federal listed plants and animals, high-quality plant communities, geologic features, and breeding animal concentrations.

If your project meets none of these criteria and you are requesting ONHD data for ORAM verification, please fill out and sign this form and submit it for ODNR Environmental Review as instructed at ohiodnr.gov/environmentalreview

Data within the project site will automatically be searched. Data within an additional 1-mile radius of the project site may be provided upon request. Because the ONHD contains sensitive information, it is our policy to provide only the data needed to complete your specific project.

Results are listed in a letter format and include a shapefile/map. Data requests will be completed within approximately 30 days. There is currently no charge to process requests.

INSTRUCTIONS

- Please complete all fields on this form.
- Submit a map detailing your project site boundaries. Please include at least one digital map (shapefile, .kmz, or .gdb) or allow extra time for processing.
- If you have questions, please visit ohiodnr.gov/onhd before submitting your request.
- Sign this form (required) and email with other attachments to NHDRequest@dnr.ohio.gov.

DATE:	12/13/2024	COMPANY NAME:	Integral Consulting Inc.
NAME OF PERSON RESPONSE LETTER SHOULD BE ADDRESSED TO:	Cristal Reagh		
STREET ADDRESS:	1903 7th Street		
CITY:	Berkeley	STATE: CA	ZIP: 94710
PHONE:	7075086105	E-MAIL ADDRESS:	creagh@integral-corp.com
PROJECT NAME:	C4272 Canfield Ohio Level I and II Report		
SITE ADDRESS:	460 West Main Street, Canfield, Ohio		
SITE COUNTY:	Mahoning	CITY/VILLAGE/TOWNSHIP:	Canfield
SITE LATITUDE:	41.025958384688074	SITE LONGITUDE:	-80.77619185992408

BRIEF DESCRIPTION OF WORK TO BE PERFORMED AT THE PROJECT SITE:

– Review environmental history and other publicly available data (e.g., state habitat monitoring, water quality)
– Conduct a site investigation
– Identify and delineate potential wetlands
– Evaluate quality of any wetlands identified during the site inspection
– Establish GIS project
– Prepare Level I report in accordance with OEPA (2018) including an Ecological Scoping Checklist and an

HOW DO YOU WANT YOUR DATA REPORTED? ***CHOOSE ONE:***

◯ **DIGITAL SHAPEFILE** ☐ **PDF MAP**

Both formats provide the same data. If you request a digital shapefile, we will send you a letter with a list of species/features found and a shapefile of record locations and details. The PDF Map is only recommended for those who cannot use digital map data. With the PDF option we will send you a letter with a list of species/features found and a map showing their location. It may take longer to fill your request if you choose the PDF Map.

The standard data we search includes state and federal listed plants and animals, high-quality plant communities, geologic features, and breeding animal concentrations within 1 mile of your project area boundaries (as specified on the map/shapefile you attach to this request). We provide a list of the above species and features found within 1 mile of your project area and may provide specific locations for these and other features that occur within or adjacent to your project area.

PLEASE LIST ANY INFORMATION *IN ADDITION TO THIS* THAT YOU REQUIRE:

A list of species and other resources such as critical habitat that are known or suspected to be on or near the project area. Thank you so much!

HOW WILL THIS INFORMATION BE USED?

This information will be used in accordance with the Ohio Environmental Protection Agency's Ecological Risk Assessment Guidance Document to complete a Level I and Level II Ecological Risk Assessment.

The chief of the Division of Wildlife has determined that the release of the ONHD data you have requested could be detrimental to the conservation of a species or unique natural feature. Pursuant to section 1531.04 of the Ohio Revised Code, this information is not subject to section 149.43 of the Revised Code. By signing below, you certify that the data provided will not be disclosed, published, or distributed beyond the scope of your project.

SIGNATURE: Cristal Reagh **DATE:** 12/13/2024

Integral Consulting Inc.
8742 E. Washington St.
Suite 115
Chagrin Falls, OH 44022

telephone: 303.404.2944
www.integral-corp.com

May 9, 2025

Project No. C4274

Office of Real Estate & Land Management
Ohio Department of Natural Resources
2045 Morse Road, E-2
Columbus, OH 43229
environmentalreviewrequest@dnr.ohio.gov

Submitted via email

Subject: **MSC Site, Canfield, Mahoning County, Ohio Environmental Review Request**

To Whom It May Concern:

Per your email request, Integral Consulting Inc. (Integral) is submitting this request for an environmental review of the Site located at and adjacent to 460 W. Main St, Canfield, Mahoning County, Ohio (approximately centered on 41.027837°, -80.777932° in WGS 84). The Site boundaries are provided in the attached shapefile. The subject area includes an on-site area (including Material Sciences Corporation parcel and portions of the Mill Creek Metroparks parcel) and an off-site area (including additional parcels along Sawmill Creek). This request includes both Material Sciences Corporation (MSC) parcel and wetland and portions of Sawmill Creek in order to consolidate requests for the environmental review. The on-site MSC parcel and wetland habitat includes approximately 4.9 acres of developed/industrial areas, 6.0 acres of upland forest, 1.6 acres of wetland, and 0.5 acres of a ditch.

The environmental review will be used to support the wetland delineation, ORAM form completion, and ecological risk assessment associated with the spill and response activities at the site.[1] Investigation and remedial actions led by August Mack (on behalf of Material Sciences Corporation) will be conducted in close coordination with Ohio EPA under the RCRA program.

This letter constitutes Integral's fulfillment of required information to complete ODNR's environmental review request. If there is additional information that would prove helpful, please do not hesitate to reach out.

[1] https://www.mscresponse.com/

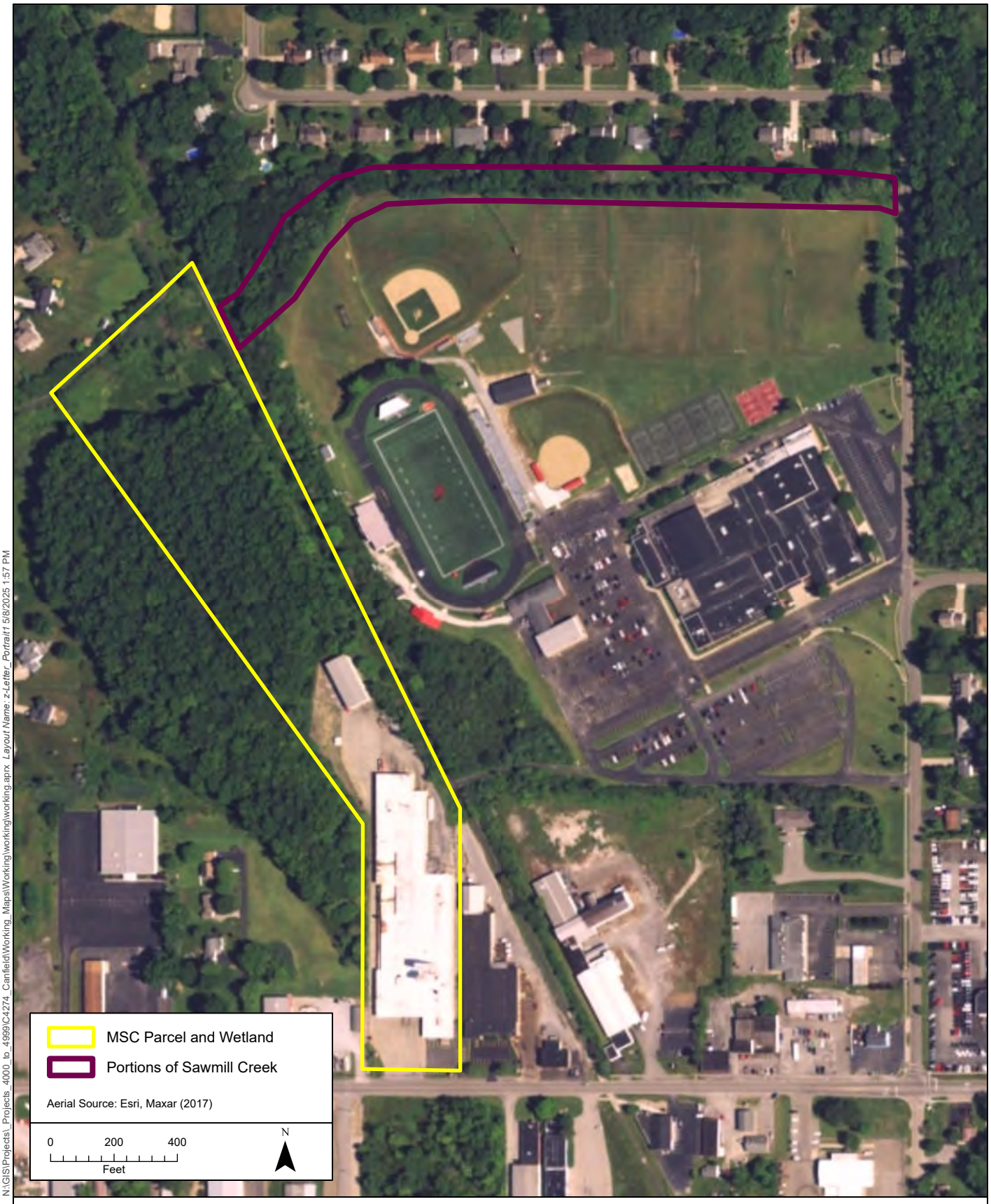
Thank you for your consideration of our request. We look forward to hearing from you.

Sincerely,

Cristal Reagh

Cristal Reagh
Scientist

Enclosure: Shapefile



N:\GIS\Projects_Projects_4000_to_4999\C4274_Canfield\Working_Maps\Working\working\working.aprx Layout Name: z-Letter_Portrait1 5/8/2025 1:57 PM

integral consulting inc.

Figure 1.
Site Boundaries
Material Science Corporation
Canfield OH

Outlook

Confirmation Receipt for ODNR Environmental Review Request Submission

From EnvironmentalReviewRequest@dnr.ohio.gov <EnvironmentalReviewRequest@dnr.ohio.gov>
Date Fri 5/9/2025 1:14 PM
To Cristal Reagh <creagh@integral-corp.com>

[CAUTION: External email. Think before you click links or open attachments.]

Thank you for contacting the Ohio Department of Natural Resources. This email is your receipt that we have received your message and/or project review request.
We aim to provide a completed Environmental Review comment letter within 45-60 calendar days, however, during periods of high volume or other extenuating circumstances, it may be longer. If you have any questions please contact Mike.Pettegrew@dnr.ohio.gov

Attachment C

November 2024 Photo Log



File Name: IMG_0575
Date/Time: 2024:11:21 14:03:27
Latitude:
Longitude:
Description: Staging area and mobile treatment units



File Name: IMG_0576
Date/Time: 2024:11:21 14:03:36
Latitude:
Longitude:
Description: Material Sciences Corporation facility (looking toward Main St.)



File Name: IMG_0578
Date/Time: 2024:11:21 14:07:24
Latitude:
Longitude:
Description: Forest area near temporary access road with erosion control measures and material stockpiles adjacent to leaf-littered ground and mature trees.



File Name: IMG_0579
Date/Time: 2024:11:21 14:07:25
Latitude:
Longitude:
Description: Temporary access road (walking north).



File Name: IMG_0580
Date/Time: 2024:11:21 14:07:27
Latitude:
Longitude:
Description: Personnel walking along temporary access road.



File Name: IMG_0582
Date/Time: 2024:11:21 14:07:33
Latitude:
Longitude:
Description: Wooded area with felled trees and accumulated debris adjacent to sediment management activities.



File Name: IMG_0584
Date/Time: 2024:11:21 14:08:16
Latitude:
Longitude:
Description: Temporary mud matting through upland forested area (ditch and temporary fencing along right side of photo).



File Name: IMG_0585
Date/Time: 2024:11:21 14:10:08
Latitude:
Longitude:
Description: Gravel access road looking south towards staged roll off boxes. Facility is in far background.



File Name: IMG_0587
Date/Time: 2024:11:21 14:10:12
Latitude:
Longitude:
Description: Temporary fenced boundary along bikeway, with flagged markers indicating designated areas for sampling in Adjacent Ditch.



File Name: IMG_0588
Date/Time: 2024:11:21 14:13:20
Latitude:
Longitude:
Description: Temporary gravel access road, water bypass pump, wetland area.



File Name: IMG_0591
Date/Time: 2024:11:21 14:15:36
Latitude:
Longitude:
Description: Outlet of ditch bypass, vegetation.



File Name: IMG_0592
Date/Time: 2024:11:21 14:17:26
Latitude:
Longitude:
Description: Wetland area with visible vegetation and leaf litter.



File Name: IMG_0594
Date/Time: 2024:11:21 14:17:35
Latitude:
Longitude:
Description: Scrub/shrub habitat near wetland.



File Name: IMG_0596
Date/Time: 2024:11:21 14:17:41
Latitude:
Longitude:
Description: Gravel access road, bypass pumps, sediment control measures, and adjacent vegetation.



File Name: IMG_0597
Date/Time: 2024:11:21 14:17:47
Latitude:
Longitude:
Description: Outlet of bypass pump near wetland.



File Name: IMG_0598
Date/Time: 2024:11:21 14:20:31
Latitude:
Longitude:
Description: Adjacent Ditch (looking south toward facility). Bypass pool in foreground.



File Name: IMG_0599
Date/Time: 2024:11:21 14:20:32
Latitude:
Longitude:
Description: Temporary dam to collect water from Adjacent Ditch.



File Name: IMG_0604
Date/Time: 2024:11:21 14:23:00
Latitude:
Longitude:
Description: Bypass pump in foreground, roll off boxes staging area in background.



File Name: IMG_0608
Date/Time: 2024:11:21 14:24:22
Latitude:
Longitude:
Description: Upland forest and scrub/shrub habitat.



File Name: IMG_0610
Date/Time: 2024:11:21 14:24:41
Latitude:
Longitude:
Description: Leaf litter.



File Name: IMG_0614
Date/Time: 2024:11:21 14:31:22
Latitude:
Longitude:
Description: Forested upland



File Name: IMG_0617
Date/Time: 2024:11:21 14:31:30
Latitude:
Longitude:
Description: Forested upland with property boundary marker.



File Name: IMG_0621
Date/Time: 2024:11:21 14:32:41
Latitude: 41.02905556
Longitude: -80.77842778
Description: Metal mesh debris observed on leaf-covered ground in upland area.



File Name: IMG_0622
Date/Time: 2024:11:21 14:32:59
Latitude: 41.02909444
Longitude: -80.77841111
Description: Brambles between forest and wetland habitat.



File Name: IMG_0625
Date/Time: 2024:11:21 14:43:40
Latitude: 41.02926389
Longitude: -80.77828333
Description: Deer path through wetland.



File Name: IMG_0626
Date/Time: 2024:11:21 14:43:48
Latitude: 41.02926667
Longitude: -80.77828333
Description: Vegetation in wetland (foreground), forested upland (background), looking south.



File Name: IMG_0628
Date/Time: 2024:11:21 14:44:25
Latitude: 41.02928611
Longitude: -80.77829722
Description: Vegetation in wetland.



File Name: IMG_0635
Date/Time: 2024:11:21 14:47:36
Latitude: 41.02935278
Longitude: -80.77825833
Description: Vegetation in wetland.



File Name: IMG_0638
Date/Time: 2024:11:21 14:49:30
Latitude: 41.02936667
Longitude: -80.77820556
Description: Vegetation in wetland.



File Name: IMG_0642
Date/Time: 2024:11:21 14:51:31
Latitude: 41.02936111
Longitude: -80.77831944
Description: Wetland habitat.



File Name: IMG_0649
Date/Time: 2024:11:21 14:58:10
Latitude: 41.02945
Longitude: -80.77842778
Description: Animal scat and leaf litter in wetland area.



File Name: IMG_0652
Date/Time: 2024:11:21 14:59:07
Latitude: 41.029475
Longitude: -80.77838056
Description: Wetland transition to upland forest.



File Name: IMG_0653
Date/Time: 2024:11:21 14:59:10
Latitude: 41.02948056
Longitude: -80.77838056
Description: Standing snag in wetland.



File Name: IMG_0655
Date/Time: 2024:11:21 14:59:29
Latitude: 41.02950278
Longitude: -80.77828889
Description: Standing snag and large woody debris in wetland.



File Name: IMG_0659
Date/Time: 2024:11:21 15:02:26
Latitude: 41.02962778
Longitude: -80.77830556
Description: Channels with standing water in wetland area.



File Name: IMG_0662
Date/Time: 2024:11:21 15:03:51
Latitude: 41.02949444
Longitude: -80.77849444
Description: Deer print in sediment in wetland area.



File Name: IMG_0665
Date/Time: 2024:11:21 15:04:11
Latitude: 41.02949444
Longitude: -80.77847222
Description: Vegetation in wetland area.



File Name: IMG_0670
Date/Time: 2024:11:21 15:07:51
Latitude: 41.0294
Longitude: -80.778625
Description: Wildlife path through wetland.



File Name: IMG_0672
Date/Time: 2024:11:21 15:16:27
Latitude: 41.02926389
Longitude: -80.77902222
Description: Access from wetlands to northern bike trail. Large *Phragmites* stands in background.



File Name: IMG_0673
Date/Time: 2024:11:21 15:16:29
Latitude: 41.02915278
Longitude: -80.77883056
Description: Open channel in wetland.



File Name: IMG_0674
Date/Time: 2024:11:21 15:16:34
Latitude: 41.02915278
Longitude: -80.77880833
Description: Open channel in wetland.



File Name: IMG_0675
Date/Time: 2024:11:21 15:18:32
Latitude: 41.02916667
Longitude: -80.778625
Description: Wetland area.



File Name: IMG_0677
Date/Time: 2024:11:21 15:19:23
Latitude: 41.02905556
Longitude: -80.778525
Description: Tree base with moss.



File Name: IMG_0682
Date/Time: 2024:11:21 15:26:28
Latitude: 41.02893056
Longitude: -80.77808333
Description: Tree with fungal growth and signs of rutting.



File Name: IMG_0684
Date/Time: 2024:11:21 15:27:01
Latitude: 41.02899167
Longitude: -80.77799167
Description: Forested habitat.



File Name: IMG_0688
Date/Time: 2024:11:21 15:27:41
Latitude: 41.02901944
Longitude: -80.77808333
Description: Forested habitat.



File Name: IMG_0694
Date/Time: 2024:11:21 15:29:56
Latitude: 41.02911389
Longitude: -80.77801389
Description: Foreground tree trunk with surrounding leaf litter and debris, adjacent to wetland vegetation and temporary construction materials within the site boundary near containment efforts.



File Name: IMG_0705
Date/Time: 2024:11:21 15:32:45
Latitude: 41.02970833
Longitude: -80.77796111
Description: Concrete structure between wetland and bikeway.



File Name: IMG_0706
Date/Time: 2024:11:21 15:32:52
Latitude: 41.02968611
Longitude: -80.77796111
Description: Wetland area.



File Name: IMG_0707
Date/Time: 2024:11:21 15:32:54
Latitude: 41.02969444
Longitude: -80.77795278
Description: Wetland area.



File Name: IMG_0711
Date/Time: 2024:11:21 15:34:31
Latitude: 41.02963889
Longitude: -80.77806111
Description: Sediment control measures around perimeter of standing water portion of wetland.



File Name: IMG_0713
Date/Time: 2024:11:21 15:34:35
Latitude: 41.02961389
Longitude: -80.778075
Description: Sediment control measures around perimeter of standing water portion of wetland.



File Name: IMG_0714
Date/Time: 2024:11:21 15:34:39
Latitude: 41.02960833
Longitude: -80.778075
Description: Sediment control measures around perimeter of standing water portion of wetland.



File Name: IMG_0715
Date/Time: 2024:11:21 15:34:41
Latitude: 41.02959722
Longitude: -80.77808333
Description: Wetland habitat.



File Name: IMG_0718
Date/Time: 2024:11:21 15:37:57
Latitude: 41.02982222
Longitude: -80.77794722
Description: Vegetation on bikeway berm.



File Name: IMG_0719
Date/Time: 2024:11:21 15:38:37
Latitude: 41.02986389
Longitude: -80.77798333
Description: Looking from bikeway berm towards wetland. Water control structure in mid-photo.



File Name: IMG_0720
Date/Time: 2024:11:21 15:38:47
Latitude: 41.02986111
Longitude: -80.77799167
Description: Wetland with water control structure in foreground and sediment control coir log and *Phragmites* stands in background.



File Name: IMG_0724
Date/Time: 2024:11:21 15:39:00
Latitude: 41.02988056
Longitude: -80.77798333
Description: View of wetland area (looking west).



File Name: IMG_0725
Date/Time: 2024:11:21 15:40:16
Latitude: 41.02950556
Longitude: -80.77767222
Description: View of bypassed Adjacent Ditch (looking upstream).

Attachment D

Ecological Scoping Checklist

Level I Attachment B
Ecological Scoping Checklist

Part 1			
SITE INFORMATION			
Site Name: Canfield Site		Date: 11/21/24	
Personnel: Jen Lyndall (Integral, lead) and Lindsay Hanna (MAD Scientist) (Identify team leader)		Time Arrived: 13:31 Time Departed: 16:25	
Site Address: 460 W. Main St, Canfield, OH 44406			
Site Location:	Latitude: 41.027837	Longitude: -80.777932	
Site Size (acres): Approx. 13.4 acres			
Weather Conditions (note any unusual conditions): Cloudy, scattered snow.			
Land uses at and adjacent to the site: (Circle all that apply and record at or adjacent)			
Residential Adjacent	Commercial	Recreational Adjacent	Industrial At/Adjacent
Agricultural	Urban	Green-Space/ Undeveloped At/adjacent	Other:_____

Note: This checklist provides a suggested format. The format may be altered to fit the needs of the site; however, all pertinent information should be presented.

Part 2		
CONTAMINANTS OF INTEREST		
Contaminants of Interest and *Ecological Stressors* (Types, names including CASRN, classes, or specific *hazardous substances* and non-chemical stressors either known or suspected)	Onsite (O) or Adjacent (A) to the site	Media (soil, sediment, wetland, surface water, ground water (seeps/springs))
Benzo(a)pyrene	Onsite, adjacent	soil, surface water
Benzo(b)fluoranthene	Onsite, adjacent	soil, surface water
Arsenic	Onsite. adjacent	soil
Cyanide	Onsite, adjacent	soil
Benzo(a)anthrecene	Onsite	surface water
Benzo(k)fluoranthene	Onsite	surface water
Indeno(1,2,3-cd)pyrene	Onsite	surface water
Mercury	Onsite	surface water
Zinc	Onsite, adjacent	soil, surface water
Dibenz(a,h)anthracene	Onsite, adjacent	soil
Chromium	Onsite, adjacent	soil

Part 3

SPECIFIC EVALUATION OF ECOLOGICAL RECEPTORS/HABITAT

Terrestrial – Wooded 45 % of site

Dominant vegetation (circle one):
Coniferous (Deciduous) Mixed

Dominant tree diameter
diameter at breast height (*dbh*): ____ (inches)

Evidence/observation of wildlife*: squirrels, deer, birds

Terrestrial - Shrub/scrub/grasses 2 % of site

Dominant vegetation (circle one):
shrub/scrub (grasses)

vegetation density: Dense, (Patchy), Sparse
Prominent height of shrub/scrub (<2', 2' to 5', >5')
Prominent height of grasses/herbs (<2') 2' to 5', >5')
Evidence/observation of wildlife*: birds

Terrestrial - Ruderal/Engineered 37 % of site

Dominant vegetation/surfaces (circle one):
Landscaped Agricultural Bare ground
(Parking lot) Artificial surfaces
Dominant vegetation height (0', >0' - 2', 2' - 5', >5')
Vegetation Density: Dense Patchy (Sparse)
Evidence/observation of wildlife*:
Bird calls

Aquatic - Non-Flowing (Lentic) ____% of site

Type: Lake Pond Vernal Pool Lagoon
Engineered** Impoundment Reservoir
Water source: Surface water Ground water
Industrial discharge Surface water runoff
Discharge Point: Surface water Ground water
Wetlands
Bottom Substrate***:
Vegetation: Submerged Emergent Floating
Wetland Present: (Yes/No)
Evidence/Observation of wildlife*:

Aquatic - Flowing (Lotic) 4 % of site
Aquatic Life Use Designation (if available) _____
Type: River Stream Intermittent Stream
(Ditch)
Water source: Surface Water Ground Water
Industrial discharge (seeps /springs)
Storm water runoff
Discharge Point: Surface water Ground water
(Wetlands) Impoundment
Bottom Substrate**:
Vegetation: Submerged Emergent Floating
Wetland Present: (Yes/No)
Evidence/Observation of Wildlife*: Ditch bypassed during site visit

Aquatic - Wetlands 12 % of site
Size 1.6 (acres)
Obvious or designated wetland: (Yes) / No)
Water source: (Surface Water) Ground Water
Industrial discharge Surface water runoff
Discharge Point: (Surface water) Ground water
Wetlands Impoundment
Bottom Substrate***: muck
Vegetation: Submerged Emergent Floating

Evidence/Observation of Wildlife*: Deer tracks, birds

* Wildlife includes: macroinvertebrates, reptiles, amphibians, birds, mammals, and fish.
** Engineered can mean any surface water body that has been artificially created or significantly altered.
*** Bottom substrate types include but not limited to: cobble, gravel, sand, silt, clay, muck, artificial (*e.g.*, concrete).

Part 4
Ecologically Important Resources Observed

Attachment E

Wetland Delineation Report

JURISDICTIONAL WATERS AND ISOLATED WETLANDS REPORT:

Mill Creek Metropark and Adjacent Area
Canfield, Ohio 44406

December 11, 2024

Prepared for:

Integral Consulting, Inc.
8472 E. Washington St. #115
Chagrin Falls, OH 44023

Prepared by:

MAD SCIENTIST ASSOCIATES LLC

Specialists in
Ecological & Wetland Consulting

253 North State Street, Suite 101 Westerville, Ohio 43081 (614) 818-9156 Fax (614) 818-9157 www.madscientistassociates.net

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F Ohio Rapid Assessment Method (ORAM) Forms

EXECUTIVE SUMMARY

Integral Consulting, Inc. (Integral) contracted MAD Scientist Associates, LLC (MAD) to investigate and assess aquatic resources across a ~5-acre area located to the northwest of the Material Sciences Corporation building at 460 W. Main St, Canfield, Mahoning County, Ohio (hereafter referred to as the Delineation Area). The Delineation Area is centered approximately on the following coordinates: 41.027837°, -80.777932° (WGS 84). The primary objectives of this study were to identify the boundaries of any Jurisdictional Waters (*i.e.*, non-Isolated Wetlands, streams) or Isolated Wetlands and evaluate their quality using methods developed by the Ohio Environmental Protection Agency (Ohio EPA).

Field work was completed by MAD on November 21, 2024. Wetlands were identified and delineated at the Delineation Area. One (1) identified wetland feature (Wetlands A) amounted to approximately 6.92 acres across the Delineation Area. The wetland was scored using the Ohio Rapid Assessment Method (ORAM, version 5.0) and received a score of 47. This classifies Wetland A as a Category 2 wetland.

All jurisdictional and isolated surface water features identified in this report are regulated by the Ohio EPA or the United States Army Corps of Engineers (USACE). Permits from one or both these agencies may be required if impacts (*e.g.*, placement of fill material) are proposed for the identified features. The permit(s) needed are dependent on the acreage of impact and the type of wetlands or streams affected. The determination of jurisdictional status must be verified by the USACE.

According to the USFWS Information for Planning and Consultation (IPaC) resource list, there is one (1) T&E species—the Indiana Bat—that could be potentially impacted in the project vicinity. However, no critical habitat for either species is found at the Delineation Area. Four bat species are listed as state and/or federally threatened or endangered in Ohio. Specifically, tricolored bats (state endangered), northern long-eared bats (state E, federally threatened), Indiana bats (state and federally E) and little brown bats (state E) are listed and protected. Before any tree clearing occurs, correspondence with ODNR and/or USFWS should take place to avoid take of T&E species or their habitat. MAD is also currently awaiting results from the ODNR Natural Heritage Database to confirm whether any additional listed species may be present in the area and will submit the findings as an addendum to this report once a response is received.

JURISDICTIONAL WATERS AND ISOLATED WETLANDS REPORT
Mill Creek Metropark and Adjacent Area
MAHONING COUNTY, OHIO

1 INTRODUCTION

Integral Consulting, Inc. (Integral) hired MAD Scientist Associates, LLC (MAD) to investigate and assess aquatic resources across a ~5-acre area located the northwest of the Material Sciences Corporation building at 460 W. Main St, Canfield, Mahoning County, Ohio (hereafter referred to as the Delineation Area). The Delineation Area is centered approximately on the following coordinates: 41.027837°, -80.777932° (WGS 84). The Delineation Area is located on the Mill Creek Metroparks parcel to the northwest of Material Sciences Corporation (Figures 1 and 2).

A Jurisdictional Waters and Isolated Wetlands Investigation (full wetland delineation) was completed at the Delineation Area. The primary objectives of this study were to identify the boundaries of Jurisdictional Waters (*i.e.*, non-Isolated Wetlands, streams) or Isolated Wetlands and evaluate their quality using methods developed by the Ohio Environmental Protection Agency (Ohio EPA).

1.1 General Site Description

The Delineation Area and its aquatic resources fall within the Middle Meander Creek watershed (12-digit HUC: 050301030702). The Delineation Area slopes from 1119 feet above mean sea level (AMSL) in the southern forested portion to 1112 feet AMSL in the northern emergent portion, before rising back to 1116 feet AMSL in the north along the bike path. The forested portion is dominated by pin oak (*Quercus palustris*). At the time of the Delineation Area visit, there was no understory based on the late fall timing. North of the forest, the Delineation Area opens up into an emergent wetland dominated by invasive species including giant reed (*Phragmites australis*) and reed canarygrass (*Phalaris arundinacea*). Shrub species including red-osier dogwood (*Cornus sericea*) and bush honeysuckle (*Lonicera* spp.) were located along the border between the forest and the wetland in the eastern portion of the Delineation Area. One stream flowing west to east (Sawmill Creek) and a ditch flowing south to north, were observed flowing into and across Wetland A, converging in the eastern edge of the wetland before flowing offsite to the north. All

water flows offsite to the northeast through a culvert with a water control structure. General site photographs are presented in Appendix A.

1.2 Wetland Definition and Authority

The United States Army Corps of Engineers (USACE) uses the following definition of wetlands:

> *Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*

As a result of a 2001 Supreme Court decision (Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers, 531 U.S. 159 [2001]) further defined by a 2023 Supreme Court decision (Sackett et ux. V. Environmental Protection Agency et. al., 598 U.S.___[2023]) , the USACE no longer regulates Isolated Wetlands (those with no discernible surface connection to streams or rivers). In Ohio, this regulatory authority has been assumed by the Ohio EPA through its Isolated Wetlands Permit program.

Because Site conditions suggest that wetlands are present and federal and state regulations control the discharge of fill materials in such areas, the presence and extent of these wetlands has been determined.

2 OBJECTIVES

The primary objectives of this study were to determine the presence and quality of Jurisdictional Waters (non-Isolated Wetlands, streams) and Isolated Wetlands on the Delineation Area, mark their boundaries, and evaluate the habitat quality of each feature.

3 METHODS

This Jurisdictional Waters and Isolated Wetlands study consisted of two phases: (1) a review of the existing general literature via a desktop review and (2) a field investigation to “ground truth” existing data on the presence and extent of Jurisdictional Waters and Isolated Wetlands. Wetlands were identified according to the methods presented in the 1987 USACE Wetlands Delineation Manual (Environmental Laboratory, 1987; henceforth referred to as the 1987 Manual) and the

Northcentral and Northeast Regional Supplement Version 2.0 (USACE, 2012). If a wetland (either isolated or non-isolated) or stream was found, its extent was subsequently determined by defining its boundary. The methods and materials used are described in greater detail in the following sections.

3.1 Literature Review

The following data sources were reviewed and used as supplemental information on the vegetation, soils, hydrology, and land use cover types of the Delineation Area:

- Google Earth Library. 2024. USGS Topographic Maps. Warren, OH quadrangle.
- Google Earth Pro aerial photographs. 2024.
- Ohio Geographically Referenced Information Program (OGRIP). 2012. High Resolution Orthoimagery.
- OGRIP. 2012. LiDAR.
- Ohio Department of Natural Resources (ODNR). 2024. Natural Heritage Database.
- U.S. Department of Agriculture. 2024. Web Soil Survey 3.4.0 Soil Conservation Service, http://websoilsurvey.nrcs.usda.gov/ app/WebSoilSurvey.aspx.
- U.S. Department of Homeland Security. 2023. Flood Insurance Rate Map (FIRM) Panel 39099C0194D (effective as of 11/18/2009). Federal Emergency Management Agency.
- U.S. Fish and Wildlife Service, 2024. National Wetland Inventory (NWI) map layer for the Warren, OH quadrangle. Google Earth Pro.

3.2 Site Investigation for Wetlands

Field work was completed by MAD's Team, comprised of Certified Wetland Delineator, Lindsay Hanna on November 21, 2024. Weather conditions during field work were cold and snowy with 0.21 inches of precipitation throughout the day.

During field activities, the Team examined and evaluated the vegetation, soils, and hydrologic features of the Delineation Area to determine the presence of wetland conditions. Where wetlands were found, their boundaries were delineated. Throughout the Delineation Area, the Team recorded data on the three wetland parameters (vegetation, soils, and hydrology) within representative wetland and adjacent upland sample plots. The classification schemes of Cowardin *et al*. (1979) and Dahl *et al*. (2015) were used to generally describe wetland community types.

3.2.1 Vegetation

Plants that occur in wetlands (hydrophytes) must have specific physiological and morphological adaptations that allow them to germinate and survive under saturated or anaerobic conditions. The ability of plants to withstand the stresses presented by these conditions varies. This has led to the categorization of plants into indicator status groups by the USACE and the United States Fish and Wildlife Service (USFWS). These groupings (obligate, OBL; facultative wetland, FACW; facultative, FAC; facultative upland, FACU; and upland, UPL) reflect the estimated probability of occurrence in wetlands for each species. Table 1 presents the categories and their definitions.

TABLE 1. PLANT INDICATOR STATUS CATEGORIES (Lichvar *et al.*, 2016)

Indicator Category	Indicator Symbol	Definition
Obligate Wetland Plants	OBL	Plants that occur almost always (estimated probability >99%) in wetlands under natural conditions, but which may also occur rarely (estimated probability <1%) in non-wetlands. Examples: *Spartina alterniflora, Taxodium distichum*.
Facultative Wetland	FACW	Plants that occur usually (estimated probability >67% to 99%) in wetlands, but also occur (estimated probability 1% to 33%) in non-wetlands. Examples: *Fraxinus pennsylvanica, Cornus sericea*.
Facultative Plants	FAC	Plants with a similar likelihood (estimated probability 33% to 67%) of occurring in both wetlands and non-wetlands. Examples: *Gleditsia triacanthos, Smilax rotundifolia*.
Facultative Upland	FACU	Plants that occur sometimes (estimated probability 1% to <33%) in wetlands but occur more often (estimated probability >67% to 99%) in non-wetlands. Examples: *Quercus rubra, Potentilla arguta*.
Obligate Upland Plants	UPL	Plants that occur rarely (estimated probability <1%) in wetlands but occur almost always (estimated probability >99%) in non-wetlands under natural conditions. Examples: *Pinus echinata, Bromus mollis*.

In each sample plot, herbaceous species within a 5-foot radius of the plot center, woody shrubs and saplings within a 15-foot radius, and tree and vine species within a 30-foot radius of the plot center were identified and recorded. The indicator status of the dominant species was then used to determine the presence of wetland vegetation. If more than 50% of the dominant species in a sample plot consisted of plants with an indicator status of OBL, FACW, or FAC for the Northcentral and Northeast Region (USACE, 2010), the plot was considered to contain wetland vegetation. If this criterion was not met, alternative metrics defined in the Northcentral and

Northeast Regional Supplement were used to confirm the presence or absence of hydrophytic vegetation.

3.2.2 Soils

For the hydric soils parameter to be satisfied, soils must be saturated, flooded, or ponded for a sufficient portion of the growing season to develop anaerobic conditions in the upper layers of the soil profile (USDA, 2010). The Soil Conservation Service (SCS—now called the Natural Resource Conservation Service, NRCS) and the National Technical Committee for Hydric Soils, have compiled a list of hydric soils of the United States (USDA, 2015). This list identifies the NRCS-mapped soil series that meet hydric soil criteria. However, since upland soils may have hydric soil inclusions, and hydric soils may contain pockets of upland soils, field examination of soils is an important component of the field investigation.

Under saturated, reducing (anaerobic) conditions, hydric soils exhibit characteristics that allow them to be distinguished from drier, upland soils. These include high organic matter content, accumulation of sulfidic material, green- or blue-gray color formation (gleied soils), redoximorphic features (such as mottling, sometimes associated with oxidized root zones), and dark or gray (low value or chroma) soils.

During the Delineation Area investigation, sampling was accomplished by using a spade shovel to observe soils to a depth of at least 30 centimeters. All soils were examined for hydric indicators and data were recorded in the field. Soil colors were identified using a Munsell Soil Color Chart (Kollmorgen, 1992).

3.2.3 Hydrology

Hydrology is the single-most important determinant of the establishment and maintenance of specific types of wetlands and wetland processes (Mitsch and Gosselink, 1993). Although water must be present for wetlands to exist, it need not be present throughout the entire year. Wetland hydrology is considered to be present when an area is inundated either permanently or periodically at mean water depths less than 6.6 feet or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation (Environmental Laboratory, 1987). In Mahoning County, Ohio, the average growing season extends from April through October (USDA-NRCS, 2020).

Indicators of hydrologic conditions that occur in wetlands include, but are not limited to, drainage patterns, drift lines, sediment deposition, watermarks, stream gauge data and flood predictions, historic records, visual observation of saturated soils, and visual observation of inundation (Environmental Laboratory, 1987). These indicators, plus others, such as dry algae on bare soil, water-stained leaves, or oxidized zones along live root channels (forming mottles), were documented at each sampling plot where found.

Where positive indicators of wetland hydrology were observed, it was assumed that wetland hydrology was present for a significant period during the growing season. Table 2 summarizes the hydrologic regimes and associated probability of the presence of wetlands, as presented in the 1987 Manual.

3.2.4 Wetland Delineation

Vegetation, soil, and hydrology were examined at each sample plot, and field data forms were completed to document existing conditions. At locations where all three wetland parameters were satisfied, or under normal circumstances would have been satisfied, a positive wetland determination was made. After evaluating all sample plots, a boundary determination was made where a distinct transition from wetland to upland was observed. Where ambiguous, the boundaries were marked accordingly, using pink flagging tape. This boundary was then extended around areas with similar vegetation, soils, and hydrology indicators to encompass the entire wetland.

If any of the three wetland parameters failed to be satisfied, the area was considered an upland (non-wetland) community, unless it was significantly disturbed. Disturbed areas may lack field indicators of one or more of the wetland parameters, due to recent changes. These can include both wetlands and non-wetlands that have been modified by human activity (*e.g.*, clearing of original vegetation, filling, excavation, or construction), or natural events (*e.g.*, mudslides, fire, and beaver dam construction).

During the investigation, the Team took photographs to document the wetland and sample plot locations, and wetland boundaries were logged and mapped using a hand-held Trimble GeoExplorer 6000XH GPS unit. This unit is capable of sub-foot accuracy, with differential correction (post-processing) for improved accuracy. The precision of GPS data is subject to variation in canopy cover, atmospheric interference, and satellite configuration.

TABLE 2: NON-TIDAL HYDROLOGIC REGIMES AND THEIR ASSOCIATION WITH WETLAND HYDROLOGY

Degree of Inundation or Saturation	Duration of Inundation or Saturation*	Comments
Permanently inundated	100%	Inundation >6.6 ft mean water depth - deepwater wetland present (aquatic habitat)
Semi-permanently to nearly permanently inundated or saturated	>75 - <100%	Inundation defined as ≤ 6.6 ft mean water depth - wetland present
Regularly inundated or saturated	>25 - 75%	Areas with these hydrologic characteristics are usually wetlands
Seasonally inundated or saturated	>12.5 - 25%	Wetlands often present when these hydrologic characteristics exist
Irregularly inundated or saturated	≥ 5 - 12.5%	Many areas having these hydrologic characteristics are not wetlands
Intermittently or never inundated or saturated	<5%	Areas with these hydrologic characteristics are not wetlands

*Refers to duration of inundation and/or soil saturation during the growing season.
SOURCES: Adapted from Clark and Benforado (1981), and Environmental Laboratory (1987).

3.2.5 Wetland Assessment

To document the relative quality of the wetlands at the Delineation Area, the Ohio Rapid Assessment Method (ORAM, version 5.0) for wetlands was used to score the wetland and assign it to a wetland category (Ohio EPA, 2001). This method was developed by the Ohio EPA to evaluate flood/storm water control; water quality improvement; natural biological support; and overall and specific habitat values for Ohio wetlands. The qualitative portion of the ORAM also addresses the statewide scarcity of particular types of wetlands and the potential presence of Threatened or Endangered (T&E) species.

The Ohio EPA ranks wetlands as Category 1, 2, or 3, depending on their relative quality (based on size, habitat value, etc.), with Category 3 representing the highest quality wetlands in Ohio.

4 RESULTS

The literature findings and field observations have confirmed the presence of one (1) wetland within Delineation Area boundaries. These findings are discussed in greater detail in the following sections.

4.1 Literature Findings

Based on literature review, the Delineation Area contains a riverine (RuB) system mapped on the National Wetland Inventory. In addition, a palustrine forested (PFO) wetland is mapped offsite to the west of the Delineation Area (NWI; Figure 3). The wetland portion of the Delineation Area is located within 0.2% Annual Chance Flood Hazard area according to the Federal Emergency Management Agency (FEMA; Appendix B).

The UDSA-NRCS soil survey (Appendix C) indicates that the following soils are located onsite:

- Marengo silty clay loam (Mn)
- Rittman silt loam, 2 to 6 percent slopes (RsC2)

Marengo silty clay loam, which comprises the wetland area onsite, is considered hydric, while Rittman silt loam, which is located along the southern forested edge of the Delineation Area, is not considered hydric.

According to the USFWS Information for Planning and Consultation (IPaC) resource list and ODNR state listings, all counties in Ohio lie within the range of four rare Threatened and Endangered (T&E) bat species: Indiana bat (*Myotis sodalis;* federally and state endangered); northern long-eared bat (*Myotis septentrionalis;* federally threatened, state endangered), tricolored bat (*Perimyotis subflavus;* state endangered), and little brown bat (*Myotis lucifugus;* state endangered). In Ohio, these bats are assumed present wherever suitable habitat occurs unless a presence/absence survey has been performed to document absence. The USFWS also states that if a federal nexus exists for the project (*i.e.*, if federal permits are required to construct at the Site), "no tree clearing should occur on any portion of the project area until consultation under Section 7 of the Endangered Species Act (ESA), between the USFWS and the federal action agency, is completed."

Besides bats, the monarch butterfly (*Danaus plexippus*), a candidate species, is listed in the preliminary IPaC for this Delineation Area. Given their preferred habitat requirements, it is not expected that this species has great potential to be impacted onsite. Additionally, MAD has submitted a request for review from the ODNR Natural Heritage Database to confirm whether any additional listed species may be present in the area and will submit the findings as an addendum

to this report once a response is received. Agency response letters, including recommendations for avoidance and impact minimization, can be viewed in Appendix D.

4.2 Site Findings

A Jurisdictional Waters and Isolated Wetland investigation with field mapping was completed during the Delineation Area visits on November 21, 2024. Field tasks included documentation of general conditions, such as existing plant communities and the locations, sizes, and quality of all wetlands and streams. The findings are summarized in the following sections.

4.2.1 General Observations

The forested portion of the Delineation Area is dominated by pin oak. At the time of the Delineation Area visit, there was no understory based on the late fall timing. North of the forest, the Delineation Area opens up into an emergent wetland dominated by invasive species such as giant reed and reed canarygrass. Shrub species including red-osier dogwood and bush honeysuckle were located along the border between the forest and the wetland in the eastern portion of the Delineation Area. One stream flowing west to east (Sawmill Creek) and a ditch flowing south to north, were observed flowing into and across Wetland A, converging in the eastern edge of the wetland before flowing offsite to the north. All water flows offsite to the northeast through a culvert with a water control structure.

4.2.2 Wetlands

One (1) wetland—Wetland A—was delineated within the Delineation Area (Figure 4). The wetland is summarized in Table 3.

TABLE 3: WETLAND SUMMARY TABLE

Location ID	Size	Isolated/ Non-isolated*	Vegetation Type(s)	Cowardin *et al.* (1979) Classification	ORAM Score	Category**
Wetland A	6.92	Non-isolated	Emergent	PEM	47	2
				Category 2 Total Acreage		*6.92*

*Determination on isolation status, category must be verified by USACE and Ohio EPA, respectively.
**Ohio EPA requires that the higher Category be assigned for "gray zone" scores unless a lower category is substantiated through completion of a more detailed study such as a Vegetation Index of Biotic Integrity (VIBI) assessment.

Based on Delineation Area observations and literature review, Wetland A contains a surface water connection with a Water of the U.S., meaning it is most likely jurisdictional. Sample plot and ORAM data forms for this wetland are provided in Appendices E and F, respectively.

Wetland A Detailed Description

Wetland A totals approximately 6.92 acres onsite, located along the floodplain of Sawmill Creek. The wetland feature predominantly consists of emergent hydrophytic vegetation that is dominated by invasive reed canary grass and giant reed. A shrub buffer of red-osier dogwood is located along the southeastern edge of the wetland, and a few pin oak snags were observed within the wetland. Wetland hydrology indicators for the wetland include oxidized rhizospheres on living roots, saturation visible on aerial imagery, geomorphic position, and passage of the FAC-neutral test. Hydric soil indicators exhibited within Wetland A include a depleted matrix (F3).

Wetland A received an ORAM score of 47 overall, with poor individual metric scores for buffers, habitat development, and vegetation community. Wetland A is situated along the northwestern boundary of the Delineation Area, bordered by residential development to the north, east, and west, with a buffer of forested area to the south. The wetland has a number of hydrology inputs and appears to be largely unimpacted in its hydrology and substrate. However, the wetland is dominated by invasive species and contains moderate wildlife habitat.

4.2.4 Threatened and Endangered Species

The USFWS IPaC list indicates that there are the Indiana Bat was the only T&E species that could be present in the project vicinity. These can be found in the preliminary agency review in Appendix D. The monarch butterfly (*Danaus plexippus*), a candidate species, is also listed in the preliminary IPaC for this Delineation Area. Given the preferred habitat requirements of all three species, it is not expected that they have great potential to be impacted onsite.

Overall, four bat species—tricolored bats (State E), northern long-eared bats (State E and federally T), Indiana bats (State and Federally E) and little brown bats (State E)—are listed and protected in all Ohio counties. Should removal of any potential roost trees be necessary, agency correspondence with ODNR and USFWS should take place. A seasonal tree clearing window may be permissible, which recommends tree removal between October 1 and March 31, when these bats would likely not be present. The USFWS also states that if a federal nexus exists for the project (*i.e.,* if federal

permits are required to construct at the Site), "no tree clearing should occur on any portion of the project area until consultation under Section 7 of the Endangered Species Act (ESA), between the USFWS and the federal action agency, is completed." MAD is also currently awaiting results from the ODNR Natural Heritage Database to confirm whether any additional listed species may be present in the area and will submit the findings as an addendum to this report once a response is received.

5 SUMMARY & CONCLUSIONS

Wetlands: One wetland (Wetland A) was mapped and assessed at the Delineation Area. The total onsite wetland area is approximately 6.92 acres. The wetland was scored per the scoring boundary guidelines presented in the ORAM manual. Wetlands A was categorized as a Category 2 Wetland with an ORAM score of 47. Category 2 wetlands, meanwhile, are defined as those wetlands that "...support moderate wildlife habitat, or hydrological or recreational functions," and as wetlands which are "...dominated by native species but generally without the presence of, or habitat for, rare, T&E species; and wetlands which are degraded but have a reasonable potential for reestablishing lost wetland functions" (Ohio EPA, 2001).

Threatened and Endangered Species: The USFWS indicate that there is one (1) listed T&E species that could be present in the project vicinity, along with the monarch butterfly (a candidate species). These findings can be viewed in Appendix D. In addition, tricolored bats (state E), northern long-eared bats (state E and federally T), Indiana bats (state and federally E) and little brown bats (state E) are listed and protected in all Ohio counties. Before any tree clearing takes place, especially if there is a federal nexus for the Site, correspondence with USFWS should occur to follow recommendations for avoidance of take of T&E species or their habitat. A request for a Delineation Area review has been submitted to the Ohio Natural Heritage Database, but a response has not been received by MAD at the time of writing this report.

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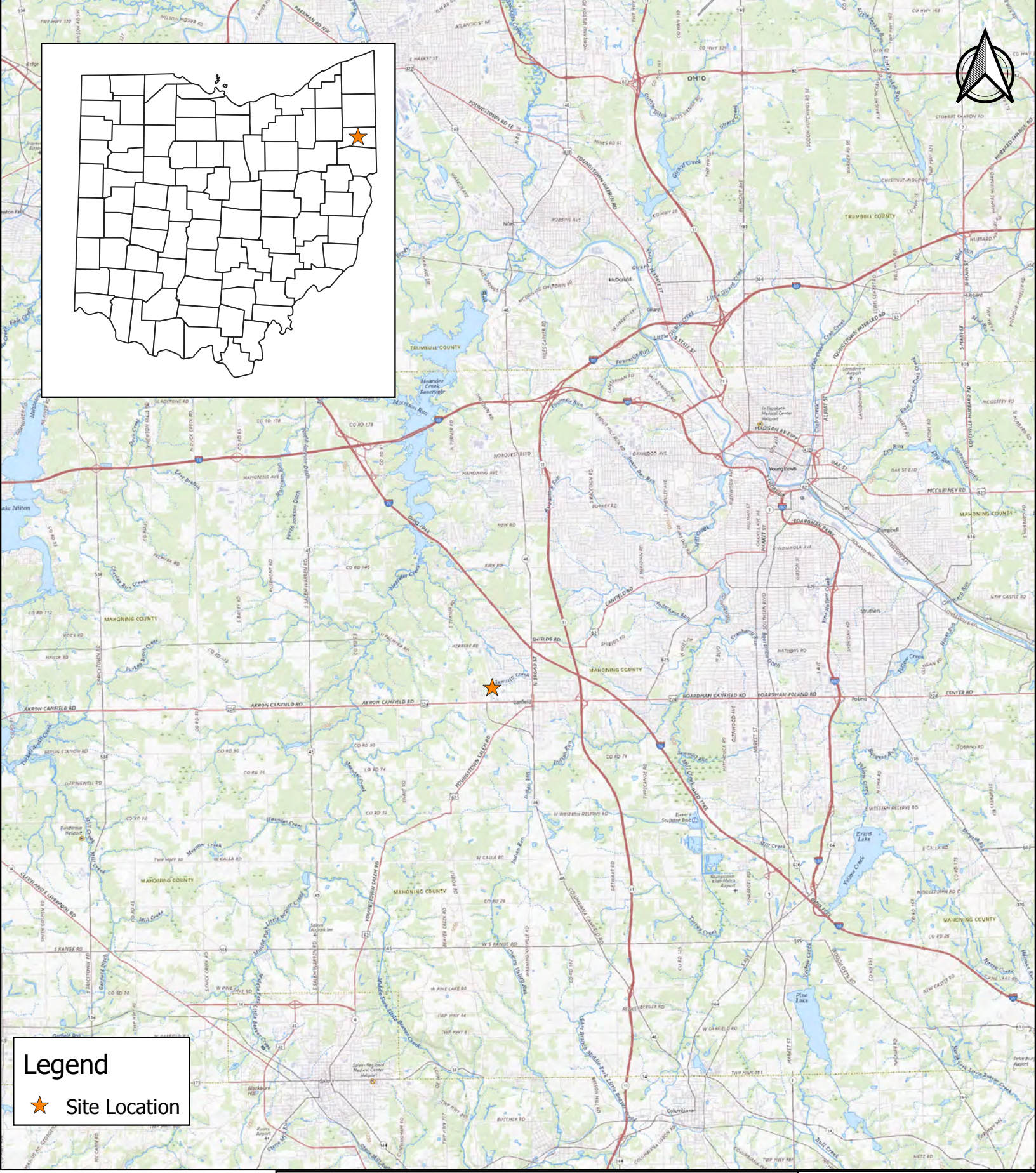
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FIGURES



MAD SCIENTIST ASSOCIATES LLC

Figure 1. Site Location
Integral Consulting, Canfield Site
Canfield, Ohio

Created by: Lindsay Hanna
Date: December 2, 2024

Data Sources: Google Satellite Imagery



MAD SCIENTIST ASSOCIATES LLC

Figure 2. Site Aerial
Integral Consulting, Canfield Site
Canfield, Ohio

250 0 250 500 750 ft

Created by: Lindsay Hanna
Date: December 2, 2024

Data Sources: Google Satellite Imagery



MAD SCIENTIST ASSOCIATES LLC

Figure 3. NWI-Mapped Waters
Integral Consulting, Canfield Site
Canfield, Ohio

250 0 250 500 750 ft

Created by: Lindsay Hanna
Date: December 2, 2024

Data Sources: Google Satellite Imagery
NWI-Mapped Imagery



MAD SCIENTIST ASSOCIATES LLC

Figure 4. Wetland Boundary
Integral Consulting, Canfield Site
Canfield, Ohio

100 0 100 200 300 ft

Created by: Lindsay Hanna
Date: December 2, 2024

Data Sources: Google Satellite Imagery

APPENDIX A

Photographs



MAD SCIENTIST ASSOCIATES LLC

Photo Locations
Integral Consulting, Canfield Site
Canfield, Ohio

50 0 50 100 150 ft

Created by: Lindsay Hanna
Date: December 2, 2024

Data Sources: Google Satellite Imagery



Photograph 1. Soil at sample point TP-1



Photograph 2. North view from TP-1.



Photograph 3. East view from TP-1.



Photograph 4. South view from TP-1.



Photograph 5. West view from TP-1.



Photograph 6. View of TP-1, facing northwest.



Photograph 7. Soil at sample point TP-2.



Photograph 8. Oxidized rhizospheres in lower soil layers at TP-2.



Photograph 9. North view from TP-2.



Photograph 10. East view from TP-2.



Photograph 11. South view from TP-2.



Photograph 12. West view from TP-2.



Photograph 13. Wetland edge on southeast side, facing south downstream.



Photograph 14. Wetland A interior facing northwest from southeast edge.



Photograph 15. Temporary disturbed area for response action within Wetland A.



Photograph 16. Wetland edge west of TP-1 facing northeast.



Photograph 17. Wetland interior facing west from edge.



Photograph 18. North view of Wetland A interior.



Photograph 19. East view of Wetland A interior.



Photograph 20. South view of Wetland A interior.



Photograph 21. West view of Wetland A interior.



Photograph 22. Upland edge of Wetland A, facing south.

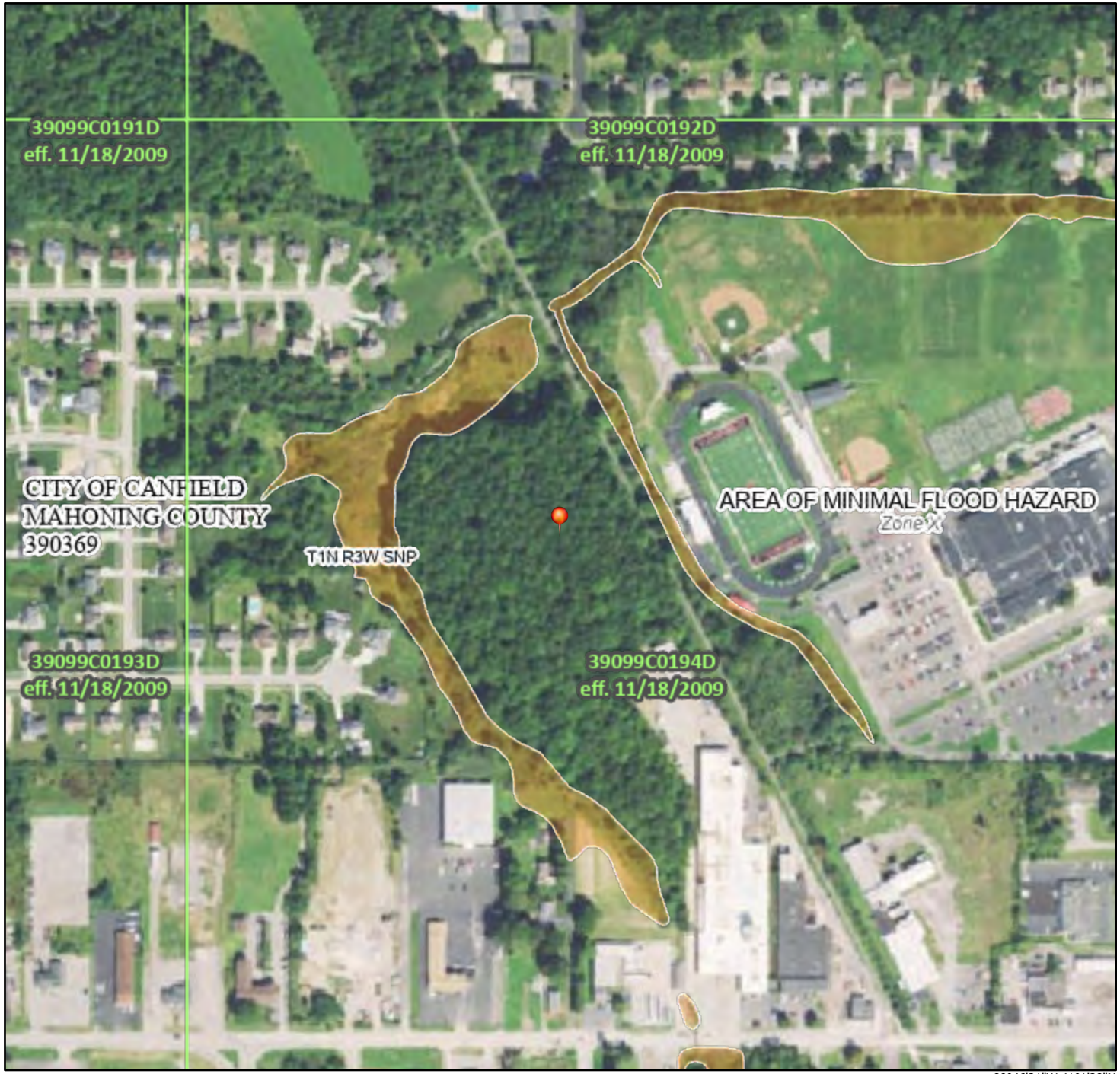
APPENDIX B

FEMA Floodplain Map

National Flood Hazard Layer FIRMette

FEMA

80°46'59"W 41°1'56"N



80°46'21"W 41°1'28"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

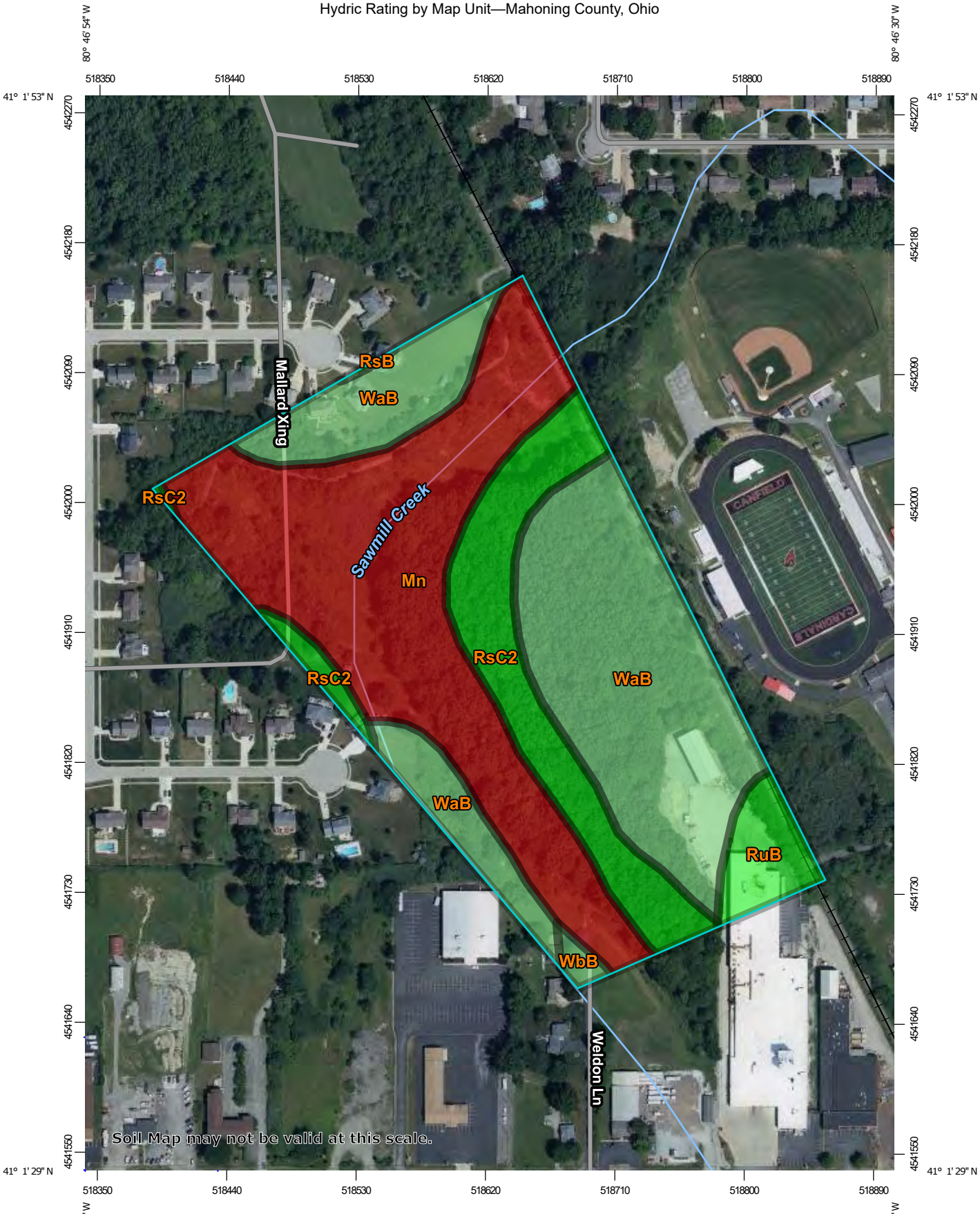
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/3/2024 at 3:22 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX C

Web Soil Survey – Hydric Rating Map


80° 46' 54" W
80° 46' 30" W
518350
518440
518530
518620
518710
518800
518890
41° 1' 53" N
41° 1' 29" N
4542270
4542180
4542090
4542000
4541910
4541820
4541730
4541640
4541550
RsB
WaB
RsC2
Mallard Xing
Sawmill Creek
Mn
RsC2
RsC2
WaB
WaB
RuB
WbB
Weldon Ln
Soil Map may not be valid at this scale.
Map Scale: 1:3,630 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0
50
100
200
300
Feet
0
150
300
600
900
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Hydric (100%)
- Hydric (66 to 99%)
- Hydric (33 to 65%)
- Hydric (1 to 32%)
- Not Hydric (0%)
- Not rated or not available

Soil Rating Lines
- Hydric (100%)
- Hydric (66 to 99%)
- Hydric (33 to 65%)
- Hydric (1 to 32%)
- Not Hydric (0%)
- Not rated or not available

Soil Rating Points
- Hydric (100%)
- Hydric (66 to 99%)
- Hydric (33 to 65%)
- Hydric (1 to 32%)
- Not Hydric (0%)
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Mahoning County, Ohio
Survey Area Data: Version 22, Aug 28, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 4, 2020—Aug 10, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydric Rating by Map Unit

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Mn	Marengo silty clay loam	100	10.7	39.2%
RsB	Rittman silt loam, 2 to 6 percent slopes	0	0.0	0.1%
RsC2	Rittman silt loam, 6 to 12 percent slopes, eroded	0	4.4	16.2%
RuB	Rittman-Urban land complex, 2 to 6 percent slopes	0	1.1	4.1%
WaB	Wadsworth silt loam, 2 to 6 percent slopes	8	10.9	39.7%
WbB	Wadsworth-Urban land complex, 2 to 6 percent slopes	5	0.2	0.7%
Totals for Area of Interest			**27.4**	**100.0%**

Description

This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit.

The thematic map is color coded based on the composition of hydric components. The five color classes are separated as 100 percent hydric components, 66 to 99 percent hydric components, 33 to 65 percent hydric components, 1 to 32 percent hydric components, and less than one percent hydric components.

In Web Soil Survey, the Summary by Map Unit table that is displayed below the map pane contains a column named 'Rating'. In this column the percentage of each map unit that is classified as hydric is displayed.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

Rating Options

Aggregation Method: Percent Present

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

APPENDIX D

State & Federal Agency Correspondence

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

NOT FOR CONSULTATION

Location

Mahoning County, Ohio



Local office

Ohio Ecological Services Field Office

(614) 416-8993
(614) 416-8994

4625 Morse Road, Suite 104

Columbus, OH 43230-8355

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

NOT FOR CONSULTATION

2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Indiana Bat Myotis sodalis Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5949	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

NOT FOR CONSULTATION

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to Bald Eagle Nesting and Sensitivity to Human Activity

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31

NOT FOR CONSULTATION

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

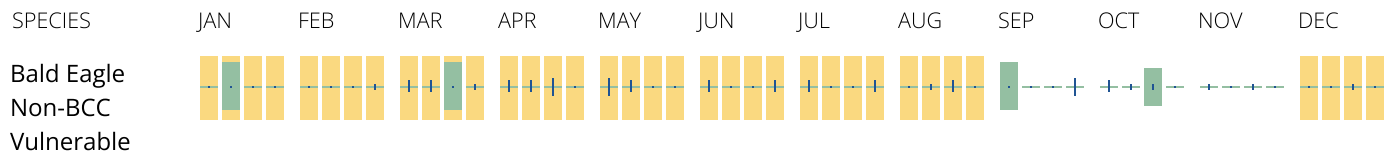
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

NOT FOR CONSULTATION

▪ probability of presence ▪ breeding season | survey effort – no data



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

NOT FOR CONSULTATION

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NOT FOR CONSULTATION

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31
Belted Kingfisher Megaceryle alcyon This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 15 to Jul 25

Blue-winged Warbler Vermivora cyanoptera — Breeds May 1 to Jun 30
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Bobolink Dolichonyx oryzivorus — Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Canada Warbler Cardellina canadensis — Breeds May 20 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Chimney Swift Chaetura pelagica — Breeds Mar 15 to Aug 25
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Eastern Meadowlark Sturnella magna — Breeds Apr 25 to Aug 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Red-headed Woodpecker Melanerpes erythrocephalus — Breeds May 10 to Sep 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Rose-breasted Grosbeak Pheucticus ludovicianus — Breeds May 15 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Wood Thrush Hylocichla mustelina — Breeds May 10 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

NOT FOR CONSULTATION

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

NOT FOR CONSULTATION

▪ probability of presence ▪ breeding season | survey effort – no data



NOT FOR CONSULTATION

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

NOT FOR CONSULTATION

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

NOT FOR CONSULTATION

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER FORESTED/SHRUB WETLAND

PSS1C

RIVERINE

R4SBC

NOT FOR CONSULTATION

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

APPENDIX E

Wetland Delineation Sample Plot Data Forms

Background Information

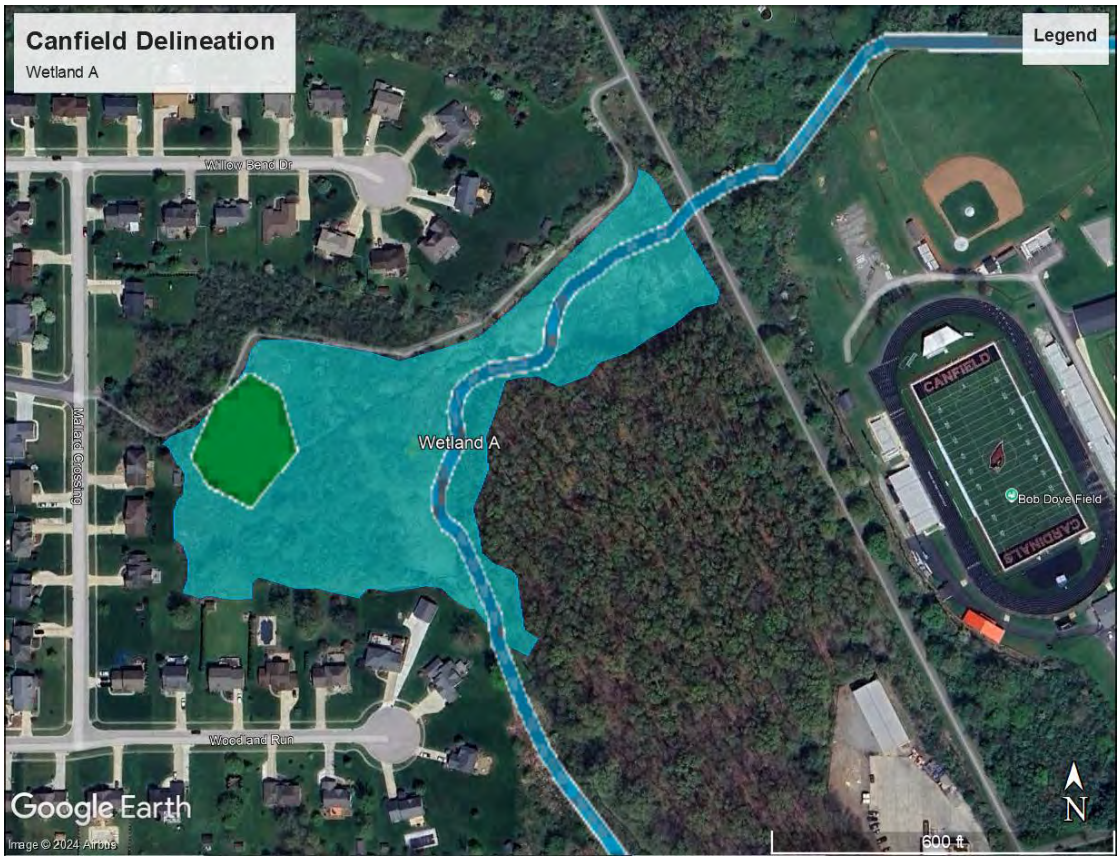
Name: Lindsay Hanna
Date: December 3 2024
Affiliation: MAD Scientist Associates
Address: 253 North State Street, Suite 101 Westerville, Ohio 43081
Phone Number: (614) 818-9156
e-mail address: Lindsay@madscientistassociates.net
Name of Wetland: Wetland A
Vegetation Communit(ies): Emergent
HGM Class(es): Riverine, Depressional
Location of Wetland: include map, address, north arrow, landmarks, distances, roads, etc.



Lat/Long or UTM Coordinate	WGS 84: 41.0259583 -80.7761918
USGS Quad Name	Warren
County	Mahoning
Township	
Section and Subsection	
Hydrologic Unit Code	050301030702
Site Visit	11/21/2024
National Wetland Inventory Map	-------
Ohio Wetland Inventory Map	-------
Soil Survey	Marengo silty clay loam
Delineation report/map	Yes

Name of Wetland:	Wetland A
Wetland Size (acres, hectares):	6.92 acres

Sketch: Include north arrow, relationship with other surface waters, vegetation zones, etc.



Comments, Narrative Discussion, Justification of Category Changes:

Wetland A totals approximately 6.92 acres, located along the floodplain of Sawmill Creek. The wetland feature predominantly consists of emergent hydrophytic vegetation that is dominated by invasive reed canary grass and giant reed. A shrub buffer of red-osier dogwood is located along the southeastern edge of the wetland, and a few pin oak snags were observed within the wetland. Wetland hydrology indicators for the wetland include oxidized rhizospheres on living roots, saturation visible on aerial imagery, geomorphic position, and passage of the FAC-neutral test. Hydric soil indicators exhibited within Wetland A include a depleted matrix (F3).

Final score : 47	**Category:**	2

Scoring Boundary Worksheet

INSTRUCTIONS. The initial step in completing the ORAM is to identify the "scoring boundaries" of the wetland being rated. In many instances this determination will be relatively easy and the scoring boundaries will coincide with the "jurisdictional boundaries." For example, the scoring boundary of an isolated cattail marsh located in the middle of a farm field will likely be the same as that wetland's jurisdictional boundaries. In other instances, however, the scoring boundary will not be as easily determined. Wetlands that are small or isolated from other surface waters often form large contiguous areas or heterogeneous complexes of wetland and upland. In separating wetlands for scoring purposes, the hydrologic regime of the wetland is the main criterion that should be used. Boundaries between contiguous or connected wetlands should be established where the volume, flow, or velocity of water moving through the wetland changes significantly. *Areas with a high degree of hydrologic interaction should be scored as a single wetland*. In determining a wetland's scoring boundaries, use the guidelines in the ORAM Manual Section 5.0. In certain instances, it may be difficult to establish the scoring boundary for the wetland being rated. These problem situations include wetlands that form a patchwork on the landscape, wetlands divided by artificial boundaries like property fences, roads, or railroad embankments, wetlands that are contiguous with streams, lakes, or rivers, and estuarine or coastal wetlands. These situations are discussed below, however, it is recommended that Rater contact Ohio EPA, Division of Surface Water, 401/Wetlands Section if there are additional questions or a need for further clarification of the appropriate scoring boundaries of a particular wetland.

#	Steps in properly establishing scoring boundaries	done?	not applicable
Step 1	Identify the wetland area of interest. This may be the site of a proposed impact, a reference site, conservation site, etc.	✔	☐
Step 2	Identify the locations where there is physical evidence that hydrology changes rapidly. Such evidence includes both natural and human-induced changes including, constrictions caused by berms or dikes, points where the water velocity changes rapidly at rapids or falls, points where significant inflows occur at the confluence of rivers, or other factors that may restrict hydrologic interaction between the wetlands or parts of a single wetland.	✔	☐
Step 3	Delineate the boundary of the wetland to be rated such that all areas of interest that are contiguous to and within the areas where the hydrology does not change significantly, i.e. areas that have a high degree of hydrologic interaction are included within the scoring boundary.	✔	☐
Step 4	Determine if artificial boundaries, such as property lines, state lines, roads, railroad embankments, etc., are present. These should not be used to establish scoring boundaries unless they coincide with areas where the hydrologic regime changes.	✔	☐
Step 5	In all instances, the Rater may enlarge the minimum scoring boundaries discussed here to score together wetlands that could be scored separately.	☐	✔
Step 6	Consult ORAM Manual Section 5.0 for how to establish scoring boundaries for wetlands that form a patchwork on the landscape, divided by artificial boundaries, contiguous to streams, lakes or rivers, or for dual classifications.	☐	✔

End of Scoring Boundary Determination. Begin Narrative Rating on next page.

Wetland A

Narrative Rating

INSTRUCTIONS. Answer each of the following questions. Questions 1, 2, 3 and 4 should be answered based on information obtained from the site visit or the literature *and* by submitting a Data Services Request to the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Natural Heritage Data Services, 1889 Fountain Square Court, Building F-1, Columbus, Ohio 43224, 614-265-6453 (phone), 614-265-3096 (fax), http://www.dnr.state.oh.us/dnap . The remaining questions are designed to be answered primarily by the results of the site visit. Refer to the User's Manual for descriptions of these wetland types. Note: "Critical habitat" is legally defined in the Endangered Species Act and is the geographic area containing physical or biological features essential to the conservation of a listed species or as an area that may require special management considerations or protection. The Rater should contact the Region 3 Headquarters or the Columbus Ecological Services Office for updates as to whether critical habitat has been designated for other federally listed threatened or endangered species. "Documented" means the wetland is listed in the appropriate State of Ohio database.

#	Question	Circle one	
1	**Critical Habitat.** Is the wetland in a township, section, or subsection of a United States Geological Survey 7.5 minute Quadrangle that has been designated by the U.S. Fish and Wildlife Service as "critical habitat" for any threatened or endangered plant or animal species? Note: as of January 1, 2001, of the federally listed endangered or threatened species which can be found in Ohio, the Indiana Bat has had critical habitat designated (50 CFR 17.95(a)) and the piping plover has had critical habitat proposed (65 FR 41812 July 6, 2000).	YES Wetland should be evaluated for possible Category 3 status Go to Question 2	(NO) Go to Question 2
2	**Threatened or Endangered Species.** Is the wetland known to contain an individual of, or documented occurrences of federal or state-listed threatened or endangered plant or animal species?	YES Wetland is a Category 3 wetland. Go to Question 3	(NO) Go to Question 3
3	**Documented High Quality Wetland.** Is the wetland on record in Natural Heritage Database as a high quality wetland?	YES Wetland is a Category 3 wetland Go to Question 4	(NO) Go to Question 4
4	**Significant Breeding or Concentration Area.** Does the wetland contain documented regionally significant breeding or nonbreeding waterfowl, neotropical songbird, or shorebird concentration areas?	YES Wetland is a Category 3 wetland Go to Question 5	(NO) Go to Question 5
5	**Category 1 Wetlands.** Is the wetland less than 0.5 hectares (1 acre) in size and **hydrologically isolated** and either 1) comprised of vegetation that is dominated (greater than eighty per cent areal cover) by *Phalaris arundinacea, Lythrum salicaria,* or *Phragmites australis*, or 2) an acidic pond created or excavated on mined lands that has little or no vegetation?	YES Wetland is a Category 1 wetland Go to Question 6	(NO) Go to Question 6
6	**Bogs.** Is the wetland a peat-accumulating wetland that 1) has no significant inflows or outflows, 2) supports acidophilic mosses, particularly *Sphagnum* spp., 3) the acidophilic mosses have >30% cover, 4) at least one species from Table 1 is present, and 5) the cover of invasive species (see Table 1) is <25%?	YES Wetland is a Category 3 wetland Go to Question 7	(NO) Go to Question 7
7	**Fens.** Is the wetland a carbon accumulating (peat, muck) wetland that is saturated during most of the year, primarily by a discharge of free flowing, mineral rich, ground water with a circumneutral ph (5.5-9.0) and with one or more plant species listed in Table 1 and the cover of invasive species listed in Table 1 is <25%?	YES Wetland is a Category 3 wetland Go to Question 8a	(NO) Go to Question 8a
8a	**"Old Growth Forest."** Is the wetland a forested wetland and is the forest characterized by, but not limited to, the following characteristics: overstory canopy trees of great age (exceeding at least 50% of a projected maximum attainable age for a species); little or no evidence of human-caused understory disturbance during the past 80 to 100 years; an all-aged structure and multilayered canopies; aggregations of canopy trees interspersed with canopy gaps; and significant numbers of standing dead snags and downed logs?	YES Wetland is a Category 3 wetland. Go to Question 8b	(NO) Go to Question 8b

8b	**Mature forested wetlands**. Is the wetland a forested wetland with 50% or more of the cover of upper forest canopy consisting of deciduous trees with large diameters at breast height (dbh), generally diameters greater than 45cm (17.7in) dbh?	YES Wetland should be evaluated for possible Category 3 status. Go to Question 9a	(NO) Go to Question 9a
9a	**Lake Erie coastal and tributary wetlands**. Is the wetland located at an elevation less than 575 feet on the USGS map, adjacent to this elevation, or along a tributary to Lake Erie that is accessible to fish?	YES Go to Question 9b	(NO) Go to Question 10
9b	Does the wetland's hydrology result from measures designed to prevent erosion and the loss of aquatic plants, i.e. the wetland is partially hydrologically restricted from Lake Erie due to lakeward or landward dikes or other hydrological controls?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 9c
9c	Are Lake Erie water levels the wetland's primary hydrological influence, i.e. the wetland is hydrologically unrestricted (no lakeward or upland border alterations), or the wetland can be characterized as an "estuarine" wetland with lake and river influenced hydrology. These include sandbar deposition wetlands, estuarine wetlands, river mouth wetlands, or those dominated by submersed aquatic vegetation.	YES Go to Question 9d	NO Go to Question 10
9d	Does the wetland have a predominance of native species within its vegetation communities, although non-native or disturbance tolerant native species can also be present?	YES Wetland is a Category 3 wetland Go to Question 10	NO Go to Question 9e
9e	Does the wetland have a predominance of non-native or disturbance tolerant native plant species within its vegetation communities?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 10
10	**Lake Plain Sand Prairies (Oak Openings)** Is the wetland located in Lucas, Fulton, Henry, or Wood Counties and can the wetland be characterized by the following description: the wetland has a sandy substrate with interspersed organic matter, a water table often within several inches of the surface, and often with a dominance of the gramineous vegetation listed in Table 1 (woody species may also be present). The Ohio Department of Natural Resources Division of Natural Areas and Preserves can provide assistance in confirming this type of wetland and its quality.	YES Wetland is a Category 3 wetland. Go to Question 11	(NO) Go to Question 11
11	**Relict Wet Prairies**. Is the wetland a relict wet prairie community dominated by some or all of the species in Table 1. Extensive prairies were formerly located in the Darby Plains (Madison and Union Counties), Sandusky Plains (Wyandot, Crawford, and Marion Counties), northwest Ohio (e.g. Erie, Huron, Lucas, Wood Counties), and portions of western Ohio Counties (e.g. Darke, Mercer, Miami, Montgomery, Van Wert etc.).	YES Wetland should be evaluated for possible Category 3 status Complete Quantitative Rating	(NO) Complete Quantitative Rating

Table 1. Characteristic plant species.

invasive/exotic spp	fen species	bog species	0ak Opening species	wet prairie species
Lythrum salicaria	*Zygadenus elegans var. glaucus*	*Calla palustris*	*Carex cryptolepis*	*Calamagrostis canadensis*
Myriophyllum spicatum	*Cacalia plantaginea*	*Carex atlantica var. capillacea*	*Carex lasiocarpa*	*Calamogrostis stricta*
Najas minor	*Carex flava*	*Carex echinata*	*Carex stricta*	*Carex atherodes*
Phalaris arundinacea	*Carex sterilis*	*Carex oligosperma*	*Cladium mariscoides*	*Carex buxbaumii*
Phragmites australis	*Carex stricta*	*Carex trisperma*	*Calamagrostis stricta*	*Carex pellita*
Potamogeton crispus	*Deschampsia caespitosa*	*Chamaedaphne calyculata*	*Calamagrostis canadensis*	*Carex sartwellii*
Ranunculus ficaria	*Eleocharis rostellata*	*Decodon verticillatus*	*Quercus palustris*	*Gentiana andrewsii*
Rhamnus frangula	*Eriophorum viridicarinatum*	*Eriophorum virginicum*		*Helianthus grosseserratus*
Typha angustifolia	*Gentianopsis spp.*	*Larix laricina*		*Liatris spicata*
Typha xglauca	*Lobelia kalmii*	*Nemopanthus mucronatus*		*Lysimachia quadriflora*
	Parnassia glauca	*Schechzeria palustris*		*Lythrum alatum*
	Potentilla fruticosa	*Sphagnum spp.*		*Pycnanthemum virginianum*
	Rhamnus alnifolia	*Vaccinium macrocarpon*		*Silphium terebinthinaceum*
	Rhynchospora capillacea	*Vaccinium corymbosum*		*Sorghastrum nutans*
	Salix candida	*Vaccinium oxycoccos*		*Spartina pectinata*
	Salix myricoides	*Woodwardia virginica*		*Solidago riddellii*
	Salix serissima	*Xyris difformis*		
	Solidago ohioensis			
	Tofieldia glutinosa			
	Triglochin maritimum			
	Triglochin palustre			

End of Narrative Rating. Begin Quantitative Rating on next page.

Site: Canfield Wetland A	**Rater(s):** LH	**Date:** December 3 2024

Metric 1. Wetland Area (size).

3 (max 6 pts.) | 3 (subtotal)

Select one size class and assign score.

Wetland A

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [x] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [ ] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [ ] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

7 (max 14 pts.) | 10 (subtotal)

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [x] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [x] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [ ] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [x] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

22 (max 30 pts.) | 32 (subtotal)

3a. Sources of Water. Score all that apply.

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [x] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [x] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- [ ] 100 year floodplain (1)
- [x] Between stream/lake and other human use (1)
- [ ] Part of wetland/upland (e.g. forest), complex (1)
- [x] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

- [x] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [ ] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

- [x] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3)
- [ ] Seasonally inundated (2)
- [ ] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- [ ] None or none apparent (12)
- [x] Recovered (7)
- [ ] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [x] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [x] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

13 (max 20 pts.) | 45 (subtotal)

4a. Substrate disturbance. Score one or double check and average.

- [ ] None or none apparent (4)
- [x] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [x] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.

- [ ] None or none apparent (9)
- [x] Recovered (6)
- [ ] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [x] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

45 (subtotal this page)

last revised 1 February 2001 jjm

Site: Canfield Wetland A	**Rater(s):** LH	**Date:** December 3 2024

45
subtotal first page

Metric 5. Special Wetlands.

Wetland A

0 max 10 pts. | 45 subtotal

Check all that apply and score as indicated.

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

Metric 6. Plant communities, interspersion, microtopography.

2 max 20 pts. | 47 subtotal

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [0] Shrub
- [0] Forest
- [ ] Mudflats
- [ ] Open water
- [ ] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high(4)
- [✔] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

- [✔] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

- [1] Vegetated hummucks/tussucks
- [1] Coarse woody debris >15cm (6in)
- [1] Standing dead >25cm (10in) dbh
- [0] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

47

End of Quantitative Rating. Complete Categorization Worksheets.

Wetland A

ORAM Summary Worksheet

		circle answer or insert score	Result
Narrative Rating	Question 1 Critical Habitat	YES (NO)	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES (NO)	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES (NO)	If yes, Category 3.
	Question 4. Significant bird habitat	YES (NO)	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES (NO)	If yes, Category 1.
	Question 6. Bogs	YES (NO)	If yes, Category 3.
	Question 7. Fens	YES (NO)	If yes, Category 3.
	Question 8a. Old Growth Forest	YES (NO)	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES (NO)	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES (NO)	If yes, Category 3
	Question 11. Relict Wet Prairies	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	3	
	Metric 2. Buffers and surrounding land use	7	
	Metric 3. Hydrology	22	
	Metric 4. Habitat	13	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	2	
	TOTAL SCORE	47	Category based on score breakpoints 2

Complete Wetland Categorization Worksheet.

Wetland A **Wetland Categorization Worksheet**

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	(NO)	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	(NO)	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	(NO)	Is quantitative rating score *greater* than the Category 2 scoring threshold *(including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	(YES) Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	(NO)	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	(NO) Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category

Choose one	Category 1	(Category 2)	Category 3

End of Ohio Rapid Assessment Method for Wetlands.


MAD
SCIENTIST
ASSOCIATES LLC

Attachment F

Evaluation of Potential Ecological Harm

Level I Attachment C

EVALUATION OF POTENTIAL ECOLOGICAL HARM		**Y**	**N**	**U**
Are ecological stressors present or potentially present in:				
a	Soil	X		
b	Surface Water	X		
c	Sediment	X		
d	Ground Water			X
e	Other (biotic media)			X
f	Are important ecological resources located at, or in the locality of the site?			X

"Y" = yes; "N" = No, "U" = Unknown (counts as a "Y")

When answering the above questions, consider the following:

X Known or suspected presence of ecological stressors stored, used or manufactured at the site.
X Ability of ecological stressors to migrate from one medium to another.
X The mobility of the various media.
X Transfer of contaminants through food webs and uptake of chemicals by organisms.
X The presence of important ecological resources, including surface waters on or in the locality of the site.

(a) If "Y" or "U" boxes in Attachment C are checked for row f and any other row, then a recommendation to move to Level II should be made for an assessment of the appropriate aquatic and/or terrestrial habitat. In completing this attachment, a lack of knowledge, presence of high uncertainty, or any "unknown" circumstances should be tabulated as a "U".

(b) If all of the "No" boxes in Attachment C are checked, or if only row f, or only rows a through e are checked “No”, then the site is highly unlikely to present significant risks to important ecological receptors and a recommendation for no further ecological investigations should be made.

Level II Ecological Risk Assessment

Material Sciences Corporation Parcel and Adjacent Wetland, Canfield, Ohio

Revision 1

Prepared for
August Mack Environmental
7830 North Central Drive, Suite B
Lewis Center, OH 43035

Prepared by

Integral Consulting Inc.
8742 E. Washington, #115
Chagrin Falls, OH 44022

August 2025

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ACRONYMS AND ABBREVIATIONS

August Mack	August Mack Environmental
COPEC	chemical of potential ecological concern
CSM	conceptual site model
Eco-SSL	ecological soil screening level
EDR	Environmental Data Resources, Inc.
EPA	U.S. Environmental Protection Agency
GIS	geographic information system
Integral	Integral Consulting Inc.
MAD Scientist	MAD Scientist Associates LLC
MSC	Material Sciences Corporation
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
ORAM	Ohio Rapid Assessment Method
PBT	persistent, bioaccumulative, and toxic
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RSL	regional screening level
TEC	threshold effect concentration
USFWS	U.S. Fish and Wildlife Service

1 INTRODUCTION AND BACKGROUND

Integral Consulting Inc. (Integral) has prepared this Level II ecological risk assessment on behalf of August Mack Environmental (August Mack) for the Material Sciences Corporation (MSC) parcel and adjacent wetland in Canfield, Ohio (Figures 1 and 2). For the purposes of this Level II ecological risk assessment, the term "site" refers to the MSC parcel and the term "assessment area" refers to the MSC parcel and a portion of the adjacent wetland (Figure 3). This assessment follows the completion of a Level I ecological risk assessment (Integral 2025).

The site is located in Mahoning County at 460 West Main Street, Canfield, Ohio (centered at 41.027837, –80.777932) and is bordered to the north and east by the Mill Creek Metroparks Bikeway, to the west by Hometown Produce Company and Mill Creek Metroparks property, and to the south by Route 224 Main Street (Figure 3). The 13.4-acre assessment area includes a 4.9-acre facility/engineered area, approximately 6 acres of terrestrial forested habitat, approximately 0.3 acres of scrub-shrub habitat, approximately 0.6 acres of stream, and approximately 1.6 acres of wetland habitat (Figure 4).

- **Facility/engineered area:** MSC operates the facility in the southern 4.9 acres of the assessment area. This area includes paved parking areas, some gravel access areas, and the facility buildings. The southern building includes offices and operations, while the northern building includes storage. Trucks use the docking area in the southwestern portion of the property.
- **Terrestrial habitat:** Approximately 6.3 acres of the assessment area consists of undeveloped forested upland habitat and scrub-shrub habitat.
- **Aquatic habitat:** Aquatic habitat in the assessment area includes two ditches and a wetland. The unnamed ditch runs to the west of the facility and Adjacent Ditch is located to the east of the facility. Water from both ditches flows north to a wetland and feeds into Sawmill Creek. Water level in the wetland is controlled by a gated culvert, located on Mill Creek Metroparks property, which allows water to pass under the bikeway as Sawmill Creek. An ecological risk assessment for Sawmill Creek is presented under separate cover.

In July 2024, an incident occurred at the facility that prompted additional investigation and interim remediation of chemicals along the Adjacent Ditch.[1] As part of that investigation, the Ohio Environmental Protection Agency (Ohio EPA) requires an evaluation of potential ecological risk assessment within the assessment area. This Level II ecological risk assessment builds on the previous scoping analysis presented in the Level I ecological risk assessment (Integral 2025). A Level II ecological risk assessment is a screening level assessment that is used to evaluate whether chemicals present from the site may pose risk to

[1] https://www.mscresponse.com/.

ecological resources in the assessment area. This report follows the Ohio EPA guidance and report outline (Ohio EPA 2018).

In accordance with Ohio EPA guidance (Ohio EPA 2018), this assessment was based on existing data, including the *Initial Site Investigation Report* (August Mack 2024), assessment area photos, aerial imagery, and a site visit, which included an evaluation of habitat type and extent, observations of species present, signs of ecological use, and a wetland delineation. In addition, the following documents, maps, or other publications were reviewed in the preparation of this report:

- Environmental Data Resources, Inc. (EDR), The EDR Aerial Photo Decade Package, Inquiry Number 7821917.5, dated November 14, 2024
- EDR, The EDR-City Directory Image Report, Inquiry Number 7821917.8, dated November 18, 2024
- EDR, The EDR Radius Map with GeoCheck, Inquiry Number 07821917.2r, dated November 14, 2024
- EDR, Certified Sanborn Map Report, Inquiry Number 7821917.3, dated November 14, 2024
- Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Maps
- U.S. Department of Agriculture, Soil Conservation Service, Soil Surveys
- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory database, http://www.fws.gov/wetlands/Data/Mapper.html
- U.S. Geological Survey, Topographic Maps
- U.S. Department of the Interior, Fish and Wildlife Service, National Wetlands Inventory Map.

1.1 SITE HISTORY

The MSC Canfield facility building was constructed in 1950 for the Life Time Products Corporation, Coated Steel Division (Ohio EPA and MSC 2024). Manufacturing operations included surface coating, machining, spray painting, and metal fabricating (Ohio EPA and MSC 2024). In the 1950s or 1960s, the facility became known as Canfield Steel, which was purchased by Pittsburgh Steel Corporation in 1968 to form the Pittsburgh-Canfield Corporation. The facility was acquired in 2013 by New Star Metals, a predecessor to MSC.[2] The facility is still operational.

[2] The facility also previously operated as the Canfield Coating Company.

The coating and electro galvanizing processes use multiple solvents and metals, and the facility is classified as a large quantity generator (EPA ID: OHD000810283). During normal operations, waste is disposed of offsite at an appropriate disposal facility.[3] Chemicals listed on the Toxic Release Inventory forms are cyanide, xylene, ethylbenzene, methyl isobutyl ketone, *n*-butyl alcohol, 1,2,4-trimethylbenzene, nitric acid, phosphoric acid, sodium hydroxide, toluene, and methyl ethyl ketone.

The facility operates under an approved 80 percent synthetic minor air permit (OH0000000250030020).[4]

1.2 HISTORICAL REGULATORY STATUS

In 1992, the U.S. Environmental Protection Agency (EPA) issued a preliminary assessment/ visual site inspection assessment report in response to a permit application. Of the 12 solid waste management units identified, EPA recommended that the former waste chromate solution treatment area undergo closure under the Resource Conservation and Recovery Act (RCRA). Documentation was not available to indicate the solid waste management unit locations, potential overlap with the current assessment area, or any implemented actions.

In 2008, Ohio EPA reached a settlement with Canfield Metal Coating Corporation for past hazardous waste violations and issued an administrative consent order[5] for violations that occurred at 460 West Main Street in Canfield. The settlement included a $10,300 penalty of which $8,240 was deposited into the state's hazardous waste cleanup fund and the remainder was contributed to the Ohio EPA Clean Diesel School Bus Program.

The facility had three informal violations in 2022 related to waste storage and disposal. All violations were corrected before the next inspection.

The facility has not had any air permit violations in the last 5 years.[6]

1.3 CURRENT REGULATORY STATUS

In July 2024, MSC and state and local agencies responded to a report of a release of process fluids in the Adjacent Ditch. During the initial response, personnel observed conditions that indicated some fluid had leaked from the facility into groundwater and sediment of the Adjacent Ditch. It is unclear how long the release had occurred. Emergency response was

[3] https://enviro.epa.gov/facts/tri/ef-facilities/#/Water/44406CNFLD460WE.
[4] https://enviro.epa.gov/envirofacts/icis-air/plant?handlerId=OH0000000250030020.
[5] https://dam.assets.ohio.gov/image/upload/epa.ohio.gov/Portals/32/pdf/Signed%20DFFO.web.Canfield%20Metal%20Coating%20Corp.%2009.03.08.pdf.
[6] https://echo.epa.gov/detailed-facility-report?fid=110000389561.

immediately initiated, in close coordination with Ohio EPA and other agencies. Initial sampling indicated the presence of "residual byproducts from the metal coating process, including elevated levels of sodium hydroxide, zinc, chromium and cyanide."[7] The emergency response included placing temporary fencing; sealing drains, pipes, and manholes; bypassing the adjacent ditch; extracting potentially contaminated water; and placing a liner in the ditch to prevent contact of surface water with impacted sediment.

The site was transferred into the RCRA program to address potential longer-term investigation and remediation following the completed emergency interim response. Ohio EPA issued an administrative consent order on December 31, 2024, to conduct corrective actions necessary at the site.

August Mack conducted an initial site investigation to analyze chemical concentrations at the site and throughout the assessment area, specifically in groundwater, soil/sediment, and surface water samples. Sample locations are presented in Figure 5. The results are summarized in August Mack (2024). Selected figures from that report are reproduced in Attachment A. Surface water and soil data from August Mack (2024) indicated that the primary chemicals of concern in the assessment area were cyanide, zinc, hexavalent chromium, and trichloroethene, as follows:[8]

- **Soil/Sediment**
  - Hexavalent chromium and zinc in sediment within the Adjacent Ditch exceeded the EPA residential regional screening level (RSL).
  - Total cyanide in sediment within the Adjacent Ditch exceeded the EPA industrial RSL.
  - Total cyanide and zinc in the wetland sediment exceeded the EPA residential RSL.
  - Arsenic in Adjacent Ditch sediment and wetland sediment exceeded residential and/or industrial RSLs, but has not historically been used at the site and concentrations are generally consistent with background concentrations.
  - Other chemicals in Adjacent Ditch that exceeded the 2024 EPA residential RSLs for soil were benzo[*a*]pyrene and benzo[*b*]fluoranthene.
  - Other chemicals in the Adjacent Ditch and/or the wetland that exceeded the 2024 EPA industrial regional soil screening levels included benzo[*a*]anthracene, benzo[*a*]pyrene, benzo[*b*]fluoranthene, dibenz[*a,h*] anthracene, cadmium, and lead.
  - High pH (8.3 to 11.7) was measured within the Adjacent Ditch.

[7] https://www.mscresponse.com/.
[8] These data were not compared to ecological toxicity benchmarks in August Mack (2024).

- **Surface Water**
  - Zinc in the Adjacent Ditch exceeded the Ohio River Basin Human Health Tier 1 Criteria for non-drinking surface water.
  - Other chemicals that exceeded Ohio River Basin Human Health Tier 1 Criteria for non-drinking surface water were mercury, benz[*a*]anthracene, benzo[*a*]pyrene, benzo[*b*]fluoranthene, benzo[*k*]fluoranthene, and indeno[1,2,3-*cd*]pyrene.

Ohio EPA approved a ditch lining plan, which will separate stormwater flow within the ditch from potential subsurface groundwater impacts and eliminate the direct contact potential of the ditch soils to both human and ecological sensitive receptors.

1.4 LEVEL I REPORT

The Level I ecological risk assessment report (Integral 2025) indicates that there are chemicals of interest[9] detected in environmental media in the assessment area that have the potential to pose a risk to ecological receptors. Integral (2025) concluded that:

- Chemicals were present in groundwater, soil, sediment,[10] and surface water in the assessment area (August Mack 2024).
- Ecological habitat (including habitats that may be used by threatened and endangered species) is present in the assessment area.
- Signs of relevant ecological receptors were observed during the site visit, but the timing of the observations (i.e., November) prohibited a full ecological characterization.
- Wetlands are present, of moderate quality, and dominated by invasive species.

Because site-related chemicals were detected in environmental media that may be used by ecological receptors, the Level I ecological risk assessment concluded that a Level II ecological risk assessment was needed.

[9] The term "chemical of interest" is used in Level I ecological risk assessment in accordance with Ohio EPA guidance (Ohio EPA 2018). Chemicals of interest are screened in the Level II ecological risk assessment to determine if they are chemicals of potential ecological concern (COPECs).
[10] The initial sampling classified all solids samples as soil. However, for the purposes of the ecological risk assessment, solids collected from within the wetland and ditch areas are considered to be sediment.

2 SITE SURVEY AND DESCRIPTION

A detailed site survey was conducted on November 21, 2024, to gather qualitative and semiquantitative data necessary for identifying relevant and complete exposure pathways in the assessment area. The site survey included geographic information system (GIS) mapping and analysis, confirmation of habitat, wetland delineation, wetland quality assessment using the Ohio Rapid Assessment Method (ORAM), terrestrial receptor inventory based on visual observations, and an avian inventory using the Merlin Bird Identification application (Merlin Bird ID 2024). A photo log is provided in Attachment B, the ecological scoping checklist is provided in Attachment C, and the wetland delineation report is provided in Attachment D. Observations from each of the main habitat areas are described below.

- **Facility/Engineered Area**: Approximately 4.9 acres (37 percent) of the assessment area consists of developed and engineered areas, which include paved parking lots, facility buildings, and gravel areas. No vegetation or wildlife was observed in this area.
- **Terrestrial Habitat**: Terrestrial wooded habitat makes up 6.0 acres (45 percent) of the assessment area. This deciduous forested habitat is dominated by oak (*Quercus* spp.), hickory (*Carya* spp.), and maple (*Acer* spp.). The mature trees have a typical diameter at breast height of 12 in. During the site visit, squirrels were observed, and deer signs (game paths, prints, tree bark scraping at approximately 3 to 4 ft above ground surface indicating rutting) were noted. Birds seen or heard during the site visit, included American crow, song sparrow, northern cardinal, swamp sparrow, and blue jay.

  Approximately 0.3 acres (2 percent) along the bike trail is scrub-shrub habitat. The area along the bikeway includes grasses and poison ivy.
- **Aquatic Habitat:** Aquatic habitat in the assessment area includes wetland and ditches.
  - Wetland: Approximately 1.6 acres (12 percent) of the assessment area is wetland habitat. The wetland was delineated by MAD Scientist Associates LLC (MAD Scientist) on November 21, 2024, and is classified as a palustrine emergent wetland.[11] The wetland area includes a large open water portion, some small (6–12 in. wide and less than 12 in. deep) open channels, and areas with submerged and emergent vegetation. The wetland is dominated by invasive species including stands of *Phragmites australis* and reed canary grass. Other typical wetland vegetation observed included *Carex* species. When present, this vegetation was dense and tall (greater than 5 ft). A shrub buffer along the southeastern edge of the wetland includes red-osier dogwood, bush honeysuckle, and multiflora rose.
  - Ditches: Approximately 0.6 acres (4 percent) of the assessment area is a ditch, which based on shape and alignment, appears to have been straightened. No

[11] The acreage presented the wetland delineation (Attachment D) is larger than the acreage presented in this report because it includes a large portion of the wetland that is located to the west of the assessment area (i.e., upstream).

standing water was present in the ditch during the site visit, which occurred after a ditch bypass had been installed as part of the emergency response actions.

Vegetation conditions observed in the assessment area were characteristic of the fall season. Because the site visit occurred in late November, many understory trees and emergent vegetation had senesced or died back.

3 LEVEL II SCREENING RESULTS

This Level II ecological risk assessment identified the environmental media of interest in the assessment area and then identified chemicals of potential ecological concern (COPECs) as those present at concentrations above ecotoxicological benchmarks. The results of the COPEC screening and assessment area investigation were used to develop a conceptual site model (CSM), including the identification of relevant and complete exposure pathways, ecological receptors of interest, and candidate assessment endpoints. The results of each of these steps are detailed in the following sections.

3.1 ENVIRONMENTAL MEDIA

Consistent with Ohio EPA guidance (Ohio EPA 2018), environmental media of interest for the ecological risk assessment are surface soil, surface sediment, and surface water. The initial investigation evaluated chemical concentrations in groundwater, surface soil/sediment, subsurface soil/sediment, and surface water (August Mack 2024). Although some chemicals have been detected in groundwater and subsurface soil, ecological receptors would not come into contact with these environmental media (discussed in more detail in Section 3.3.1) and do not require further evaluation in this ecological risk assessment.

The relevant environmental media for ecological risk assessment vary between terrestrial and aquatic exposure areas.

- Terrestrial exposure area including the upland forested habitat
  - Surface soil (0–1.2 m below ground surface) based on the depth of burrowing mammals[12]
  - Wildlife tissue from food items (i.e., invertebrates and plants that live in soil).
- Aquatic exposure area including the wetland habitat and the Adjacent Ditch
  - Surface water
  - Surface sediment (0–15 cm) based on the bioactive zone as specified in Ohio EPA (2018)
  - Wildlife tissue from food items (i.e., invertebrates and plants that live in the wetland).

[12] This Ohio EPA (2018)-recommended surface soil depth is based on burrowing mammals. This depth is highly conservative because most mammals burrow to substantially shallower depths. If a Level III ecological risk assessment is conducted, the depth of surface soil may be updated based on mammals observed in the assessment area.

3.2 CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN

The analytical chemistry results were screened against relevant ecotoxicological benchmarks to identify COPECs for each environmental medium. The screening process followed the procedure in Ohio EPA (2018) except that chemical screening compared to background concentrations was not conducted because few background samples were available. Any chemical that met one or both of the following criteria was not of ecological concern and therefore was removed from further evaluation:

- The maximum detected concentration is less than the ecotoxicological screening benchmark.
- The maximum detection limit of a nondetected chemical is less than its screening benchmark.

A chemical was retained as a COPEC for further evaluation if it met one or both of the following criteria:

- The maximum detected concentration exceeds the screening benchmark.
- Ohio EPA (2018) defines the chemical as persistent, bioaccumulative, and toxic (PBT).

Ohio EPA (2018) also allows removal of a detected chemical if it is present at a low frequency of detection (<5 percent). This criterion did not apply to the screening evaluation for soil or surface water because the site-specific data set contained fewer than 20 samples within the assessment area boundary. More than 20 surface water samples were collected, however, so the chemicals detected in less than 5 percent of sediment samples were excluded as COPECs.

3.2.1 Surface Soil

Chemicals detected in soil were compared to screening values following the hierarchy in Ohio EPA (2018):

- EPA's ecological soil screening levels (Eco-SSLs)[13]
- Preliminary remediation goals for ecological endpoints (Efroymson et al. 1997)

When soil screening benchmarks were unavailable from these two sources, Integral used screening values from the EPA Region 4 soil screening values for hazardous waste sites (Table 3 in USEPA 2018). The soil COPEC screening is summarized in Table 1.

[13] https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents. The lowest (i.e., most conservative) of the chemical-specific bird or mammal Eco-SSLs or the USEPA (2018) soil screening benchmarks were used to select the soil COPECs, if available.

Three metals and total cyanide were identified as COPECs in soil (Table 2). Chromium, zinc, and total cyanide exceeded their relevant soil screening values, and lead is a PBT chemical.

3.2.2 Surface Water

Chemicals detected in surface water were compared to the outside mixing zone average chemical criteria presented in OAC 3745-1-35. For chemicals without criteria in OAC 3745-1-35, Integral compared concentrations against chronic freshwater screening levels for hazardous waste sites (Table 1A in USEPA 2018). Metals with hardness-dependent criteria were evaluated based on a water hardness value of 200 mg/L, which is representative of aquatic systems in the area that ranged from 140 to 330 mg/L (Ohio EPA 1996). For surface water screening, total and dissolved analytical results for metals were screened separately. The surface water COPEC screening is summarized in Table 3.

Integral identified 17 metals[14] and polycyclic aromatic hydrocarbons (PAHs) were identified as COPECs in surface water samples (Table 2). Arsenic, barium, cadmium, chromium, hexavalent chromium, copper, lead, mercury, selenium, zinc, benz[*a*]anthracene, benzo[*a*]pyrene, benzo[*ghi*]perylene, benzo[*a*]fluoranthene, indeno[1,2,3-*cd*]pyrene, free cyanide, and total cyanide exceed the relevant screening values and/or were retained as COPECs (Table 2).

3.2.3 Surface Sediment

Chemicals detected in sediment were compared to the consensus-based threshold effect concentrations (TECs) from MacDonald et al. (2000) in accordance with OEPA (2018). TECs are available only for select metals and PAHs. When sediment screening benchmarks were not available in MacDonald et al. (2000), Integral used the EPA Region 4 sediment screening values for hazardous waste sites: non-narcotic modes of action (Table 2a in USEPA 2018). When screening levels were not available in USEPA (2018), Integral used EPA Region 3 RCRA Screening Levels for Sediment. The soil COPEC screening is summarized in Table 4.

Integral identified 29 COPECs in sediment samples including metals, PAHs, polychlorinated biphenyls (PCBs),[15] semivolatile organic compounds, free cyanide, and total cyanide because of exceedances of their respective screening value, status as PBT compounds, or known chemical released at the site (Table 2).

3.3 CONCEPTUAL SITE MODEL

A CSM provides a framework for understanding how COPECs interact with the environment by defining the source, release and transport mechanisms, exposure routes, and potential ecological receptors. It helps identify areas where exposure may occur and informs risk

[14] Metals were identified as COPECs in both dissolved and total fractions.
[15] PCBs were evaluated as total PCB Aroclors where applicable.

assessment and management decisions. CSMs are dynamic tools that evolve over time, incorporating new data through an iterative process to refine the understanding of chemical behavior and ecological risk.

Figure 6 presents the preliminary CSM, which illustrates the relationships between potentially affected environmental media (i.e., soil, surface water, sediment, tissue) and major ecological receptor groups (i.e., communities of invertebrates, plants, birds, and mammals) that may be exposed to COPECs in these media via direct contact, incidental ingestion, or dietary ingestion.

3.3.1 Relevant and Complete Exposure Pathways

An exposure pathway is considered complete if an ecological receptor could contact one or more COPECs in one or more environmental media via one or more exposure routes (e.g., ingestion).

The relevant and complete exposure pathways for the assessment area are presented in the CSM in Figure 6. Terrestrial receptors may be exposed to chemicals through direct contact (i.e., dermal exposure), incidental ingestion of soil, or dietary exposure through the ingestion of plants, terrestrial invertebrates, and small mammals that have accumulated chemicals in their tissues. Similarly, aquatic receptors may be exposed to chemicals by direct contact with environmental media (i.e., skin contact or respiration [gills]), incidental ingestion, or dietary exposure. The relevant and complete exposure pathways for the assessment area are presented in the CSM in Figure 6. Aquatic receptors may be exposed to chemicals by direct contact (i.e., skin contact or respiration through gills) with environmental media, incidental ingestion, or dietary exposure. Wildlife exposure to surface soil, sediment, and surface water via direct contact are complete pathways but are likely to be insignificant based on the duration of exposure; dietary exposures are considered to be a more significant exposure pathway for wildlife. Amphibian exposures to chemicals via surface soil and sediment ingestion is considered a complete exposure pathway, but ingestion is incidental and therefore would not be a significant pathway. The fish that are likely to be present in the assessment area may encounter sediment, resulting in a complete exposure pathway, but this exposure pathway is considered insignificant because these fish species are not bottom dwellers so contact with sediment would be variable. The CSM will be updated based on any additional biological data that is collected in the assessment area.

3.3.2 Selected Ecological Receptors

Ecological data from the site survey and publicly available information were used to identify potential ecological receptors of interest in the assessment area. Ecological receptors are defined as those observed or potentially present in habitats within the assessment area. Receptors are populations, communities, and/or relevant trophic guilds that are sensitive and/or susceptible to toxic effects from exposure to COPECs. These receptors have been well-researched and have large toxicity data sets available in the peer-reviewed literature and

guidance. Integral selected ecological receptors after consideration of potentially threatened and endangered species, species observed in the assessment area, and species known to be present in the vicinity of the assessment area.

3.3.2.1 Threatened and Endangered Species

Integral requested information from USFWS and the Ohio Department of Natural Resources (ODNR) on the presence and distribution of threatened and/or endangered species in the assessment area. The information obtained from this request is included in Attachment E.[16]

Based on the information received, the assessment area is located within the range of four federally listed species: tricolored bat (*Perimyotis subflavus*, state endangered), northern long-eared bat (*Myotis septentrionalis*, federally threatened and state endangered), Indiana bat (*M. sodalis*, federally and state endangered), and little brown bat (*M. lucifugus*, state endangered). USFWS has previously stated that Indiana bats are assumed to be present in Ohio during the summer wherever suitable habitat occurs unless a presence/absence survey has been performed to document their absence (USFWS 2007).

In addition to the four bat species, the monarch butterfly (*Danaus plexippus*) is a candidate federally listed species that may be present in the area.

No threatened or endangered species were observed during the site visit. However, because presence/absence surveys have not been conducted for threatened or endangered species in the assessment area, their potential use of the assessment area cannot be ruled out.

The focus of the risk assessment is on ecological receptors that are likely to use the assessment area, with the expectation that protection of those ecological receptors will also be protective of the habitat that potentially could be used by threatened and endangered species.

3.3.2.2 Selected Ecological Receptors

Section 2 provides summaries of the species that were observed in the assessment area in November 2024. Due to the timing of the site visit, this should be considered an initial species list and not a comprehensive list of ecological receptors in the assessment area. The selection of ecological receptors focuses on those with complete exposure pathways and those that are representative of key feeding guilds. It is not feasible or necessary to evaluate risk for every species that may use the assessment area, so surrogate species are used to represent different avian and mammalian feeding guilds.

[16] The ODNR environmental review has not been received at the time of this report.

Terrestrial receptors in the assessment area may include terrestrial plants, soil invertebrates (e.g., earthworms), birds, and mammals. In this Level II risk assessment Integral selected the following terrestrial ecological receptors:

- Soil invertebrate community, represented by earthworms
- Small terrestrial wildlife species with restricted home ranges and high incidental soil ingestion rates including:
  - American robin (avian omnivore)
  - American woodcock (avian invertivore)
  - Short-tailed shrew (mammalian invertivore).
- A top avian and mammalian carnivore that feeds on small mammals (to address the Ohio EPA [2018] requirement based on the presence of at least one PBT compound):
  - Red-tailed hawk (avian carnivore)
  - Red fox (mammalian carnivore).

Earthworms, birds, and mammals are the focus of this evaluation because these receptors provide a comprehensive assessment of chemical exposure and risk. Terrestrial plants are generally less sensitive to many chemicals, particularly metals, compared to earthworms, which serve as a key indicator of soil contamination. Moreover, birds and mammals represent higher trophic levels and potential bioaccumulation pathways, ensuring that the assessment captures risks across the terrestrial food web.

Aquatic receptors in the assessment area may include aquatic vegetation, macroinvertebrates, amphibians, and fish communities. Because the Adjacent Ditch is currently bypassed, these ecological receptors are not using the ditch as aquatic habitat and, therefore, would not be exposed to any potential chemicals. In this Level II aquatic risk assessment, Integral selected the following aquatic ecological receptors:

- Aquatic vegetation community
- Invertebrate community
- Fish community
- Amphibian community
- Small semiaquatic wildlife species with restricted home ranges and high incidental sediment ingestion rates including:
  - Mallard (avian omnivore)
  - Heron (avian piscivore)
  - Muskrat (mammalian herbivore)

– Mink (mammalian piscivore).

Aquatic vegetation, invertebrates, fish, amphibians, birds, and mammals are the focus of this evaluation because these receptors provide a comprehensive assessment of chemical exposure and risk.

3.3.3 Candidate Assessment Endpoints

Assessment endpoints represent an expression of the key ecological resources to be protected from harm. They generally reflect sensitive populations, communities, or trophic guilds. Ecological resources should have relevance, be susceptible to the stressors of concern, have biological, social, and/or economic value, and be applicable to risk management goals. Candidate assessment endpoints would be used in the Level III evaluation to evaluate the targeted resource groups in the terrestrial and aquatic exposure areas. The selected assessment endpoints are as follows:

- Soil invertebrate community structure and function
- Terrestrial and semiaquatic avian abundance
- Terrestrial and semiaquatic mammalian abundance
- Aquatic vegetation community structure and function
- Benthic invertebrate community structure and function
- Fish community structure and function
- Amphibian community structure and function.

These assessment endpoints may be updated if a Level III ecological risk assessment is conducted.

4 CONCLUSIONS AND RECOMMENDATIONS

This Level II ecological risk assessment was based on a CSM that includes the identified environmental media (soil, sediment, surface water, and tissue), complete exposure pathways, and environmental receptors of interest. COPECs were identified by screening maximum detected concentrations in each environmental medium against ecological screening benchmarks. Chemicals that exceeded the screening values and those identified as PBT compounds were retained as COPECs for further evaluation. The Level II ecological risk assessment could not rule out the potential for adverse ecological risk due to the presence of multiple COPECs at concentrations that exceeded screening thresholds, indicating the potential for risk in surface soil, surface sediment, and surface water.

Interim remedial actions are already under way at the site; however, we recommend that a Level III ecological assessment be conducted to evaluate site-specific risk to determine the adequacy of the interim actions and determine if additional action is warranted. Additional data collection efforts may be needed to provide a more intensive habitat and biological evaluation and to collect additional background data.

5 REFERENCES

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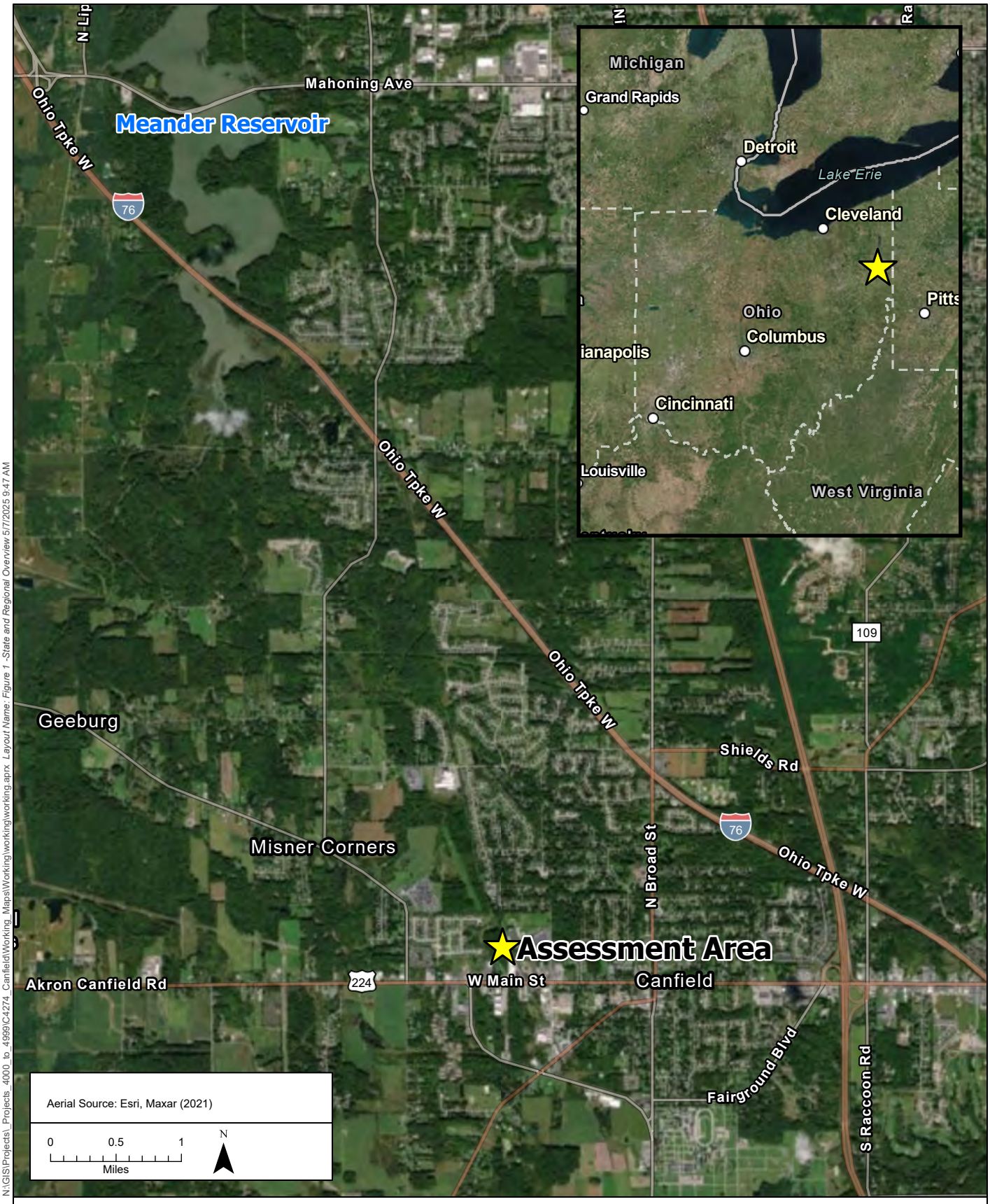
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FIGURES



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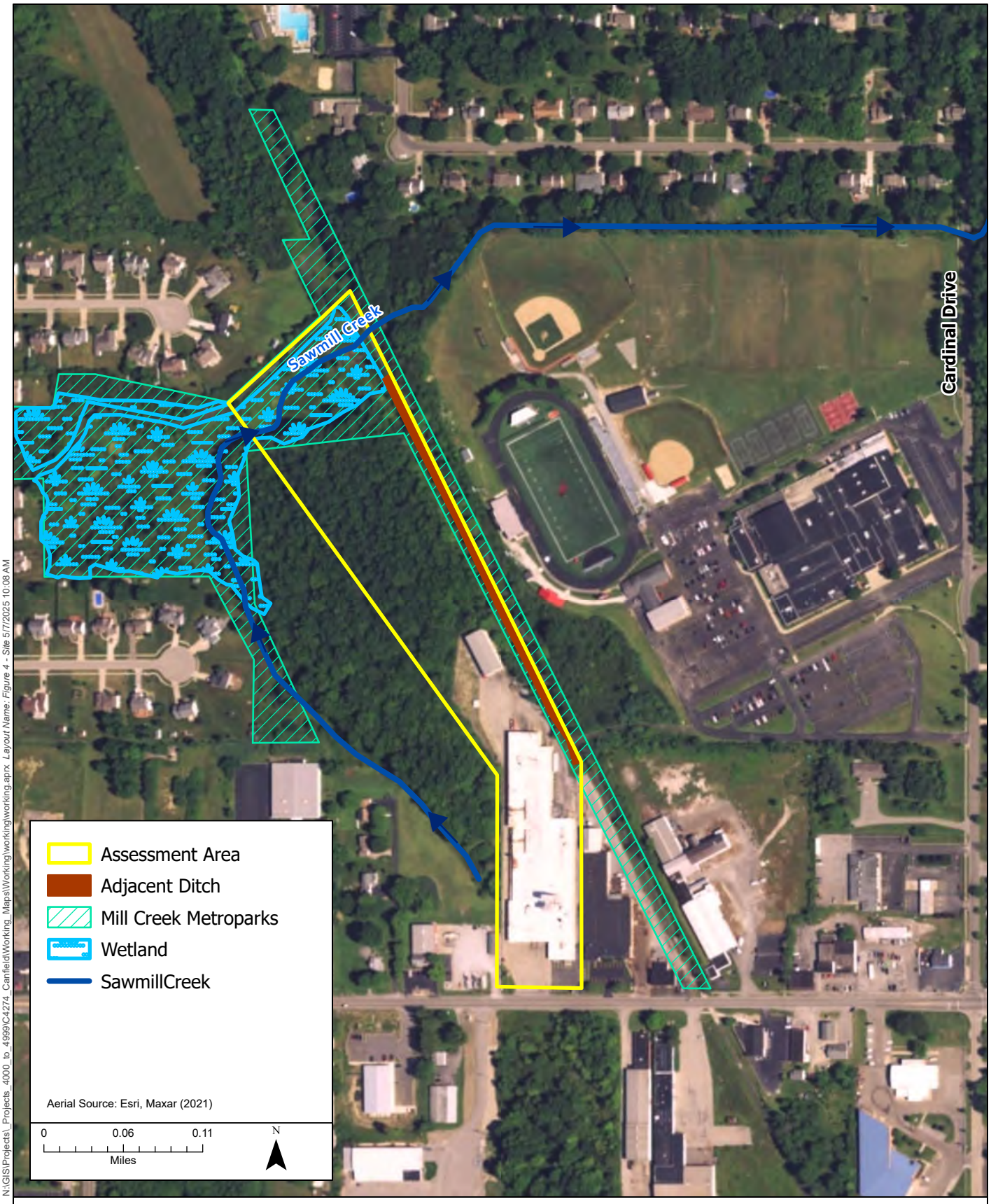
Figure 1. Regional Map of Assessment Area
Canfield, Ohio



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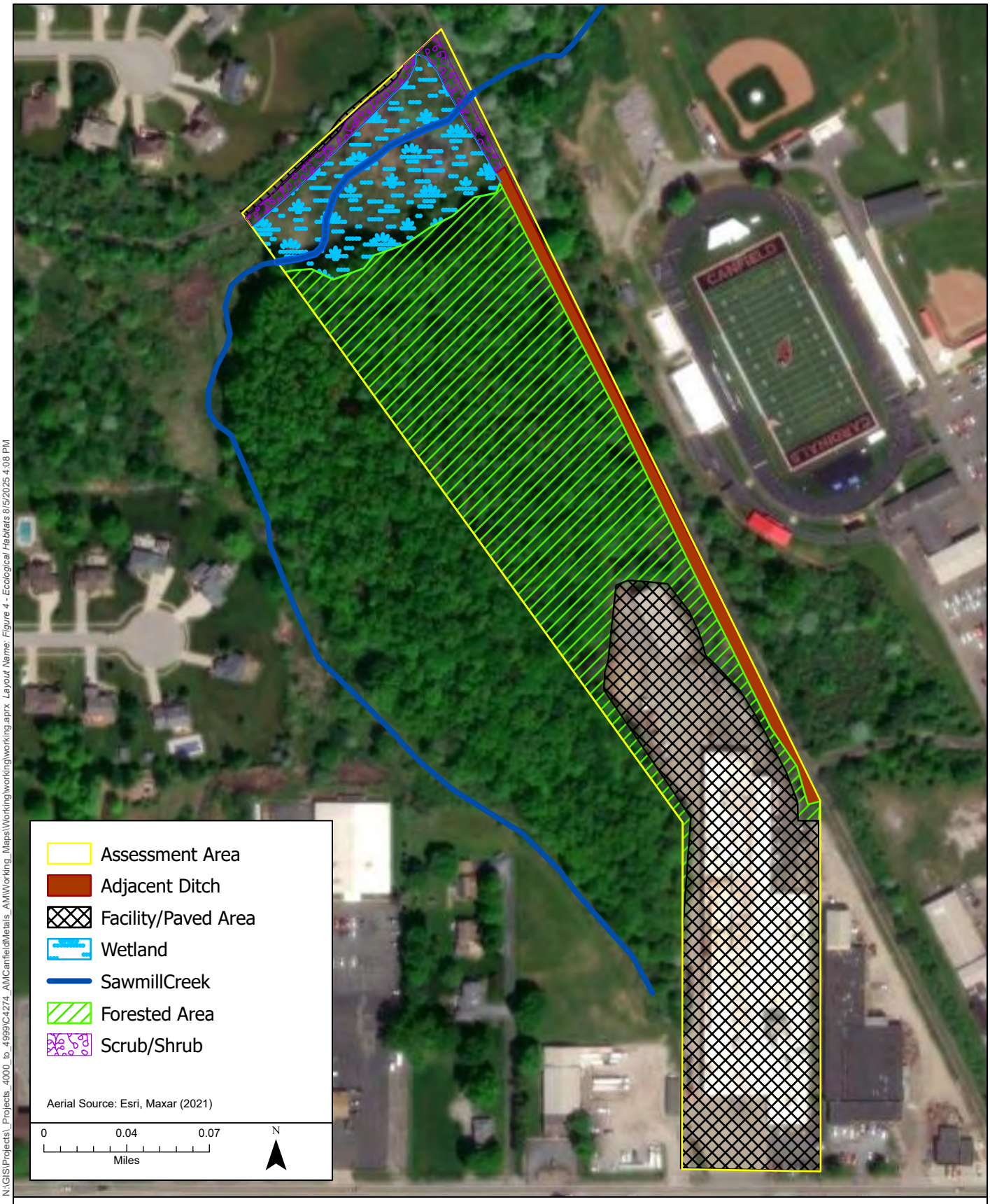
Figure 2. Local Map of Assessment Area and Adjacent Properties
Canfield, Ohio



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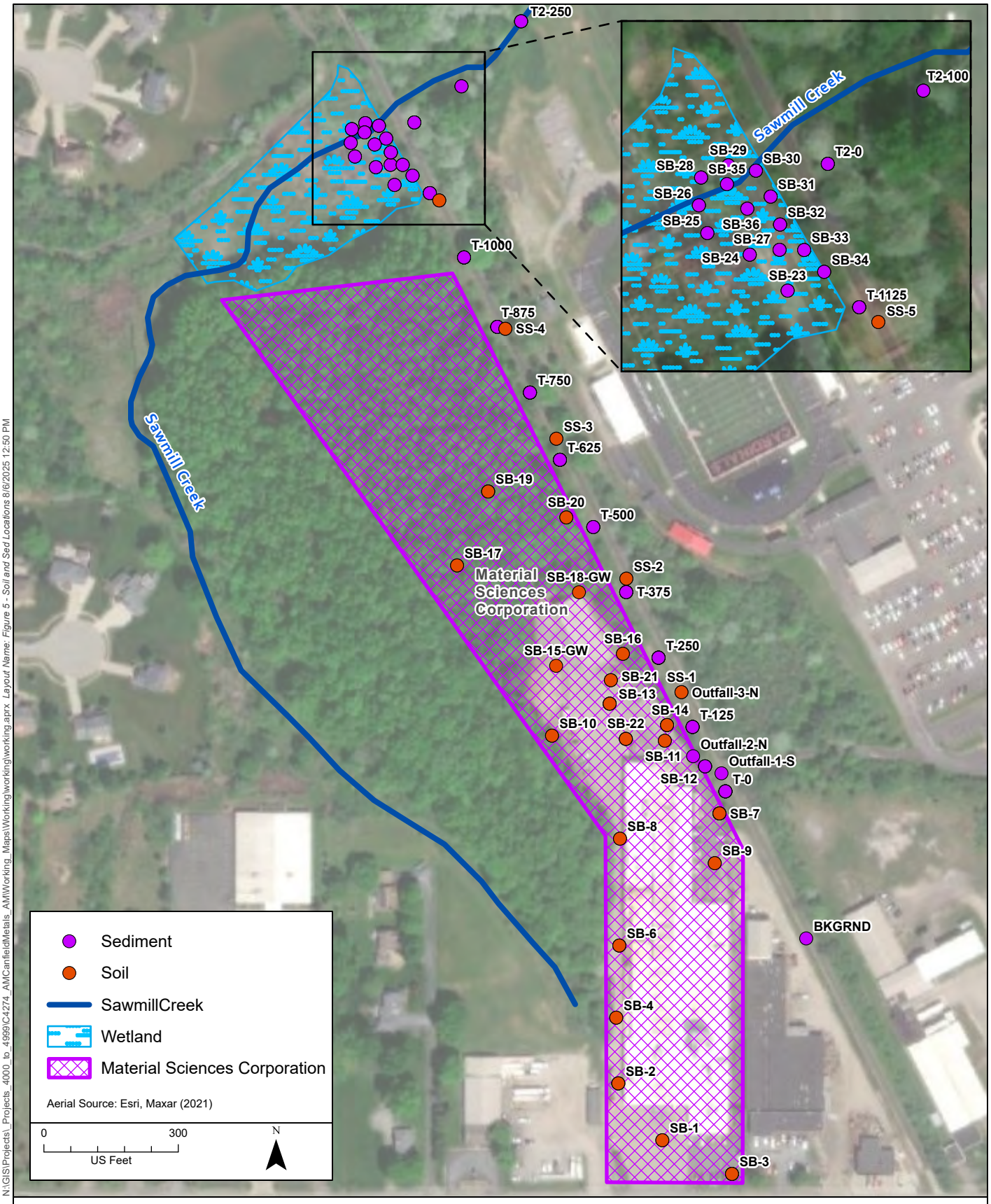
Figure 3. Assessment Area Features
MSC Parcel and Wetland
Canfield, Ohio



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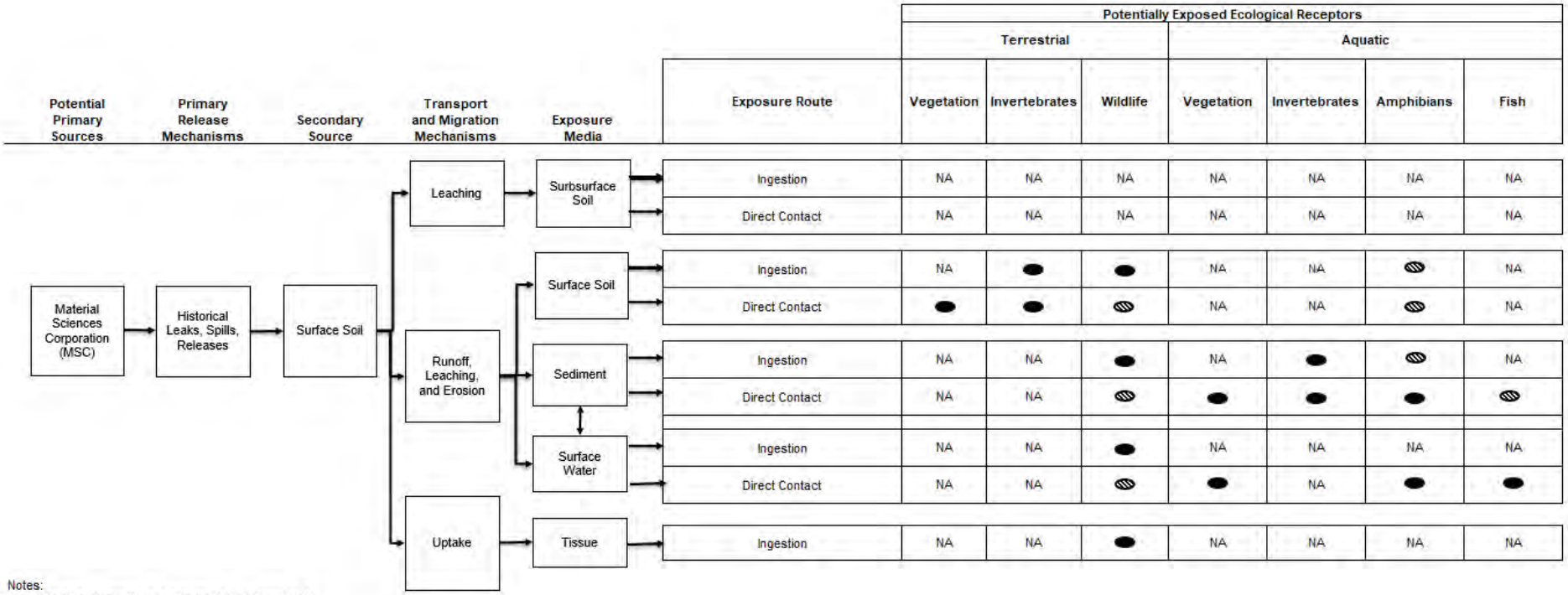
Figure 4 - Ecological Habitats within Assessment Area
Canfield, Ohio



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Figure 5 - Sample Locations for August Mack (2024) Sampling
Canfield, Ohio



Exposure Route	Potentially Exposed Ecological Receptors: Terrestrial – Vegetation	Terrestrial – Invertebrates	Terrestrial – Wildlife	Aquatic – Vegetation	Aquatic – Invertebrates	Aquatic – Amphibians	Aquatic – Fish
Ingestion	NA	NA	NA	NA	NA	NA	NA
Direct Contact	NA	NA	NA	NA	NA	NA	NA
Ingestion	NA	●	●	NA	NA	▨	NA
Direct Contact	●	●	▨	NA	NA	▨	NA
Ingestion	NA	NA	●	NA	●	▨	NA
Direct Contact	NA	NA	▨	●	●	●	▨
Ingestion	NA	NA	●	NA	NA	NA	NA
Direct Contact	NA	NA	▨	●	NA	●	●
Ingestion	NA	NA	●	NA	NA	NA	NA

Notes:
● Potenitally complete and significant exposure route
▨ Exposure route potentially complete but insignificant
NA Not Applicable - receptor is not potentially exposed via this pathway

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Figure 6 — Conceptual Site Model
MSC Parcel and Adjacent Wetland
Canfield, Ohio

TABLES

Table 1. COPEC Screening for Surface Soil

Chemical	CAS Number	FOD	Maximum Detected Concentration	Maximum Reporting Limit	Location of Maximum Detected Concentration (mg/kg)	Screening Value (mg/kg)	Screening Value Source	PBT (Yes/No) [a]	COPEC (Yes/No)	Reason for Selection or Deletion [b]
Metals										
Arsenic	7440-38-2	9 / 9	19	2.7	SS #3 - N	43	EPA EcoSSLs	No	No	BSV
Cadmium	7440-43-9	0 / 9		0.92		0.36	EPA EcoSSLs	No	No	ND2
Chromium	7440-47-3	9 / 9	95	1.8	SS #1	23	EPA EcoSSLs	No	Yes	ASV
Copper	7440-50-8	5 / 9	19	4.6	SS #2 - N	28	EPA EcoSSLs	No	No	BSV
Lead	7439-92-1	9 / 9	47	1.8	SS #1	11	EPA EcoSSLs	Yes	Yes	PBT
Mercury	7439-97-6	0 / 9		0.22		0.00051	Efroymsen et al. (1997)	Yes	No	ND2
Nickel	7440-02-0	5 / 9	29	7.3	SS #4 - N	130	EPA EcoSSLs	No	No	BSV
Silver	7440-22-4	0 / 9		1.8		4.2	EPA EcoSSLs	No	No	ND1
Zinc	7440-66-6	9 / 9	20,000	180	SS #1	46	EPA EcoSSLs	No	Yes	ASV
Physico-chemical Measurements										
Total Cyanide	57-12-5	9 / 9	3,700	230	SS #1	1	USEPA (2018)	No	Yes	ASV

Source:

Efroymson, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones. 1997. Preliminary remediation goals for ecological endpoints. ES/ER/TM-162/R2. Available at https://rais.ornl.gov/documents/tm162r2.pdf. Oak Ridge National Laboratory, Oak Ridge, Tennessee. August.

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Notes:

Highlighted chemicals are retained as sediment COPECs for further evaluation.
COPEC = chemical of potential ecological concern
EcoSSL = ecological soil screen level
EPA = U.S. Environmental Protection Agency
FOD = frequency of detection
PBT = persistent, bioaccumulative, toxic

[a] Persistent, bioaccumulative, and toxic pollutant as identified in OEPA (2018)

[b] Reason for selection or deletion

Selection reason : **ASV**: Maximum detected concentration is above the screening value; **PBT**: chemical is detected and listed as persistent, bioaccumulative, and toxic.

Deletion reason : **BSV**: maximum detected concentration falls below screening value; **NSV**: chemical detected but no screening value available (see Uncertainty Analysis); **ND1**: chemical not detected and reporting limit falls below screening value; **ND2**: chemical not detected but reporting limit exceeds screening value (see Uncertainty Analysis).

Table 2. COPEC Summary

COPEC	Sediment	Soil	Surface Water
Metals			
Arsenic	X		X
Barium	X		X
Cadmium	X		
Chromium	X	X	
Chromium(VI)			X
Copper	X		X
Lead	X	X	X
Mercury	X		X
Selenium	X		X
Silver	X		
Zinc	X	X	X
PAHs			
Anthracene	X		
Benzo[a]anthracene	X		X
Benzo[a]pyrene	X		X
Benzo[ghi]perylene			X
Benzo[k]fluoranthene			X
Chrysene	X		
Dibenz[a,h]anthracene	X		
Fluoranthene	X		
Fluorene	X		
Indeno[1,2,3-cd]pyrene			X
Naphthalene	X		
Phenanthrene	X		
Pyrene	X		
PCBs			
Total PCB Aroclors (ND=0)	X		
Physico-chemical Measurements			
Free Cyanide	X	X	X
Semivolatile Organic Compounds			
Benzaldehyde	X		
Phenol	X		

Notes:
COPEC = chemical of potential ecological concern
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl

Table 3. COPEC Screening for Surface Water

Chemical	Fraction	CAS Number	FOD	Maximum Detected Concentration (µg/L)		Maximum Reporting Limit (µg/L)	Location of Maximum Detected Concentration	Screening Value (µg/L)	Screening Value Source	PBT (Yes/No) [a]	COPEC (Yes/No)	Reason for Selection or Deletion [b]
Metals												
Arsenic	D	7440-38-2	4 / 6	210		15	T500-C-SW; T500-C-SW	150	Rule 3745-1-35 OMZA	No	No	BSV
Arsenic	T	7440-38-2	6 / 6	600		75	T500-C-SW; T500-C-SW	150	Rule 3745-1-35 OMZA	No	Yes	ASV
Barium	D	7440-39-3	6 / 6	650		200	T500-C-SW; T500-C-SW	220	USEPA (2018)	No	Yes	ASV
Barium	T	7440-39-3	6 / 6	1,800		200	T500-C-SW; T500-C-SW	220	USEPA (2018)	No	Yes	ASV
Cadmium	D	7440-43-9	1 / 6	5	J	5	T500-C-SW; T500-C-SW	3.9	Rule 3745-1-35 OMZA	No	Yes	ASV
Cadmium	T	7440-43-9	3 / 6	6.7	J	25	T500-C-SW; T500-C-SW	4.2	Rule 3745-1-35 OMZA	No	Yes	ASV
Chromium	D	7440-47-3	6 / 6	250		10	T500-C-SW; T500-C-SW	130	Rule 3745-1-35 OMZA	No	Yes	ASV
Chromium	T	7440-47-3	6 / 6	620		10	T500-C-SW; T500-C-SW	150	Rule 3745-1-35 OMZA	No	Yes	ASV
Chromium(VI)	D	18540-29-9	0 / 6			1,000		11	USEPA (2024)	No	No	ND2
Chromium(VI)	T	18540-29-9	1 / 6	1,000	J	1,000	T500-C-SW	11	USEPA (2024)	No	Yes	ASV
Copper	D	7440-50-8	4 / 6	310		25	T500-C-SW; T500-C-SW	16	Rule 3745-1-35 OMZA	No	Yes	ASV
Copper	T	7440-50-8	6 / 6	710		130	T500-C-SW; T500-C-SW	17	Rule 3745-1-35 OMZA	No	Yes	ASV
Lead	D	7439-92-1	3 / 6	210		10	T500-C-SW; T500-C-SW	12	Rule 3745-1-35 OMZA	Yes	Yes	ASV
Lead	T	7439-92-1	5 / 6	730		50	T500-C-SW; T500-C-SW	16	Rule 3745-1-35 OMZA	Yes	Yes	ASV
Mercury	D	7439-97-6	1 / 6	0.52		0.2	T500-C-SW; T500-C-SW	0.77	Rule 3745-1-35 OMZA	Yes	No	PBT
Mercury	T	7439-97-6	1 / 6	1.2		0.2	T500-C-SW; T500-C-SW	0.91	Rule 3745-1-35 OMZA	Yes	Yes	ASV
Selenium	D	7782-49-2	1 / 6	20	J	20	T500-C-SW; T500-C-SW	5	USEPA (2003)	No	Yes	ASV
Selenium	T	7782-49-2	2 / 6	51	J	100	T500-C-SW; T500-C-SW	5	USEPA (2003)	No	Yes	ASV
Silver	D	7440-22-4	0 / 6			10		3.2	USEPA (2024)	No	No	ND2
Silver	T	7440-22-4	0 / 6			10		3.2	USEPA (2024)	No	No	ND2
Zinc	D	7440-66-6	6 / 6	19,000		50	T500-C-SW; T500-C-SW	210	Rule 3745-1-35 OMZA	No	Yes	ASV
Zinc	T	7440-66-6	6 / 6	69,000		250	T500-C-SW; T500-C-SW	220	Rule 3745-1-35 OMZA	No	Yes	ASV
PAHs												
2-Methylnaphthalene	T	91-57-6	0 / 6			0.22		4.7	USEPA (2018)	No	No	ND1
Acenaphthene	T	83-32-9	0 / 6			0.22		38	USEPA (2003)	No	No	ND1
Acenaphthylene	T	208-96-8	0 / 6			0.22		4,840	USEPA (2003)	No	No	ND1
Anthracene	T	120-12-7	0 / 6			0.22		0.035	USEPA (2003)	No	No	ND2
Benzo[a]anthracene	T	56-55-3	3 / 6	0.34		0.22	T375-C-SW	0.025	USEPA (2003)	No	Yes	ASV
Benzo[a]pyrene	T	50-32-8	3 / 6	0.58		0.22	T375-C-SW	0.014	USEPA (2003)	No	Yes	ASV
Benzo[b]fluoranthene	T	205-99-2	4 / 6	1.3		0.22	T375-C-SW	9.07	USEPA (2003)	No	No	BSV
Benzo[ghi]perylene	T	191-24-2	3 / 6	0.74		0.22	T375-C-SW	0.012	USEPA (2018)	No	Yes	ASV
Benzo[k]fluoranthene	T	207-08-9	3 / 6	0.41		0.22	T375-C-SW	0.06	USEPA (2018)	No	Yes	ASV
Chrysene	T	218-01-9	4 / 6	0.71		0.22	T375-C-SW	4.7	USEPA (2018)	No	No	BSV
Dibenz[a,h]anthracene	T	53-70-3	0 / 6			0.22		0.012	USEPA (2018)	No	No	ND2
Fluoranthene	T	206-44-0	4 / 6	1.1		0.22	T375-C-SW	1.9	USEPA (2003)	No	No	BSV
Fluorene	T	86-73-7	0 / 6			0.22		19	USEPA (2003)	No	No	ND1
Indeno[1,2,3-cd]pyrene	T	193-39-5	3 / 6	0.54		0.22	T375-C-SW	0.012	USEPA (2018)	No	Yes	ASV
Naphthalene	T	91-20-3	1 / 6	0.22	J	0.22	SB-36-SW	13	USEPA (2003)	No	No	BSV
Phenanthrene	T	85-01-8	3 / 6	0.31		0.22	T375-C-SW	2.3	Rule 3745-1-35 OMZA	No	No	BSV
Pyrene	T	129-00-0	5 / 6	0.92		0.22	T375-C-SW	4.6	USEPA (2018)	No	No	BSV
PCBs												
Aroclor 1016	T	12674-11-2	0 / 6			0.5				Yes	No	ND3
Aroclor 1221	T	11104-28-2	0 / 6			0.5				Yes	No	ND3
Aroclor 1232	T	11141-16-5	0 / 6			0.5				Yes	No	ND3

Table 3. COPEC Screening for Surface Water

Chemical	Fraction	CAS Number	FOD	Maximum Detected Concentration (µg/L)		Maximum Reporting Limit (µg/L)	Location of Maximum Detected Concentration	Screening Value (µg/L)	Screening Value Source	PBT (Yes/No) [a]	COPEC (Yes/No)	Reason for Selection or Deletion [b]
Aroclor 1242	T	53469-21-9	0 / 6			0.5				Yes	No	ND3
Aroclor 1248	T	12672-29-6	0 / 6			0.5				Yes	No	ND3
Aroclor 1254	T	11097-69-1	0 / 6			0.5				Yes	No	ND3
Aroclor 1260	T	11096-82-5	0 / 6			0.5				Yes	No	ND3
Aroclor 1262	T	37324-23-5	0 / 6			0.5				Yes	No	ND3
Aroclor 1268	T	11100-14-4	0 / 6			0.5				Yes	No	ND3
Total PCB Aroclors (ND=0)	T	1336-36-3	0 / 6			0.5		0.00012	USEPA (2018)	Yes	No	PBT
Pesticides												
Atrazine	T	1912-24-9	0 / 6			2.2		0.03	USEPA (2018)	No	No	ND2
Carbazole	T	86-74-8	0 / 6			1.1		4	USEPA (2018)	No	No	ND1
Phenols												
2-Chlorophenol	T	95-57-8	0 / 6			1.1		18	USEPA (2018)	No	No	ND1
Pentachlorophenol	T	87-86-5	0 / 6			11		11	Rule 3745-1-35 OMZA	Yes	No	ND1
Physico-chemical Measurements												
Free Cyanide	T	57-12-5	6 / 6	130		6	SB-29-SW; SB-36-SW	5.2	USEPA (2024)	No	Yes	ASV
Total Cyanide	T	57-12-5	6 / 6	8,100		500	SB-29-SW			No	Yes	NSV
Semivolatile Organic Compounds												
1,1'-Biphenyl	T	92-52-4	0 / 6			1.1		6.5	USEPA (2018)	No	No	ND1
2,2'-Oxybis(1-chloropropane)	T	108-60-1	0 / 6			1.1				No	No	ND3
2,4,5-Trichlorophenol	T	95-95-4	0 / 6			5.4		1.9	USEPA (2018)	No	No	ND2
2,4,6-Trichlorophenol	T	88-06-2	0 / 6			5.4		4.9	USEPA (2003)	No	No	ND2
2,4-Dichlorophenol	T	120-83-2	0 / 6			2.2		11	USEPA (2018)	No	No	ND1
2,4-Dimethylphenol	T	105-67-9	0 / 6			2.2		15	USEPA (2018)	No	No	ND1
2,4-Dinitrophenol	T	51-28-5	0 / 6			11		71	USEPA (2018)	No	No	ND1
2,6-Dinitrotoluene	T	606-20-2	0 / 6			5.4		81	USEPA (2018)	No	No	ND1
2-Chloronaphthalene	T	91-58-7	0 / 6			1.1		0.396	USEPA (2003)	No	No	ND2
2-Methylphenol	T	95-48-7	0 / 6			1.1		67	USEPA (2018)	No	No	ND1
2-Nitroaniline	T	88-74-4	0 / 6			2.2		17	USEPA (2018)	No	No	ND1
2-Nitrophenol	T	88-75-5	0 / 6			2.2		73	USEPA (2018)	No	No	ND1
3 & 4-Methylphenol (m,p-Cresols)	T	65794-96-9	1 / 6	2.2	J	2.2	T375-C-SW			No	No	ND3
3,3'-Dichlorobenzidine	T	91-94-1	0 / 6			5.4		4.5	USEPA (2018)	No	No	ND2
3-Nitroaniline	T	99-09-2	0 / 6			2.2				No	No	ND3
4,6-Dinitro-O-cresol	T	534-52-1	0 / 6			5.4		23	USEPA (2003)	No	No	ND1
4-Bromophenyl-phenylether	T	101-55-3	0 / 6			2.2		1.5	USEPA (2018)	No	No	ND2
4-Chloro-3-methylphenol	T	59-50-7	0 / 6			2.2		1	USEPA (2018)	No	No	ND2
4-Chloroaniline	T	106-47-8	0 / 6			2.2		0.8	USEPA (2018)	No	No	ND2
4-Chlorophenyl-phenyl ether	T	7005-72-3	0 / 6			2.2				No	No	ND3
4-Nitroaniline	T	100-01-6	0 / 6			2.2				No	No	ND3
4-Nitrophenol	T	100-02-7	0 / 6			11		58	USEPA (2018)	No	No	ND1
Acetophenone	T	98-86-2	0 / 6			1.1				No	No	ND3
Benzaldehyde	T	100-52-7	0 / 6			2.2		143	USEPA (2018)	No	No	ND1
Butyl benzyl phthalate	T	85-68-7	0 / 6			2.2		23	USEPA (2018)	No	No	ND1
Caprolactam	T	105-60-2	0 / 6			5.4				No	No	ND3
Di-n-butyl phthalate	T	84-74-2	0 / 6			5.4		9.7	USEPA (2003)	No	No	ND1
Di-n-octylphthalate	T	117-84-0	0 / 6			2.2		215	USEPA (2018)	No	No	ND1

Table 3. COPEC Screening for Surface Water

Chemical	Fraction	CAS Number	FOD	Maximum Detected Concentration (µg/L)		Maximum Reporting Limit (µg/L)	Location of Maximum Detected Concentration	Screening Value (µg/L)	Screening Value Source	PBT (Yes/No) [a]	COPEC (Yes/No)	Reason for Selection or Deletion [b]
Dibenzofuran	T	132-64-9	0 / 6			1.1		4	USEPA (2003)	No	No	ND1
Diethyl phthalate	T	84-66-2	0 / 6			5.4		110	USEPA (2003)	No	No	ND1
Dimethyl phthalate	T	131-11-3	0 / 6			2.2		1,100	USEPA (2018)	No	No	ND1
Hexachlorobenzene	T	118-74-1	0 / 6			0.22		0.0003	USEPA (2003)	Yes	No	ND2
Hexachlorobutadiene	T	87-68-3	0 / 6			1.1		0.053	USEPA (2003)	Yes	No	ND2
Hexachlorocyclopentadiene	T	77-47-4	0 / 6			11		77	USEPA (2003)	No	No	ND1
Hexachloroethane	T	67-72-1	0 / 6			1.1		8	USEPA (2003)	No	No	ND1
Isophorone	T	78-59-1	0 / 6			1.1		920	USEPA (2003)	No	No	ND1
Methyl Acetate	T	79-20-9	0 / 6			50				No	No	ND3
N-Nitrosodi-n-propylamine	T	621-64-7	0 / 6			1.1				No	No	ND3
N-Nitrosodiphenylamine	T	86-30-6	0 / 6			1.1		25	USEPA (2018)	No	No	ND1
Nitrobenzene	T	98-95-3	0 / 6			1.1		220	USEPA (2003)	No	No	ND1
Phenol	T	108-95-2	0 / 6			1.1		180	USEPA (2003)	No	No	ND1
Bis(2-chloroethoxy)methane	T	111-91-1	0 / 6			1.1				No	No	ND3
Bis(2-ethylhexyl)phthalate	T	117-81-7	1 / 6	5.4	J	5.4	T375-C-SW	8	USEPA (2018)	No	No	BSV
Volatile Organic Compounds												
1,1,1-Trichloroethane	T	71-55-6	0 / 6			5		76	USEPA (2018)	No	No	ND1
1,1,2,2-Tetrachloroethane	T	79-34-5	0 / 6			5		200	USEPA (2018)	No	No	ND1
1,1,2-Trichloro-1,2,2-trifluoroethane	T	76-13-1	0 / 6			5				No	No	ND3
1,1,2-Trichloroethane	T	79-00-5	0 / 6			5		730	USEPA (2018)	No	No	ND1
1,1-Dichloroethane	T	75-34-3	0 / 6			5		410	USEPA (2018)	No	No	ND1
1,1-Dichloroethene	T	75-35-4	0 / 6			5		130	USEPA (2018)	No	No	ND1
1,2,4-Trichlorobenzene	T	120-82-1	0 / 6			5		130	USEPA (2018)	No	No	ND1
1,2-Dibromo-3-chloropropane	T	96-12-8	0 / 6			10				No	No	ND3
1,2-Dibromoethane	T	106-93-4	0 / 6			5				No	No	ND3
1,2-Dichlorobenzene	T	95-50-1	0 / 6			5		23	USEPA (2018)	No	No	ND1
1,2-Dichloroethane	T	107-06-2	0 / 6			5		2,000	USEPA (2018)	No	No	ND1
1,2-Dichloropropane	T	78-87-5	0 / 6			5		520	USEPA (2018)	No	No	ND1
1,3-Dichlorobenzene	T	541-73-1	0 / 6			5		22	USEPA (2018)	No	No	ND1
1,4-Dichlorobenzene	T	106-46-7	0 / 6			5		9.4	USEPA (2018)	No	No	ND1
2,4-Dinitrotoluene	T	121-14-2	0 / 6			5.4		44	USEPA (2018)	No	No	ND1
2-Butanone	T	78-93-3	1 / 6	10	J	50	T500-C-SW	22,000	USEPA (2018)	No	No	BSV
2-Hexanone	T	591-78-6	0 / 6			50		99	USEPA (2018)	No	No	ND1
4-Methyl-2-pentanone	T	108-10-1	0 / 6			50		170	USEPA (2018)	No	No	ND1
Acetone	T	67-64-1	2 / 6	32	J	50	T500-C-SW	1,700	USEPA (2003)	No	No	BSV
Benzene	T	71-43-2	0 / 6			5		114	USEPA (2003)	No	No	ND1
Bis(2-chloroethyl)ether	T	111-44-4	0 / 6			1.1		19,000	USEPA (2003)	No	No	ND1
Bromodichloromethane	T	75-27-4	0 / 6			5		340	USEPA (2018)	No	No	ND1
Bromoform	T	75-25-2	0 / 6			5		230	USEPA (2003)	No	No	ND1
Bromomethane	T	74-83-9	0 / 6			5		16	USEPA (2018)	No	No	ND1
Carbon Tetrachloride	T	56-23-5	0 / 6			5		77	USEPA (2018)	No	No	ND1
Carbon disulfide	T	75-15-0	0 / 6			5		15	USEPA (2003)	No	No	ND1
Chlorobenzene	T	108-90-7	0 / 6			5		47	USEPA (2003)	No	No	ND1
Chloroethane	T	75-00-3	0 / 6			5				No	No	ND3
Chloroform	T	67-66-3	0 / 6			5		140	USEPA (2003)	No	No	ND1

Table 3. COPEC Screening for Surface Water

Chemical	Fraction	CAS Number	FOD	Maximum Detected Concentration (µg/L)	Maximum Reporting Limit (µg/L)	Location of Maximum Detected Concentration	Screening Value (µg/L)	Screening Value Source	PBT (Yes/No) [a]	COPEC (Yes/No)	Reason for Selection or Deletion [b]
Chloromethane	T	74-87-3	0 / 6		5				No	No	ND3
Cyclohexane	T	110-82-7	0 / 6		5		158	USEPA (2018)	No	No	ND1
Dibromochloromethane	T	124-48-1	0 / 6		5		320	USEPA (2018)	No	No	ND1
Dichlorodifluoromethane	T	75-71-8	0 / 6		5				No	No	ND3
Ethylbenzene	T	100-41-4	0 / 6		5		14	USEPA (2003)	No	No	ND1
Isopropylbenzene	T	98-82-8	0 / 6		5		4.8	USEPA (2018)	No	No	ND2
Methyl tert-butyl ether	T	1634-04-4	0 / 6		5		730	USEPA (2018)	No	No	ND1
Methylcyclohexane	T	108-87-2	0 / 6		5		52	USEPA (2018)	No	No	ND1
Methylene Chloride	T	75-09-2	0 / 6		25		940	USEPA (2003)	No	No	ND1
Styrene	T	100-42-5	0 / 6		5		32	USEPA (2003)	No	No	ND1
Tetrachloroethene	T	127-18-4	0 / 6		5		45	USEPA (2003)	No	No	ND1
Toluene	T	108-88-3	0 / 6		5		253	USEPA (2003)	No	No	ND1
Trichloroethylene	T	79-01-6	0 / 6		5		47	USEPA (2003)	No	No	ND1
Trichlorofluoromethane	T	75-69-4	0 / 6		5				No	No	ND3
Vinyl Chloride	T	75-01-4	0 / 6		5		930	USEPA (2003)	No	No	ND1
Xylenes, Total	T	1330-20-7	0 / 6		10		27	USEPA (2018)	No	No	ND1
cis-1,2-Dichloroethene	T	156-59-2	0 / 6		5				No	No	ND3
cis-1,3-Dichloropropene	T	10061-01-5	0 / 6		5				No	No	ND3
trans-1,2-Dichloroethene	T	156-60-5	0 / 6		5				No	No	ND3
trans-1,3-Dichloropropene	T	10061-02-6	0 / 6		5				No	No	ND3

Sources:

USEPA. 2003. Region 5 RCRA ecological screening levels. U.S. Environmental Protection Agency. August 22.

USEPA. 2018. Region 4 ecological risk assessment supplemental guidance. March Update. Available at: https://www.epa.gov/sites/default/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf. U.S. Environmental Protection Agency.

USEPA 2024. National recommended water quality criteria - Aquatic life criteria table. Available at: www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table#table. Last updated on October 9, 2024. U.S. Environmental Protection Agency.

Notes:

Highlighted chemicals are retained as sediment COPECs for further evaluation
COPEC = chemical of potential ecological concern
D = dissolved
FOD = frequency of detection
OMZM = outside mixing zone maximum
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PBT = persistent, bioaccumulative, toxic
T = total

Data Qualifier:
J = estimated concentration

[a] Persistent, bioaccumulative, and toxic pollutant as identified in Ohio EPA (2018).

[b] Reason for selection or deletion:
Selection reason : **ASV**: maximum detected concentration is above the screening value; **PBT**: chemical is detected and listed as PBT.
Deletion reason : **BSV**: maximum detected concentration falls below screening value; **NSV**: chemical detected but no screening value available (see Uncertainty Analysis); **ND1**: chemical not detected and reporting limit falls below screening value; **ND2**: chemical not detected but reporting limit exceeds screening value (see Uncertainty Analysis); **ND3**: chemical not detected and lacks screening value.

Table 4. COPEC Screening for Surface Sediment

Chemical	CAS Number	FOD	Maximum Detected Concentration (mg/kg)		Maximum Reporting Limit (mg/kg)	Location of Maximum Detected Concentration	Screening Value (mg/kg)	Screening Value Source	OEPA SRV [a]	PBT (Yes/No) [b]	COPEC (Yes/No)	Reason for Selection or Deletion [c]
Metals												
Arsenic	7440-38-2	47 / 47	32		4.3	T125-E-0.0	9.79	MacDonald et al. (2000)	25	No	Yes	ASV
Barium	7440-39-3	47 / 47	160		51	T125-C-0.0; T375-E-0.0	20	USEPA (2018)	190	No	Yes	ASV
Cadmium	7440-43-9	46 / 47	1		3.2	T1000-E-0.0; T125-E-0.0	0.99	MacDonald et al. (2000)	0.79	No	Yes	ASV
Chromium	7440-47-3	47 / 47	340		2.6	T125-E-0.0	43.4	MacDonald et al. (2000)	29	No	Yes	ASV
Chromium(VI)	18540-29-9	2 / 47	18	J	34	SB-27-0				No	No	FOD
Copper	7440-50-8	42 / 47	800		16	T125-E-0.0	31.6	MacDonald et al. (2000)	32	No	Yes	ASV
Lead	7439-92-1	47 / 47	71		6.5	T125-E-0.0	35.8	MacDonald et al. (2000)	47	Yes	Yes	PBT
Mercury	7439-97-6	42 / 47	0.19	J	0.32	SB-26-0	0.18	MacDonald et al. (2000)	0.12	Yes	Yes	PBT
Selenium	7782-49-2	29 / 47	5.1	J	5.8	SB-34-0; T375-E-0.0; T875-W-0.0	0.72	USEPA (2018)	1.7	No	Yes	ASV
Silver	7440-22-4	17 / 47	2.6	J	2.6	SB-24-0; T125-E-0.0; T500-W-0.0; T875-C-0.0; T875-W-0.0	1	USEPA (2018)	0.43	No	Yes	ASV
Zinc	7440-66-6	47 / 47	33,000		600	SB-32-0	121	MacDonald et al. (2000)	160	No	Yes	ASV
PAHs												
2-Methylnaphthalene	91-57-6	30 / 30	1.6		0.25	T250-C-0.0				No	No	NSV
Acenaphthene	83-32-9	21 / 47	0.2		0.25	T125-W-0.0				No	No	NSV
Acenaphthylene	208-96-8	22 / 47	0.27		0.25	TO-E-0.0; T1000-E-0.0				No	No	NSV
Anthracene	120-12-7	39 / 47	0.51		0.25	T250-W-0.0	0.0572	MacDonald et al. (2000)		No	Yes	ASV
Benzo[a]anthracene	56-55-3	46 / 47	2.4		0.25	T250-W-0.0	0.108	MacDonald et al. (2000)		No	Yes	ASV
Benzo[a]pyrene	50-32-8	47 / 47	3.3		0.25	T250-W-0.0; T375-E-0.0	0.15	MacDonald et al. (2000)		No	Yes	ASV
Benzo[b]fluoranthene	205-99-2	47 / 47	6.6		0.25	T375-W-0.0				No	No	NSV
Benzo[g,h,i]perylene	191-24-2	45 / 47	2.3		0.25	T375-E-0.0				No	No	NSV
Benzo[k]fluoranthene	207-08-9	46 / 47	2.3		0.25	T250-C-0.0				No	No	NSV
Chrysene	218-01-9	46 / 47	3.9		0.25	T250-W-0.0	0.166	MacDonald et al. (2000)		No	Yes	ASV
Dibenz[a,h]anthracene	53-70-3	40 / 47	0.45		0.25	T375-E-0.0	0.033	MacDonald et al. (2000)		No	Yes	ASV
Fluoranthene	206-44-0	47 / 47	7.5		0.25	T250-W-0.0	0.423	MacDonald et al. (2000)		No	Yes	ASV
Fluorene	86-73-7	21 / 47	0.18	J	0.25	T125-C-0.0	0.0774	MacDonald et al. (2000)		No	Yes	ASV
Indeno[1,2,3-cd]pyrene	193-39-5	45 / 47	1.9		0.25	T375-E-0.0				No	No	NSV
Naphthalene	91-20-3	41 / 47	0.98		0.25	T250-C-0.0	0.176	MacDonald et al. (2000)		No	Yes	ASV
Phenanthrene	85-01-8	47 / 47	3.1		0.25	T250-C-0.0	0.204	MacDonald et al. (2000)		No	Yes	ASV
Pyrene	129-00-0	47 / 47	5.7		0.25	T250-W-0.0	0.195	MacDonald et al. (2000)		No	Yes	ASV
PCBs												
Aroclor 1016	12674-11-2	0 / 30			0.086					Yes	No	ND3
Aroclor 1221	11104-28-2	0 / 30			0.086					Yes	No	ND3
Aroclor 1232	11141-16-5	0 / 30			0.086					Yes	No	ND3
Aroclor 1242	53469-21-9	6 / 30	0.12		0.086	T125-C-0.0				Yes	Yes	PBT
Aroclor 1248	12672-29-6	4 / 30	0.083	J	0.086	T250-W-0.0; T500-W-0.0				Yes	Yes	PBT
Aroclor 1254	11097-69-1	6 / 30	0.086	J	0.086	T250-C-0.0				Yes	Yes	PBT
Aroclor 1260	11096-82-5	1 / 30	0.086	J	0.086	T250-E-0.0_20241003				Yes	Yes	PBT
Aroclor 1262	37324-23-5	0 / 30			0.086					Yes	No	ND3
Aroclor 1268	11100-14-4	0 / 30			0.086					Yes	No	ND3
Total PCB Aroclors (ND=0)	1336-36-3	12 / 30	0.16	J	0.5	T125-C-0.0	0.0598	MacDonald et al. (2000)		Yes	Yes	PBT
Pesticides												
Atrazine	1912-24-9	0 / 30			2.1		0.0003	Ohio EPA (2018)		No	No	ND2

Table 4. COPEC Screening for Surface Sediment

Chemical	CAS Number	FOD	Maximum Detected Concentration (mg/kg)		Maximum Reporting Limit (mg/kg)	Location of Maximum Detected Concentration	Screening Value (mg/kg)	Screening Value Source	OEPA SRV [a]	PBT (Yes/No) [b]	COPEC (Yes/No)	Reason for Selection or Deletion [c]
Carbazole	86-74-8	24 / 30	0.58		0.62	T250-W-0.0				No	No	NSV
Phenols												
2-Chlorophenol	95-57-8	0 / 30			0.62		0.055	Ohio EPA (2018)		No	No	ND2
Pentachlorophenol	87-86-5	0 / 30			1.7		0.01	Ohio EPA (2018)		Yes	No	ND2
Estimated Free Cyanide in Soil (Leachate mg/L x 20) = mg/kg of Soil	57-12-5	30 / 30	0.17		0.006	SB-35-0				No	Yes	NSV1
Total Cyanide	57-12-5	47 / 47	1,400		220	T250-E-0.0_20241003	0.001	EPA Region 5 RCRA ESLs(2003)		No	Yes	ASV
1,1'-Biphenyl	92-52-4	3 / 30	0.62	J	0.62	T1000-W-0.0; T1125-E-0.0; T125-E-0.0; T250-C-0.0; T625-E-0.0; T750-W-0.0; T750-W-0.0; T875-W-0.0				No	No	NSV
Semivolatile Organic Compounds												
2,2'-Oxybis(1-chloropropane)	108-60-1	0 / 30			0.62					No	No	ND3
2,4,5-Trichlorophenol	95-95-4	0 / 30			0.93		0.034	Ohio EPA (2018)		No	No	ND2
2,4,6-Trichlorophenol	88-06-2	0 / 30			0.93		0.089	Ohio EPA (2018)		No	No	ND2
2,4-Dichlorophenol	120-83-2	0 / 30			0.93					No	No	ND3
2,4-Dimethylphenol	105-67-9	0 / 30			0.93		0.039	Ohio EPA (2018)		No	No	ND2
2,4-Dinitrophenol	51-28-5	0 / 30			2.1		0.223	Ohio EPA (2018)		No	No	ND2
2,6-Dinitrotoluene	606-20-2	0 / 30			1.2		0.296	Ohio EPA (2018)		No	No	ND2
2-Chloronaphthalene	91-58-7	0 / 30			0.62					No	No	ND3
2-Methylphenol	95-48-7	0 / 30			1.2		0.119	Ohio EPA (2018)		No	No	ND2
2-Nitroaniline	88-74-4	0 / 30			1.2					No	No	ND3
2-Nitrophenol	88-75-5	0 / 30			0.62		0.168	Ohio EPA (2018)		No	No	ND2
3 & 4-Methylphenol (m,p-Cresols)	65794-96-9	10 / 30	2.5		2.5	T1125-E-0.0				No	No	NSV
3,3'-Dichlorobenzidine	91-94-1	0 / 30			0.93		0.031	Ohio EPA (2018)		No	No	ND2
3-Nitroaniline	99-09-2	0 / 30			1.2					No	No	ND3
4,6-Dinitro-O-cresol	534-52-1	0 / 30			2.1		1.477	Ohio EPA (2018)		No	No	ND2
4-Bromophenyl-phenylether	101-55-3	0 / 30			0.62					No	No	ND3
4-Chloro-3-methylphenol	59-50-7	0 / 30			0.93		0.005	Ohio EPA (2018)		No	No	ND2
4-Chloroaniline	106-47-8	0 / 30			0.93		0.0009	Ohio EPA (2018)		No	No	ND2
4-Chlorophenyl-phenyl ether	7005-72-3	0 / 30			0.62					No	No	ND3
4-Nitroaniline	100-01-6	0 / 30			1.2					No	No	ND3
4-Nitrophenol	100-02-7	0 / 30			2.1		0.153	Ohio EPA (2018)		No	No	ND2
Acetophenone	98-86-2	2 / 30	0.62	J	0.62	T250-C-0.0				No	No	NSV
Benzaldehyde	100-52-7	6 / 30	2.1	J	2.1	T250-C-0.0	0.059	USEPA (2018)		No	Yes	ASV
Butyl benzyl phthalate	85-68-7	1 / 30	0.93	J	0.93	T250-W-0.0				No	No	FOD
Caprolactam	105-60-2	0 / 30			2.1					No	No	ND3
Di-n-butyl phthalate	84-74-2	0 / 30			0.93					No	No	ND3
Di-n-octylphthalate	117-84-0	0 / 30			0.93					No	No	ND3
Dibenzofuran	132-64-9	16 / 30	0.55		0.62	T250-C-0.0				No	No	NSV
Diethyl phthalate	84-66-2	0 / 30			0.93					No	No	ND3
Dimethyl phthalate	131-11-3	0 / 30			0.93					No	No	ND3
Hexachlorobenzene	118-74-1	0 / 30			0.25		0.02	Ohio EPA (2018)		Yes	No	ND2
Hexachlorobutadiene	87-68-3	0 / 30			0.62					Yes	No	ND3

Table 4. COPEC Screening for Surface Sediment

Chemical	CAS Number	FOD	Maximum Detected Concentration (mg/kg)		Maximum Reporting Limit (mg/kg)	Location of Maximum Detected Concentration	Screening Value (mg/kg)	Screening Value Source	OEPA SRV [a]	PBT (Yes/No) [b]	COPEC (Yes/No)	Reason for Selection or Deletion [c]
Hexachlorocyclopentadiene	77-47-4	0 / 30			2.1		0.0065	Ohio EPA (2018)		No	No	ND2
Hexachloroethane	67-72-1	0 / 30			0.62					No	No	ND3
Isophorone	78-59-1	1 / 30	0.62	J	0.62	TO-C-0.0; TO-W-0.0; T1000-C-0.0; T1125-E-0.0; T1125-W-0.0; T375-E-0.0				No	No	FOD
Methyl Acetate	79-20-9	2 / 30	0.043	J	0.043	TO-C-0.0				No	No	NSV
N-Nitrosodi-n-propylamine	621-64-7	0 / 30			0.62					No	No	ND3
N-Nitrosodiphenylamine	86-30-6	0 / 30			0.62					No	No	ND3
Nitrobenzene	98-95-3	0 / 30			0.62					No	No	ND3
Phenol	108-95-2	4 / 30	0.62	J	0.62	T250-C-0.0	0.175	USEPA (2018)		No	Yes	ASV
Bis(2-Chloroethoxy)methane	111-91-1	0 / 30			0.62					No	No	ND3
bis(2-Ethylhexyl)phthalate	117-81-7	14 / 30	0.93		0.93	T250-C-0.0				No	No	NSV
Volatile Organic Compounds												
1,1,1-Trichloroethane	71-55-6	0 / 30			0.0085					No	No	ND3
1,1,2,2-Tetrachloroethane	79-34-5	0 / 30			0.0085					No	No	ND3
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0 / 30			0.0085					No	No	ND3
1,1,2-Trichloroethane	79-00-5	0 / 30			0.0085					No	No	ND3
1,1-Dichloroethane	75-34-3	0 / 30			0.0085					No	No	ND3
1,1-Dichloroethene	75-35-4	0 / 30			0.0085					No	No	ND3
1,2,4-Trichlorobenzene	120-82-1	0 / 30			0.0085					No	No	ND3
1,2-Dibromo-3-chloropropane	96-12-8	0 / 30			0.017					No	No	ND3
1,2-Dibromoethane	106-93-4	0 / 30			0.0085					No	No	ND3
1,2-Dichlorobenzene	95-50-1	0 / 30			0.0085					No	No	ND3
1,2-Dichloroethane	107-06-2	0 / 30			0.0085					No	No	ND3
1,2-Dichloropropane	78-87-5	0 / 30			0.0085					No	No	ND3
1,3-Dichlorobenzene	541-73-1	0 / 30			0.0085					No	No	ND3
1,4-Dichlorobenzene	106-46-7	0 / 30			0.0085					No	No	ND3
2,4-Dinitrotoluene	121-14-2	0 / 30			1.2		0.29	Ohio EPA (2018)		No	No	ND2
2-Butanone	78-93-3	3 / 30	0.034	J	0.034	T625-W-0.0				No	No	NSV
2-Hexanone	591-78-6	0 / 30			0.034					No	No	ND3
4-Methyl-2-pentanone	108-10-1	0 / 30			0.034					No	No	ND3
Acetone	67-64-1	4 / 30	0.068		0.043	T125-C-0.0				No	No	NSV
Benzene	71-43-2	0 / 30			0.0085					No	No	ND3
Bis(2-chloroethyl)ether	111-44-4	0 / 30			0.62					No	No	ND3
Bromodichloromethane	75-27-4	0 / 30			0.0085		0.21	Ohio EPA (2018)		No	No	ND1
Bromoform	75-25-2	0 / 30			0.0085		0.142	Ohio EPA (2018)		No	No	ND1
Bromomethane	74-83-9	0 / 30			0.0085		0.0065	Ohio EPA (2018)		No	No	ND2
Carbon Tetrachloride	56-23-5	0 / 30			0.0085					No	No	ND3
Carbon disulfide	75-15-0	1 / 30	0.0085	J	0.0085	T125-C-0.0				No	No	FOD
Chlorobenzene	108-90-7	0 / 30			0.0085					No	No	ND3
Chloroethane	75-00-3	0 / 30			0.0085					No	No	ND3
Chloroform	67-66-3	0 / 30			0.0085					No	No	ND3
Chloromethane	74-87-3	0 / 30			0.0085					No	No	ND3
Cyclohexane	110-82-7	0 / 30			0.017					No	No	ND3
Dibromochloromethane	124-48-1	0 / 30			0.0085		0.198	Ohio EPA (2018)		No	No	ND1

Table 4. COPEC Screening for Surface Sediment

Chemical	CAS Number	FOD	Maximum Detected Concentration (mg/kg)		Maximum Reporting Limit (mg/kg)	Location of Maximum Detected Concentration	Screening Value (mg/kg)	Screening Value Source	OEPA SRV [a]	PBT (Yes/No) [b]	COPEC (Yes/No)	Reason for Selection or Deletion [c]
Dichlorodifluoromethane	75-71-8	0 / 30			0.0085					No	No	ND3
Ethylbenzene	100-41-4	0 / 30			0.0085					No	No	ND3
Isopropylbenzene	98-82-8	0 / 30			0.0085					No	No	ND3
Methyl tert-butyl ether	1634-04-4	0 / 30			0.0085					No	No	ND3
Methylcyclohexane	108-87-2	0 / 30			0.017					No	No	ND3
Methylene Chloride	75-09-2	0 / 30			0.043					No	No	ND3
Styrene	100-42-5	0 / 30			0.0085					No	No	ND3
Tetrachloroethene	127-18-4	1 / 30	0.0085		0.0085	T250-C-0.0; T500-E-0.0				No	No	FOD
Toluene	108-88-3	1 / 30	0.0085	J	0.0085	T250-C-0.0				No	No	FOD
Trichloroethylene	79-01-6	0 / 30			0.0085					No	No	ND3
Trichlorofluoromethane	75-69-4	0 / 30			0.0085					No	No	ND3
Vinyl Chloride	75-01-4	0 / 30			0.0085					No	No	ND3
Xylenes, Total	1330-20-7	0 / 30			0.017					No	No	ND3
cis-1,2-Dichloroethene	156-59-2	0 / 30			0.0085					No	No	ND3
cis-1,3-Dichloropropene	10061-01-5	0 / 30			0.0085					No	No	ND3
trans-1,2-Dichloroethene	156-60-5	0 / 30			0.0085					No	No	ND3
trans-1,3-Dichloropropene	10061-02-6	0 / 30			0.0085					No	No	ND3

Sources:

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. *Arch. Environ. Contam. Toxicol*. 39:20-31.
Ohio EPA. 2018. Ecological risk assessment guidance document. Ohio Environmental Protection Agency, Division of Environmental Response and Revitalization Assessment, Remediation and Corrective Action Section. July.
Agency.

Notes:

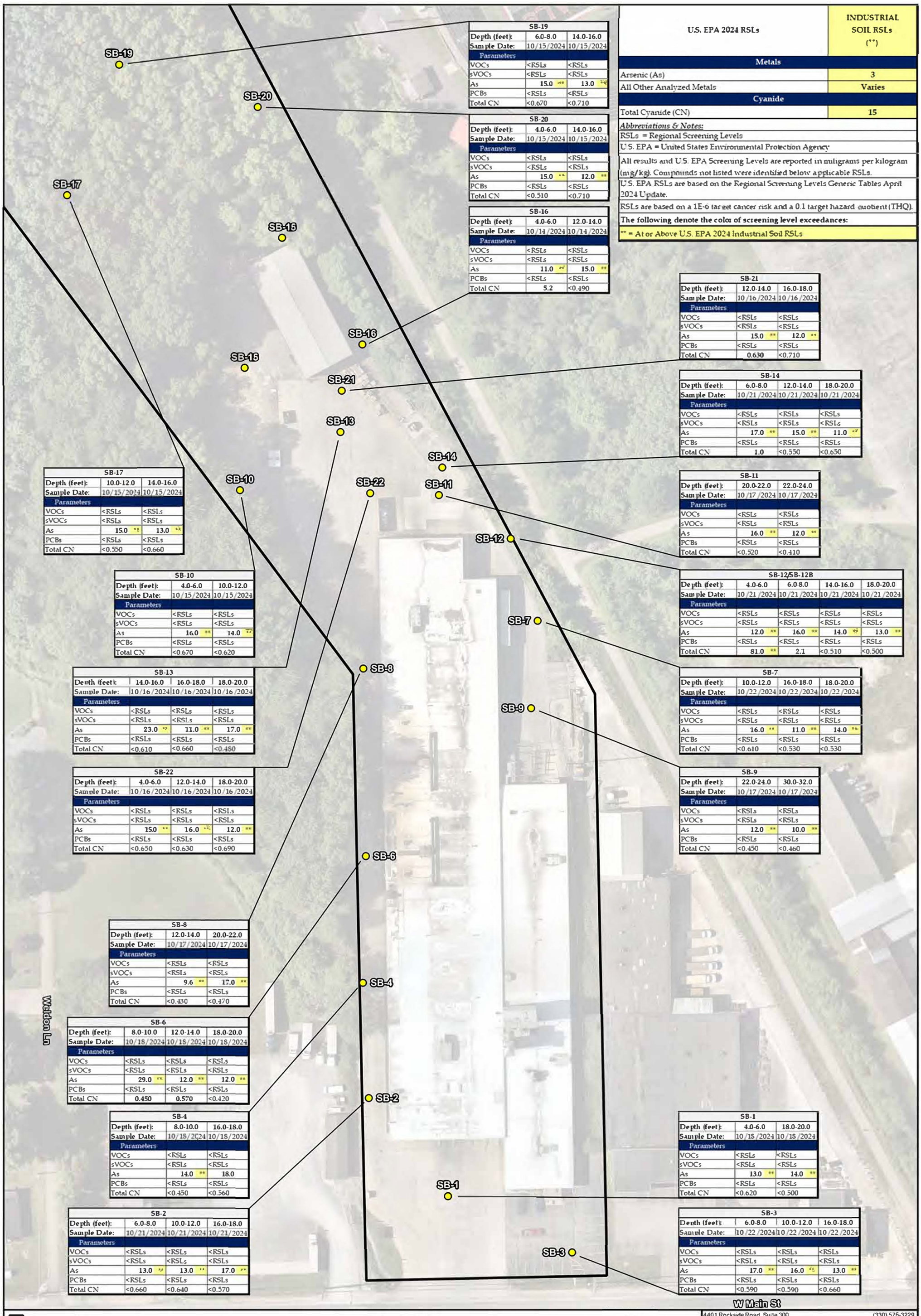
Highlighted chemicals are retained as sediment COPECs for further evaluation
COPEC = chemical of potential ecological concern
FOD = frequency of detection
Ohio EPA = Ohio Environmental Protection Agency
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PBT = persistent, bioaccumulative, toxic
SRV = sediment reference value

Data Qualifier:
J = estimated concentration

[a] Ohio-specific SRVs for Erie-Ontario Lake Plain (Ohio EPA 2018).
[b] Persistent, bioaccumulative, and toxic pollutant as identified in Ohio EPA (2018).
[c] Reason for selection or deletion:
Selection reason: **ASV**: maximum detected concentration is above the screening value; **PBT**: chemical is detected and listed as PBT.
Deletion reason: **BSV**: maximum detected concentration falls below screening value; **NSV**: chemical detected but no screening value available (see Uncertainty Analysis); **NSV1**: chemical detected, no screening value available, but retained as COPC due to known release (see Uncertainty Analysis); **FOD:** chemical was detected but the frequency of detection was <5%; **ND1**: chemical not detected and reporting limit falls below screening value; **ND2**: chemical not detected but reporting limit exceeds screening value (see Uncertainty Analysis); **ND3**: chemical not detected and lacks screening value.

Attachment A

Extent of Hazardous Substances



SB-19		
Depth (feet):	6.0-8.0	14.0-16.0
Sample Date:	10/15/2024	10/15/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	15.0 **	13.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.670	<0.710

SB-20		
Depth (feet):	4.0-6.0	14.0-16.0
Sample Date:	10/15/2024	10/15/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	15.0 **	12.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.510	<0.710

SB-16		
Depth (feet):	4.0-6.0	12.0-14.0
Sample Date:	10/14/2024	10/14/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	11.0 **	15.0 **
PCBs	<RSLs	<RSLs
Total CN	5.2	<0.490

U.S. EPA 2024 RSLs	INDUSTRIAL SOIL RSLs (**)
Metals	
Arsenic (As)	3
All Other Analyzed Metals	Varies
Cyanide	
Total Cyanide (CN)	15

Abbreviations & Notes:

RSLs = Regional Screening Levels

U.S. EPA = United States Environmental Protection Agency

All results and U.S. EPA Screening Levels are reported in milligrams per kilogram (mg/kg). Compounds not listed were identified below applicable RSLs.

U.S. EPA RSLs are based on the Regional Screening Levels Generic Tables April 2024 Update.

RSLs are based on a 1E-6 target cancer risk and a 0.1 target hazard quotient (THQ).

The following denote the color of screening level exceedances:

** = At or Above U.S. EPA 2024 Industrial Soil RSLs

SB-21		
Depth (feet):	12.0-14.0	16.0-18.0
Sample Date:	10/16/2024	10/16/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	15.0 **	12.0 **
PCBs	<RSLs	<RSLs
Total CN	0.630	<0.710

SB-14			
Depth (feet):	6.0-8.0	12.0-14.0	18.0-20.0
Sample Date:	10/21/2024	10/21/2024	10/21/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	17.0 **	15.0 **	11.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	1.0	<0.550	<0.650

SB-17		
Depth (feet):	10.0-12.0	14.0-16.0
Sample Date:	10/15/2024	10/15/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	15.0 **	13.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.550	<0.660

SB-11		
Depth (feet):	20.0-22.0	22.0-24.0
Sample Date:	10/17/2024	10/17/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	16.0 **	12.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.520	<0.410

SB-10		
Depth (feet):	4.0-6.0	10.0-12.0
Sample Date:	10/15/2024	10/15/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	16.0 **	14.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.670	<0.620

SB-12/SB-12B				
Depth (feet):	4.0-6.0	6.0 8.0	14.0-16.0	18.0-20.0
Sample Date:	10/21/2024	10/21/2024	10/21/2024	10/21/2024
Parameters				
VOCs	<RSLs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs	<RSLs
As	12.0 **	16.0 **	14.0 **	13.0 **
PCBs	<RSLs	<RSLs	<RSLs	<RSLs
Total CN	81.0 **	2.1	<0.510	<0.500

SB-13			
Depth (feet):	14.0-16.0	16.0-18.0	18.0-20.0
Sample Date:	10/16/2024	10/16/2024	10/16/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	23.0 **	11.0 **	17.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	<0.610	<0.660	<0.480

SB-7			
Depth (feet):	10.0-12.0	16.0-18.0	18.0-20.0
Sample Date:	10/22/2024	10/22/2024	10/22/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	16.0 **	11.0 **	14.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	<0.610	<0.530	<0.530

SB-22			
Depth (feet):	4.0-6.0	12.0-14.0	18.0-20.0
Sample Date:	10/16/2024	10/16/2024	10/16/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	15.0 **	16.0 **	12.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	<0.650	<0.630	<0.690

SB-9		
Depth (feet):	22.0-24.0	30.0-32.0
Sample Date:	10/17/2024	10/17/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	12.0 **	10.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.450	<0.460

SB-8		
Depth (feet):	12.0-14.0	20.0-22.0
Sample Date:	10/17/2024	10/17/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	9.6 **	17.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.430	<0.470

SB-6			
Depth (feet):	8.0-10.0	12.0-14.0	18.0-20.0
Sample Date:	10/18/2024	10/18/2024	10/18/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	29.0 **	12.0 **	12.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	0.450	0.570	<0.420

SB-4		
Depth (feet):	8.0-10.0	16.0-18.0
Sample Date:	10/18/2024	10/18/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	14.0 **	18.0
PCBs	<RSLs	<RSLs
Total CN	<0.450	<0.560

SB-1		
Depth (feet):	4.0-6.0	18.0-20.0
Sample Date:	10/18/2024	10/18/2024
Parameters		
VOCs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs
As	13.0 **	14.0 **
PCBs	<RSLs	<RSLs
Total CN	<0.620	<0.500

SB-2			
Depth (feet):	6.0-8.0	10.0-12.0	16.0-18.0
Sample Date:	10/21/2024	10/21/2024	10/21/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	13.0 **	13.0 **	17.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	<0.660	<0.640	<0.570

SB-3			
Depth (feet):	6.0-8.0	10.0-12.0	16.0-18.0
Sample Date:	10/22/2024	10/22/2024	10/22/2024
Parameters			
VOCs	<RSLs	<RSLs	<RSLs
sVOCs	<RSLs	<RSLs	<RSLs
As	17.0 **	16.0 **	13.0 **
PCBs	<RSLs	<RSLs	<RSLs
Total CN	<0.590	<0.590	<0.660

Subject Property

Soil Sample

Nearmap Aerial Imagery: June 15, 2024

Material Sciences Corporation
Canfield

On-Site Soil Borings - Soil Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372	DATE: 12/12/2024
	SCALE: 1:1,000
FIGURE: 3	CREATED BY: CC

U.S. EPA 2024 RSLs	RESIDENT SOIL RSLs (*)	INDUSTRIAL SOIL RSLs (**)
Semi-Volatile Organic Compounds (sVOCs)		
Benzo(a)pyrene (BaP)	0.11	2
Benzo(b)fluoranthene (BbF)	1.1	21
Dibenz(a,h)anthracene (DBA)	0.11	2
Metals		
Arsenic (As)	0.68	3
Cadmium (Cd)	0.71	10
Chromium (Hexavalent) (Cr(VI))	0.3	6
Lead	200	800
Zinc (Zn)	2,300	35,000
Cyanide		
Total Cyanide (CN)	2.3	15

Abbreviations & Notes:

BRL = Below Laboratory Reporting Limits

RSLs = Regional Screening Levels

U.S. EPA = United States Environmental Protection Agency

Other analyzed compounds not listed were detected at concentrations below applicable RSLs (<RSLs).

Results and U.S. EPA Screening Levels are reported in milligrams per kilogram (mg/kg).

U.S. EPA RSLs are based on the Regional Screening Levels Generic Tables April 2024 Update.

RSLs are based on a 1E-6 target cancer risk and a 0.1 target hazard quotient (THQ)

The following denote the color of screening level exceedances:

* = At or Above U.S. EPA 2024 Resident Soil RSLs

** = At or Above U.S. EPA 2024 Industrial Soil RSLs

SB-35			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.220 *	0.110 *	<0.067
BbF	0.430	0.220	0.074
DBA	0.045	<0.082	<0.067
As	6.9 **	12.0 **	9.2 **
Cd	0.520	0.460	0.250
Cr(VI)	<6.0 E	<0.28	<2.3 E
Pb	29.0	32.0	24.0
Zn	21,000 *	1,500	1,200
Cyanide (Total)	860 **	14.0 *	8.5 *

SB-29			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.110 *	0.120 *	0.019
BbF	0.250	0.260	0.036
DBA	<0.094	<0.077	<0.053
As	7.3 **	9.2 **	5.6 **
Cd	0.500	0.500	0.170
Cr(VI)	<1.6 E	<1.4 E	<1.9 E
Pb	27.0	42.0	14.0
Zn	4,700 *	170	69.0
Cyanide (Total)	450 **	220 **	6.6 *

SB-30			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.230 *	0.066	0.023
BbF	0.420	0.110	0.042
DBA	0.047	<0.057	<0.050
As	7.0 **	9.2 **	8.3 **
Cd	0.430	0.240	0.240
Cr(VI)	<2.8 E	<2.0 E	<0.19
Pb	23.0	370 *	19.0
Zn	22,000 *	300	230
Cyanide (Total)	320 **	28.0 **	24.0 **

SB-31			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.480 *	0.087	0.030
BbF	0.960	0.150	0.057
DBA	0.088	<0.058	<0.073
As	8.2 **	11.0 **	10.0 **
Cd	0.350	0.320	0.140
Cr(VI)	<2.7 E	<2.2 E	<2.5 E
Pb	23.0	31.0	18.0
Zn	9,500 *	600	320
Cyanide (Total)	690 **	37.0 **	17.0 **

SB-28			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.230 *	0.033	0.018
BbF	0.460	0.065	0.031
DBA	0.042	<0.056	<0.049
As	8.7 **	6.6 **	11.0 **
Cd	0.420	0.440	0.064
Cr(VI)	<3.7 E	<1.9 E	<0.17
Pb	28.0	31.0	11.0
Zn	2,300 *	240	45.0
Cyanide (Total)	270 **	9.0 *	6.9 *

SB-26			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.270 *	0.035	<0.050
BbF	0.550	0.055	<0.050
DBA	0.058	<0.058	<0.050
As	12.0 **	6.0 **	7.8 **
Cd	0.480	0.250	0.100
Cr(VI)	<3.5 E	<2.1 E	<0.88 E
Pb	30.0	28.0	9.9
Zn	2,300 *	99.0	60.0
Cyanide (Total)	380 **	20.0 **	9.9 *

SB-36			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.410 *	0.370 *	0.051
BbF	0.820	0.780	0.087
DBA	0.083	0.078	<0.051
As	8.1 **	11.0 **	7.5 **
Cd	0.430	0.380	0.230
Cr(VI)	<2.3 E	<2.1 E	<0.18
Pb	26.0	27.0	21.0
Zn	20,000 *	810	290
Cyanide (Total)	700 **	6.5 *	<6.0 E

SB-32			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.350 *	0.310 *	0.040
BbF	0.750	0.560	0.082
DBA	0.072	0.053	<0.057
As	7.5 **	12.0 **	9.4 **
Cd	0.310	0.370	0.098
Cr(VI)	<2.2 E	<2.1 E	<2.1 E
Pb	25.0	32.0	17.0
Zn	21,000 *	1,700	790
Cyanide (Total)	700 **	260 **	60.0 **

SB-33			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/09/2024	10/09/2024	10/09/2024
Parameters			
BaP	0.470 *	0.120 *	<0.048
BbF	1.1 *	0.200	<0.048
DBA	0.097	0.020	<0.048
As	11.0 **	14.0 **	11.0 **
Cd	0.390	0.120	0.078
Cr(VI)	<4.1 E	0.250	<0.17
Pb	29.0	15.0	13.0
Zn	7,600 *	280	190
Cyanide (Total)	390 **	36.0 **	8.1 *

SB-25			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.350 *	0.100	<0.050
BbF	0.690	0.200	<0.050
DBA	0.069	<0.078	<0.050
As	17.0 **	9.8 **	4.1 **
Cd	0.520	0.500	0.048
Cr(VI)	<4.1 E	<1.3 E	<0.90 E
Pb	28.0	40.0	9.4
Zn	16,000 *	380	81.0
Cyanide (Total)	860 **	74.0 **	22.0 **

SB-24			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.590 *	0.130 *	<0.050
BbF	1.3 *	0.250	0.026
DBA	0.140 *	0.027	<0.050
As	7.8 **	10.0 **	7.6 **
Cd	0.310	0.520	0.120
Cr(VI)	<2.3 E	<1.0 E	<0.89 E
Pb	22.0	36.0	10.0
Zn	24,000 *	620	150
Cyanide (Total)	940 **	24.0 **	30.0 **

SB-27			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.300 *	0.280 *	0.018
BbF	0.610	0.460	0.035
DBA	0.066	0.060	<0.051
As	9.3 **	19.0 **	8.8 **
Cd	0.330	0.870 *	0.110
Cr(VI)	13.0 **	<0.22	<0.18
Pb	26.0	83.0	13.0
Zn	7,500 *	1,400	360
Cyanide (Total)	930 **	100 **	100 **

SB-23			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.370 *	0.430 *	<0.049
BbF	0.760	0.800	0.028
DBA	0.068	0.086	<0.049
As	11.0 **	12.0 **	15.0 **
Cd	0.260	0.190	0.051
Cr(VI)	<0.23	<1.0 E	<0.17
Pb	22.0	20.0	13.0
Zn	9,400 *	2,100	260
Cyanide (Total)	600 **	240 **	87.0 **

SB-34			
Depth (feet):	0.0-0.5	0.5-1.0	2.0-2.5
Sample Date:	10/08/2024	10/08/2024	10/08/2024
Parameters			
BaP	0.610 *	0.035	0.021
BbF	1.1 *	0.065	0.039
DBA	0.120 *	<0.049	<0.047
As	10.0 **	14.0 **	12.0 **
Cd	0.390	0.088	0.120
Cr(VI)	<1.1 E	<0.16	<0.16
Pb	28.0	14.0	13.0
Zn	3,700 *	180	200
Cyanide (Total)	500 **	63.0 **	21.0 **

SB-35 SB-29 SB-30 SB-31 SB-28 SB-26 SB-36 SB-32 SB-25 SB-27 SB-24 SB-33 SB-34 SB-23

Soil Sample

Nearmap Aerial Imagery: June 15, 2024

Material Sciences Corporation Canfield

Surface Water Feature - Soil Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 10 20 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372 | DATE: 12/10/2024

SCALE: 1:250

FIGURE: 5 | CREATED BY: CC

Transect 1125	East Bank			Center	West Bank	
Depth (feet):	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	0.0-0.5	2.0-2.5
Sample Date:	10/03/2024	10/06/2024	10/06/2024	10/03/2024	10/03/2024	10/06/2024
Parameters						
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	0.560	<0.048	<0.047	0.220	0.088	0.018
BaP	0.750 *	<0.048	0.018	0.310 *	0.110 *	0.018
BbF	1.3 *	0.031	0.038	0.640	0.210	0.031
DBA	0.150 *	<0.048	<0.047	0.069	<0.052	<0.049
IP	0.470	0.017	0.015	0.240	0.090	0.015
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	13.0 **	25.0 **	13.0 *^3	9.9 **	11.0 **	14.0 **
Cd	0.320	0.051	0.081	0.260	0.200	0.130
Cr(VI)	<0.200	<0.170	<0.170 E	<2.1 E	<0.18	<0.18
Cu	26.0	19.0	15.0	3.3	11.0	17.0
Zn	740	270	600	4,500 *	660	160
Cyanide (Total)	140 *^3	16.0 *^3	18.0 *^3	570 *^3	66.0 *^3	<17 E

Transect 1100 SS#5/5N		
Depth (feet):	0.0-0.5	2.0-2.5
Sample Date:	07/24/2024	08/08/2024
Parameters		
VOCs	NA	NA
BaA	NA	NA
BaP	NA	NA
BbF	NA	NA
DBA	NA	NA
IP	NA	NA
PCBs	NA	NA
As	16.0 **	13.0 **
Cd	0.610	0.550
Cr(VI)	NA	NA
Cu	16.0	15.0
Zn	530	380
Cyanide (Total)	89.0 *^3	38.0 **

Transect 1000	East Bank	Center			West Bank	
Depth (feet):	0.0-0.5	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	2.0-2.5
Sample Date:	10/03/2024	10/03/2024	10/06/2024	10/06/2024	10/03/2024	10/06/2024
Parameters						
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	0.620	0.060	0.036	0.150	0.110	<0.043
BaP	0.680 *	0.067	0.029	0.130 *	0.140 *	<0.043
BbF	1.3 *	0.120	0.042	0.170	0.220	<0.045
DBA	0.140 *	<0.051	<0.061	0.036	<0.054	<0.045
IP	0.350	0.016	<0.064	0.055	0.110	<0.045
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	9.7 **	15.0 **	28.0 *^5	11.0 **	9.3 **	15.0 *^3
Cd	1.0 *	0.150	0.270	0.067	0.310	0.730
Cr(VI)	<2.2 E	<0.18	<0.22	<0.54 E	<0.180	<0.16
Cu	27.0	1.9	26.0	18.0	15.0	17.0
Zn	140	6.600 *	160	95.0	280	75.0
Cyanide (Total)	29.0 *^3	1.9	11.0 *	21.0 **	370 *^3	6.3 *

U.S. EPA 2024 RSLs	RESIDENT SOIL RSLs (*)	INDUSTRIAL SOIL RSLs (**)
Semi-Volatile Organic Compounds (sVOCs)		
Benzo(a)anthracene (BaA)	1.1	21
Benzo(a)pyrene (BaP)	0.11	2
Benzo(b)fluoranthene (BbF)	1.1	21
Dibenz(a,h)anthracene (DBA)	0.11	2
Indeno(1,2,3-cd)pyrene (IP)	1.1	21
Metals		
Arsenic (As)	0.68	3
Cadmium (Cd)	0.71	10
Chromium (Hexavalent) (Cr(VI))	0.3	6
Copper (Cu)	310	4700
Zinc (Zn)	2,300	35,000
Cyanide		
Total Cyanide (CN)	2.3	15

Abbreviations & Notes:

BRL = Below Laboratory Reporting Limits; PCB = Polychlorinated Biphenyls

RSLs = Regional Screening Levels; VOCs = Volatile Organic Compounds

U.S. EPA = United States Environmental Protection Agency

Other analyzed compounds not listed were detected at concentrations below applicable RSLs (<RSLs)

Results and U.S. EPA Screening Levels are reported in milligrams per kilogram (mg/kg)

U.S. EPA RSLs are based on the Regional Screening Levels Generic Tables April 2024 Update.

RSLs are based on a 1E-6 target cancer risk and a 0.1 target hazard quotient (THQ).

The following denote the color of screening level exceedances:

* = At or Above U.S. EPA 2024 Resident Soil RSLs

** = At or Above U.S. EPA 2024 Industrial Soil RSLs

Transect 875	East Bank			Center	SS#4/SS#4N		West Bank		
Depth (feet):	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5	4.0-4.5
Sample Date:	10/03/2024	10/03/2024	10/03/2024	10/03/2024	07/24/2024	08/08/2024	10/03/2024	10/03/2024	10/06/2024
Parameters									
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	NA	NA	<RSLs	<RSLs	<RSLs
BaA	0.037	<0.048	0.210	0.027	NA	NA	0.270	<0.045	<0.039
BaP	0.038	<0.048	0.170 *	0.017	NA	NA	0.350 *	<0.045	<0.039
BbF	0.056	0.017	0.240	0.029	NA	NA	0.660	0.013	0.014
DBA	<0.047	<0.048	0.038	<0.019	NA	NA	0.069	<0.045	<0.039
IP	0.018	<0.048	0.100	<0.049	NA	NA	0.230	<0.045	<0.039
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	NA	NA	<RSLs	<RSLs	<RSLs
As	9.8 **	20.0 **	11.0 *^3	16.0 **	13.0 *^3	11.0 **	12.0 **	12.0 *^3	14.0 *^3
Cd	0.230	0.078	0.060	<0.53	0.550	0.570	0.380	0.100	<0.46
Cr(VI)	<0.16	<0.17	<0.17	<0.18	NA	NA	<1.0 E	<0.16	<0.14
Cu	15.0	19.0	16.0	11.0	2.8	16.0	31.0	19.0	17.0
Zn	75.0	68.0	66.0	820	10.000 *	440	430	93.0	62.0
Cyanide (Total)	1.4	1.8	14.0 *	170 *^3	1,900 **	79.0 **	23.0 *^3	4.0 *	5.4 *

Transect 750	East Bank			West Bank	
Depth (feet):	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	2.0-2.5
Sample Date:	10/03/2024	10/05/2024	10/05/2024	10/03/2024	10/05/2024
Parameters					
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	0.290	0.035	0.061	0.660	<0.047
BaP	0.400 *	0.031	0.046	0.940 *	<0.047
BbF	0.760	0.050	0.084	1.9 *	0.017
DBA	0.068	<0.050	<0.051	0.130 *	<0.047
IP	0.190	0.018	0.031	0.550	<0.047
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	13.0 **	13.0 *^3	14.0 **	12.0 **	21.0 *^2
Cd	0.440	0.130	0.120	0.540	<0.56
Cr(VI)	<2.3 E	<0.15	<0.15	<2.1 E	<0.16
Cu	27.0	20.0	20.0	24.0	24.0
Zn	420	110	140	1,200	210
Cyanide (Total)	20.0 **	<15 E	<15 E	43.0 *^3	52.0 **

Transect 670 SS#3/SS#3N		
Depth (feet):	0.0-0.5	2.0-2.5
Sample Date:	07/24/2024	08/08/2024
Parameters		
VOCs	NA	NA
BaA	NA	NA
BaP	NA	NA
BbF	NA	NA
DBA	NA	NA
IP	NA	NA
PCBs	NA	NA
As	11.0 **	19.0 **
Cd	0.530	0.460
Cr(VI)	NA	NA
Cu	2.6	17.0
Zn	6.200 *	460
Cyanide (Total)	990 *^3	41.0 **

Transect 500	East Bank	West Bank		
Depth (feet):	0.0-0.5	0.0-0.5	2.0-2.5	4.0-4.5
Sample Date:	10/03/2024	10/03/2024	10/05/2024	10/05/2024
Parameters				
VOCs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	1.5 *	0.470	<0.052	0.046
BaP	2.2 **	0.610 *	<0.052	0.058
BbF	4.3 *	1.4 *	<0.052	0.110
DBA	0.330 *	0.110 *	<0.052	<0.051
IP	1.2 *	0.350	<0.052	0.051
PCBs	<RSLs	<RSLs	<RSLs	<RSLs
As	11.0 **	14.0 *^5	13.0 *^3	11.0 *^3
Cd	0.900 *	0.600	0.110	<0.63
Cr(VI)	<2.2 E	<2.2 E	<0.18	<0.18
Cu	27.0	17.0	11.0	17.0
Zn	3,400 *	2,600 *	600	130
Cyanide (Total)	370 *^3	540 *^3	2.8 *	14.0 *

Transect 625	East Bank			Center			West Bank	
Depth (feet):	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	2.0-2.5
Sample Date:	10/03/2024	10/05/2024	10/05/2024	10/03/2024	10/05/2024	10/05/2024	10/03/2024	10/05/2024
Parameters								
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	0.210	0.039	0.018	<0.14	0.021	<0.045	0.510	0.081
BaP	0.260 *	0.033	0.019	0.060	0.018	0.019	0.790 *	0.083
BbF	0.470	0.060	0.030	0.120	0.150	0.027	1.6 *	0.160
DBA	0.055	<0.051	<0.019	<0.14 E	<0.050	<0.015	0.110 *	0.030
IP	0.190	0.025	<0.019	<0.14	<0.050	0.017	0.470	0.064
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	11.0 *^3	14.0 **	15.0 **	15.0 **	16.0 *^3	17.0 **	14.0 **	17.0 *^3
Cd	0.410	0.160	0.130	0.280	0.310	0.150	0.530	<0.55
Cr(VI)	2.4 *	<0.18	<0.17	<1.9 E	<0.15	0.330 *	<2.1 E	<0.16
Cu	26.0	23.0	28.0	3.7	33.0	18.0	11.0	21.0
Zn	210	230	160	12.000 *	550	860	3,700 *	68.0
Cyanide (Total)	10.0 *	40.0 **	7.3 *	160 **	12.0 *	3.2 *	740 **	78.0 **

Transect 250	East Bank		Center	West Bank		
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	0.0-0.5	2.0-2.5	4.0-4.5
Sample Date:	10/03/2024	10/04/2024	10/03/2024	10/03/2024	10/04/2024	10/04/2024
Parameters						
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	1.6 *	0.170	2.2 *	2.4 *	0.075	0.120
BaP	2.0 *	0.180 *	3.2 **	3.3 **	0.130 *	0.120 *
BbF	4.0 *	0.350	5.3 *	5.6 *	0.120	0.190
DBA	0.260 *	<0.051	0.410 *	0.420 *	<0.053	<0.052
IP	0.800	0.130	1.6 *	1.8 *	0.053	0.081
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	13.0 **	12.0 **	11.0 *^3	13.0 *^3	16.0 **	12.0 **
Cd	0.500	0.250	0.570	0.920 *	0.210	0.350
Cr(VI)	<1.9 E	<0.18	<2.2 E	<2.4 E	<0.19	<0.18
Cu	4.2	22.0	2.5	31.0	8.3	60.0
Zn	4,400 *	430	5,800 *	3,100 *	2,400 *	370
Cyanide (Total)	1,400 **	240 **	710 **	1,300 **	45.0 **	32.0 **

Transect 375	East Bank			SS#2/2N		West Bank		
Depth (feet):	0.0-0.5	2.0-2.5	4.0-4.5	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5	4.0-4.5
Sample Date:	10/03/2024	10/04/2024	10/04/2024	07/24/2024	08/08/2024	10/03/2024	10/04/2024	10/04/2024
Parameters								
VOCs	<RSLs	<RSLs	<RSLs	NA	NA	<RSLs	<RSLs	<RSLs
BaA	2.3 *	0.140	0.400	NA	NA	2.1 *	0.150	0.059
BaP	3.3 **	0.140 *	0.310 *	NA	NA	3.2 *^5	0.150 *	0.063
BbF	4.9 *	0.220	0.440	NA	NA	6.6 *	0.220	0.099
DBA	0.450 *	0.032	0.067	NA	NA	0.420 *	<0.051	<0.052
IP	1.9 *	0.097	0.210	NA	NA	1.7 *	0.110	0.054
PCBs	<RSLs	<RSLs	<RSLs	NA	NA	<RSLs	<RSLs	<RSLs
As	14.0 *^3	15.0 **	14.0 *^3	11.0 **	9.8 *^3	12.0 *^3	12.0 **	14.0 **
Cd	0.790 *	0.210	0.120	0.650	0.550	0.750 *	0.140	0.410
Cr(VI)	<1.3 E	0.280	<0.20	NA	NA	<2.4 E	<0.19	<0.18
Cu	11.0	25.0	20.0	3.2	19.0	12.0	16.0	20.0
Zn	10.000 *	460	330	19,000 *	140	5,200 *	310	630
Cyanide (Total)	1,200 **	<32 E	<36 E	2,500 *^3	14.0 *	1,300 *^3	49.0 **	<38 E

Transect 125	East Bank		Center	West Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	0.0-0.5	2.0-2.5
Sample Date:	10/02/2024	10/03/2024	10/03/2024	10/02/2024	10/04/2024
Parameters					
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	1.2 *	1.3 *	1.9 *	1.4 *	0.420
BaP	1.3 *	1.3 *	2.0 *	1.4 *	0.430 *
BbF	2.1 *	1.8 *	4.2 *	2.3 *	0.580
DBA	0.240 *	0.190 *	0.310 *	0.200 *	0.081
IP	0.850	0.690	1.1 *	0.780	0.220
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	32.0 **	12.0 *^3	12.0 **	11.0 *^5	9.4 *^3
Cd	1.0 *	1.2 *	0.670	0.620	1.9 *
Cr(VI)	<0.97 E	<0.18	<2.1 E	<1.0 E	<0.17
Cu	800 *	22.0	4.7	28.0	20.0
Zn	5,200 *	850	6,700 *	3,100 *	510
Cyanide (Total)	240 **	14.0 *	780 *^5	610 *^3	63.0 *^3

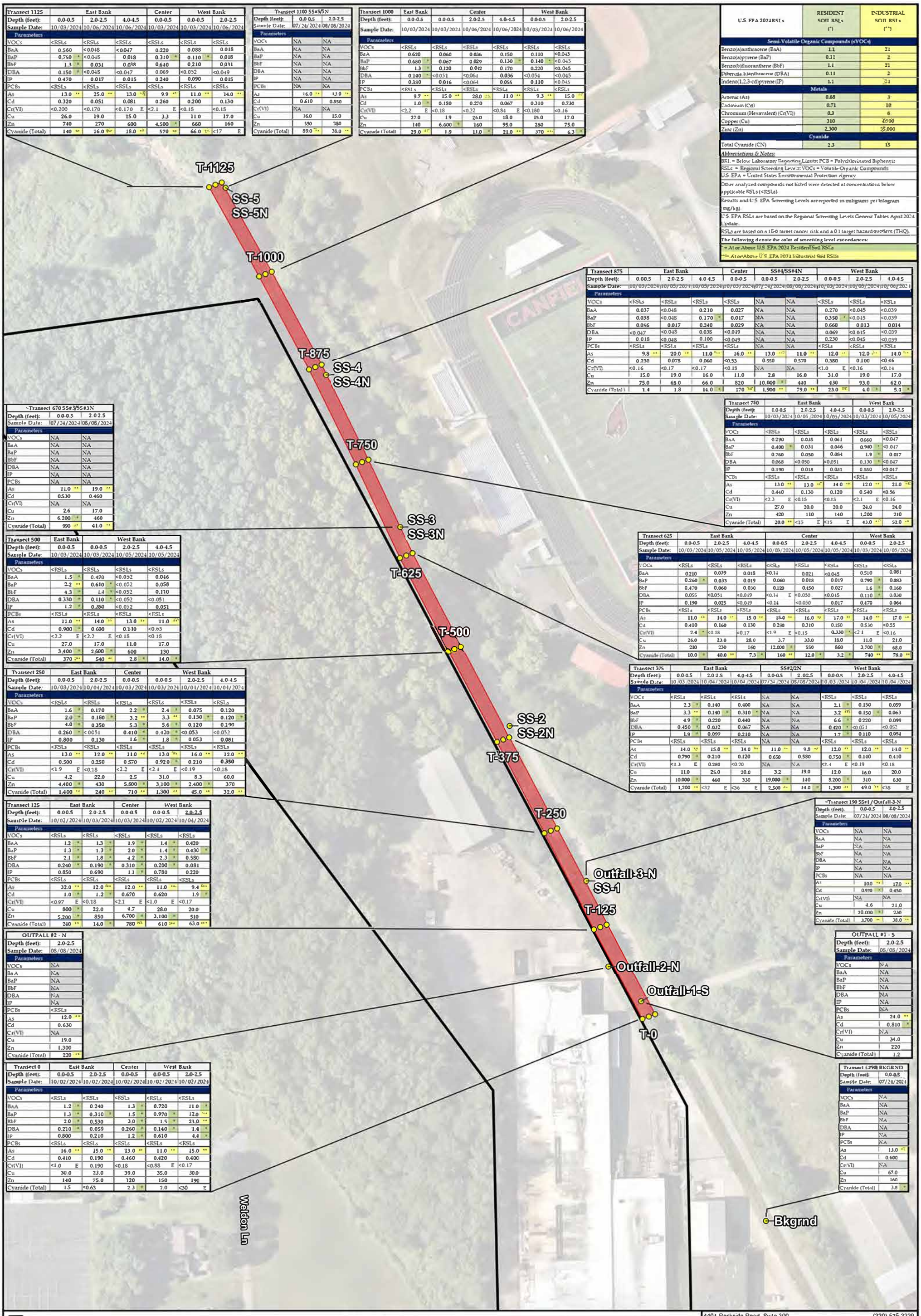
Transect 190 SS#1/Outfall-3-N		
Depth (feet):	0.0-0.5	2.0-2.5
Sample Date:	07/24/2024	08/08/2024
Parameters		
VOCs	NA	NA
BaA	NA	NA
BaP	NA	NA
BbF	NA	NA
DBA	NA	NA
IP	NA	NA
PCBs	NA	NA
As	100 **	17.0 **
Cd	0.920 *	0.450
Cr(VI)	NA	NA
Cu	4.6	21.0
Zn	20.000 *	230
Cyanide (Total)	3,700 **	38.0 **

OUTFALL #2 - N	
Depth (feet):	2.0-2.5
Sample Date:	08/08/2024
Parameters	
VOCs	NA
BaA	NA
BaP	NA
BbF	NA
DBA	NA
IP	NA
PCBs	<RSLs
As	12.0 **
Cd	0.630
Cr(VI)	NA
Cu	19.0
Zn	1,300
Cyanide (Total)	220 **

OUTFALL #1 - S	
Depth (feet):	2.0-2.5
Sample Date:	08/08/2024
Parameters	
VOCs	NA
BaA	NA
BaP	NA
BbF	NA
DBA	NA
IP	NA
PCBs	NA
As	24.0 **
Cd	0.810 *
Cr(VI)	NA
Cu	34.0
Zn	220
Cyanide (Total)	1.2

Transect 0	East Bank		Center	West Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	0.0-0.5	2.0-2.5
Sample Date:	10/02/2024	10/02/2024	10/02/2024	10/02/2024	10/02/2024
Parameters					
VOCs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
BaA	1.2 *	0.240	1.3 *	0.720	11.0 *
BaP	1.3 *	0.310 *	1.5 *	0.970 *	12.0 *^3
BbF	2.0 *	0.530	3.0 *	1.5 *	23.0 **
DBA	0.210 *	0.059	0.260 *	0.140 *	1.4 *
IP	0.800	0.210	1.2 *	0.610	4.4 *
PCBs	<RSLs	<RSLs	<RSLs	<RSLs	<RSLs
As	16.0 **	15.0 **	13.0 **	11.0 **	15.0 **
Cd	0.410	0.190	0.460	0.420	0.400
Cr(VI)	<1.0 E	0.190	<0.18	<0.88 E	<0.17
Cu	30.0	23.0	39.0	35.0	30.0
Zn	140	75.0	720	150	190
Cyanide (Total)	1.5	<0.63	2.3 *	2.0	<30 E

Transect 6290 BKGRND	
Depth (feet):	0.0-0.5
Sample Date:	07/24/2024
Parameters	
VOCs	NA
BaA	NA
BaP	NA
BbF	NA
DBA	NA
IP	NA
PCBs	NA
As	13.0 *^3
Cd	0.600
Cr(VI)	NA
Cu	67.0
Zn	160
Cyanide (Total)	3.8 *



Subject Property

Ditch Excavation Area

Soil Sample

Nearmap Aerial Imagery: June 15, 2024

Material Sciences Corporation
Canfield

Adjacent Ditch - Soil Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229

August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372	DATE: 12/11/2024
	SCALE: 1:1,250
FIGURE: 6	CREATED BY: CC

OHIO EPA
NON-DRINKING
SURFACE WATER
HUMAN HEALTH CRITERIA

Semi-Volatile Organic Compounds (sVOCs)	
Benzo(a)anthracene (BaA)	0.013
Benzo(a)pyrene (BaP)	0.0013
Benzo(b)fluoranthene (BbF)	0.013
Benzo(k)fluoranthene (BkF)	0.130
Indeno(1,2,3-cd)pyrene (IP)	0.013
Metals	
Mercury	0.012
Zinc (Zn) (Dissolved [Zn(d)])	26000
Cyanide	
Total Cyanide (CN)	NE
Free Cyanide (CN)	400

Abbreviations & Notes:

NE = Not Established; PCBs = Polychlorinated Biphenyls; VOCs = Volatile Organic Compounds

U.S. EPA = United States Environmental Protection Agency

The higher of the two values between original sample and duplicate sample is posted if a compound exceeds OH EPA Surface Water.

Results and Screening Levels are reported in micrograms per liter (ug/L). Analyzed compounds not listed were not detected above Ohio EPA Surface Water Criteria (<SurfCrit).

Per the U.S. EPA's RSL User's Guide, the chemical abstract services number (CAS#) for total cyanide is based on free cyanide toxicity. Since cyanide speciation was performed as part of Site investigation, the total cyanide OH EPA Surface Water Criteria is listed as NE and free cyanide results are compared to the OH EPA Surface Water Criteria.

The following denote the color of screening level exceedances:

^ = At or Above Ohio EPA Non-Drinking Surface Water Human Health Criteria

Transect 750 Center	
Depth (feet):	Surface
Sample Date:	10/07/2024
Parameters	
VOCs	<SurfCrit
BaA	<0.065
BaP	<0.17
BbF	0.160 ^
BkF	<0.13
IP	<0.13
PCBs	<SurfCrit
Hg	<0.13
Zn	3,200
Zn	2,700
Total CN	840
Free CN	46.0

Transect 500 Center	
Depth (feet):	Surface
Sample Date:	10/07/2024
Parameters	
VOCs	<SurfCrit
BaA	0.250 ^
BaP	0.240 ^
BbF	0.430 ^
BkF	0.160 ^
IP	0.160 ^
PCBs	<SurfCrit
Hg	1.2 ^
Zn	69,000 ^
Zn(d)	19,000
Total CN	2,000
Free CN	94.0

Transect 375 Center /SW-DUP-1	
Depth (feet):	Surface
Sample Date:	10/07/2024
Parameters	
VOCs	<SurfCrit
BaA	0.340 ^
BaP	0.580 ^
BbF	1.3 ^
BkF	0.410 ^
IP	0.540 ^
PCBs	<SurfCrit
Hg	<0.200
Zn	28,000 ^
Zn(d)	970
Total CN	4,900
Free CN	83.0

T-750

T-500

T-375

CANFIELD

Weldon Ln

Subject Property

Surface Water Sample

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation
Canfield

Adjacent Ditch - Surface Water Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229

August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372

DATE: 12/11/2024

SCALE: 1:1,250

FIGURE: 8

CREATED BY: CC

SB-29-SW	
Depth (feet):	Surface
Sample Date:	10/25/2024
Parameters	
VOCs	<SurfCrit
BaA	0.190 ^
BaP	0.320 ^
BbF	0.600 ^
BkF	0.180 ^
IP	0.240 ^
Metals	<SurfCrit
PCBs	<SurfCrit
Total CN	8,100
Free CN	130

SB-36-SW	
Depth (feet):	Surface
Sample Date:	10/25/2024
Parameters	
VOCs	<SurfCrit
BaA	<0.065
BaP	<0.17
BbF	<0.15
BkF	<0.13
IP	<0.13
Metals	<SurfCrit
PCBs	<SurfCrit
Total CN	2,400
Free CN	130

OHIO EPA
NON-DRINKING
SURFACE WATER
HUMAN HEALTH CRITERIA

Semi-Volatile Organic Compounds (sVOCs)	
Benzo(a)anthracene (BaA)	0.013
Benzo(a)pyrene (BaP)	0.0013
Benzo(b)fluoranthene (BbF)	0.013
Benzo(k)fluoranthene (BkF)	0.130
Indeno(1,2,3-cd)pyrene (IP)	0.013
Cyanide	
Total Cyanide (CN)	NE
Free Cyanide (CN)	400

Abbreviations & Notes:

NE = Not Established; PCBs = Polychlorinated Biphenyls; VOCs = Volatile Organic Compounds

U.S. EPA = United States Environmental Protection Agency

Results and Screening Levels are reported in micrograms per liter (ug/L). Analyzed compounds not listed were not detected above Ohio EPA Surface Water Criteria (<SurfCrit).

Per the U.S. EPA's RSL User's Guide, the chemical abstract services number (CAS#) for total cyanide is based on free cyanide toxicity. Since cyanide speciation was performed as part of Site investigation, the total cyanide OH EPA Surface Water Criteria is listed as NE and free cyanide results are compared to the OH EPA Surface Water Criteria.

The following denote the color of screening level exceedances:

^ = At or Above Ohio EPA Non-Drinking Surface Water Human Health Criteria

SB-29
SB-30
SB-28
SB-35
SB-31
SB-26
SB-36
SB-32
SB-25
SB-27
SB-33
SB-24
SB-34
SB-23

Soil Boring Location

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation
Canfield

Surface Water Feature -
Surface Water Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 10 20 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229

August Mack
ENVIRONMENTAL

PROJECT NO.: JY2380.372	DATE: 12/11/2024
	SCALE: 1:250
FIGURE: 9	CREATED BY: CC

Attachment B

November 2024 Photo Log



File Name: IMG_0575
Date/Time: 2024:11:21 14:03:27
Latitude:
Longitude:
Description: Staging area and mobile treatment units



File Name: IMG_0576
Date/Time: 2024:11:21 14:03:36
Latitude:
Longitude:
Description: Material Sciences Corporation facility (looking toward Main St.)



File Name: IMG_0578
Date/Time: 2024:11:21 14:07:24
Latitude:
Longitude:
Description: Forest area near temporary access road with erosion control measures and material stockpiles adjacent to leaf-littered ground and mature trees.



File Name: IMG_0579
Date/Time: 2024:11:21 14:07:25
Latitude:
Longitude:
Description: Temporary access road (walking north).



File Name: IMG_0580
Date/Time: 2024:11:21 14:07:27
Latitude:
Longitude:
Description: Personnel walking along temporary access road.



File Name: IMG_0582
Date/Time: 2024:11:21 14:07:33
Latitude:
Longitude:
Description: Wooded area with felled trees and accumulated debris adjacent to sediment management activities.



File Name: IMG_0584
Date/Time: 2024:11:21 14:08:16
Latitude:
Longitude:
Description: Temporary mud matting through upland forested area (ditch and temporary fencing along right side of photo).



File Name: IMG_0585
Date/Time: 2024:11:21 14:10:08
Latitude:
Longitude:
Description: Gravel access road looking south towards staged roll off boxes. Facility is in far background.



File Name: IMG_0587
Date/Time: 2024:11:21 14:10:12
Latitude:
Longitude:
Description: Temporary fenced boundary along bikeway, with flagged markers indicating designated areas for sampling in Adjacent Ditch.



File Name: IMG_0588
Date/Time: 2024:11:21 14:13:20
Latitude:
Longitude:
Description: Temporary gravel access road, water bypass pump, wetland area.



File Name: IMG_0591
Date/Time: 2024:11:21 14:15:36
Latitude:
Longitude:
Description: Outlet of ditch bypass, vegetation.



File Name: IMG_0592
Date/Time: 2024:11:21 14:17:26
Latitude:
Longitude:
Description: Wetland area with visible vegetation and leaf litter.



File Name: IMG_0594
Date/Time: 2024:11:21 14:17:35
Latitude:
Longitude:
Description: Scrub/shrub habitat near wetland.



File Name: IMG_0596
Date/Time: 2024:11:21 14:17:41
Latitude:
Longitude:
Description: Gravel access road, bypass pumps, sediment control measures, and adjacent vegetation.



File Name: IMG_0597
Date/Time: 2024:11:21 14:17:47
Latitude:
Longitude:
Description: Outlet of bypass pump near wetland.



File Name: IMG_0598
Date/Time: 2024:11:21 14:20:31
Latitude:
Longitude:
Description: Adjacent Ditch (looking south toward facility). Bypass pool in foreground.



File Name: IMG_0599
Date/Time: 2024:11:21 14:20:32
Latitude:
Longitude:
Description: Temporary dam to collect water from Adjacent Ditch.



File Name: IMG_0604
Date/Time: 2024:11:21 14:23:00
Latitude:
Longitude:
Description: Bypass pump in foreground, roll off boxes staging area in background.



File Name: IMG_0608
Date/Time: 2024:11:21 14:24:22
Latitude:
Longitude:
Description: Upland forest and scrub/shrub habitat.



File Name: IMG_0610
Date/Time: 2024:11:21 14:24:41
Latitude:
Longitude:
Description: Leaf litter.



File Name: IMG_0614
Date/Time: 2024:11:21 14:31:22
Latitude:
Longitude:
Description: Forested upland



File Name: IMG_0617
Date/Time: 2024:11:21 14:31:30
Latitude:
Longitude:
Description: Forested upland with property boundary marker.



File Name: IMG_0621
Date/Time: 2024:11:21 14:32:41
Latitude: 41.02905556
Longitude: -80.77842778
Description: Metal mesh debris observed on leaf-covered ground in upland area.



File Name: IMG_0622
Date/Time: 2024:11:21 14:32:59
Latitude: 41.02909444
Longitude: -80.77841111
Description: Brambles between forest and wetland habitat.



File Name: IMG_0625
Date/Time: 2024:11:21 14:43:40
Latitude: 41.02926389
Longitude: -80.77828333
Description: Deer path through wetland.



File Name: IMG_0626
Date/Time: 2024:11:21 14:43:48
Latitude: 41.02926667
Longitude: -80.77828333
Description: Vegetation in wetland (foreground), forested upland (background), looking south.



File Name: IMG_0628
Date/Time: 2024:11:21 14:44:25
Latitude: 41.02928611
Longitude: -80.77829722
Description: Vegetation in wetland.



File Name: IMG_0635
Date/Time: 2024:11:21 14:47:36
Latitude: 41.02935278
Longitude: -80.77825833
Description: Vegetation in wetland.



File Name: IMG_0638
Date/Time: 2024:11:21 14:49:30
Latitude: 41.02936667
Longitude: -80.77820556
Description: Vegetation in wetland.



File Name: IMG_0642
Date/Time: 2024:11:21 14:51:31
Latitude: 41.02936111
Longitude: -80.77831944
Description: Wetland habitat.



File Name: IMG_0649
Date/Time: 2024:11:21 14:58:10
Latitude: 41.02945
Longitude: -80.77842778
Description: Animal scat and leaf litter in wetland area.



File Name: IMG_0652
Date/Time: 2024:11:21 14:59:07
Latitude: 41.029475
Longitude: -80.77838056
Description: Wetland transition to upland forest.



File Name: IMG_0653
Date/Time: 2024:11:21 14:59:10
Latitude: 41.02948056
Longitude: -80.77838056
Description: Standing snag in wetland.



File Name: IMG_0655
Date/Time: 2024:11:21 14:59:29
Latitude: 41.02950278
Longitude: -80.77828889
Description: Standing snag and large woody debris in wetland.



File Name: IMG_0659
Date/Time: 2024:11:21 15:02:26
Latitude: 41.02962778
Longitude: -80.77830556
Description: Channels with standing water in wetland area.



File Name: IMG_0662
Date/Time: 2024:11:21 15:03:51
Latitude: 41.02949444
Longitude: -80.77849444
Description: Deer print in sediment in wetland area.



File Name: IMG_0665
Date/Time: 2024:11:21 15:04:11
Latitude: 41.02949444
Longitude: -80.77847222
Description: Vegetation in wetland area.



File Name: IMG_0670
Date/Time: 2024:11:21 15:07:51
Latitude: 41.0294
Longitude: -80.778625
Description: Wildlife path through wetland.



File Name: IMG_0672
Date/Time: 2024:11:21 15:16:27
Latitude: 41.02926389
Longitude: -80.77902222
Description: Access from wetlands to northern bike trail. Large *Phragmites* stands in background.



File Name: IMG_0673
Date/Time: 2024:11:21 15:16:29
Latitude: 41.02915278
Longitude: -80.77883056
Description: Open channel in wetland.



File Name: IMG_0674
Date/Time: 2024:11:21 15:16:34
Latitude: 41.02915278
Longitude: -80.77880833
Description: Open channel in wetland.



File Name: IMG_0675
Date/Time: 2024:11:21 15:18:32
Latitude: 41.02916667
Longitude: -80.778625
Description: Wetland area.



File Name: IMG_0677
Date/Time: 2024:11:21 15:19:23
Latitude: 41.02905556
Longitude: -80.778525
Description: Tree base with moss.



File Name: IMG_0682
Date/Time: 2024:11:21 15:26:28
Latitude: 41.02893056
Longitude: -80.77808333
Description: Tree with fungal growth and signs of rutting.



File Name: IMG_0684
Date/Time: 2024:11:21 15:27:01
Latitude: 41.02899167
Longitude: -80.77799167
Description: Forested habitat.



File Name: IMG_0688
Date/Time: 2024:11:21 15:27:41
Latitude: 41.02901944
Longitude: -80.77808333
Description: Forested habitat.



File Name: IMG_0694
Date/Time: 2024:11:21 15:29:56
Latitude: 41.02911389
Longitude: -80.77801389
Description: Foreground tree trunk with surrounding leaf litter and debris, adjacent to wetland vegetation and temporary construction materials within the site boundary near containment efforts.



File Name: IMG_0705
Date/Time: 2024:11:21 15:32:45
Latitude: 41.02970833
Longitude: -80.77796111
Description: Concrete structure between wetland and bikeway.



File Name: IMG_0706
Date/Time: 2024:11:21 15:32:52
Latitude: 41.02968611
Longitude: -80.77796111
Description: Wetland area.



File Name: IMG_0707
Date/Time: 2024:11:21 15:32:54
Latitude: 41.02969444
Longitude: -80.77795278
Description: Wetland area.



File Name: IMG_0711
Date/Time: 2024:11:21 15:34:31
Latitude: 41.02963889
Longitude: -80.77806111
Description: Sediment control measures around perimeter of standing water portion of wetland.



File Name: IMG_0713
Date/Time: 2024:11:21 15:34:35
Latitude: 41.02961389
Longitude: -80.778075
Description: Sediment control measures around perimeter of standing water portion of wetland.



File Name: IMG_0714
Date/Time: 2024:11:21 15:34:39
Latitude: 41.02960833
Longitude: -80.778075
Description: Sediment control measures around perimeter of standing water portion of wetland.



File Name: IMG_0715
Date/Time: 2024:11:21 15:34:41
Latitude: 41.02959722
Longitude: -80.77808333
Description: Wetland habitat.



File Name: IMG_0718
Date/Time: 2024:11:21 15:37:57
Latitude: 41.02982222
Longitude: -80.77794722
Description: Vegetation on bikeway berm.



File Name: IMG_0719
Date/Time: 2024:11:21 15:38:37
Latitude: 41.02986389
Longitude: -80.77798333
Description: Looking from bikeway berm towards wetland. Water control structure in mid-photo.



File Name: IMG_0720
Date/Time: 2024:11:21 15:38:47
Latitude: 41.02986111
Longitude: -80.77799167
Description: Wetland with water control structure in foreground and sediment control coir log and *Phragmites* stands in background.



File Name: IMG_0724
Date/Time: 2024:11:21 15:39:00
Latitude: 41.02988056
Longitude: -80.77798333
Description: View of wetland area (looking west).



File Name: IMG_0725
Date/Time: 2024:11:21 15:40:16
Latitude: 41.02950556
Longitude: -80.77767222
Description: View of bypassed Adjacent Ditch (looking upstream).

Attachment C

Ecological Scoping Checklist

Level I Attachment B
Ecological Scoping Checklist

Part 1			
SITE INFORMATION			
Site Name: Canfield Site		Date: 11/21/24	
Personnel: Jen Lyndall (Integral, lead) and Lindsay Hanna (MAD Scientist) (Identify team leader)		Time Arrived: 13:31 Time Departed: 16:25	
Site Address: 460 W. Main St, Canfield, OH 44406			
Site Location:	Latitude: 41.027837	Longitude: -80.777932	
Site Size (acres): Approx. 13.4 acres			
Weather Conditions (note any unusual conditions): Cloudy, scattered snow.			
Land uses at and adjacent to the site: (Circle all that apply and record at or adjacent)			
Residential Adjacent	Commercial	Recreational Adjacent	Industrial At/Adjacent
Agricultural	Urban	Green-Space/ Undeveloped At/adjacent	Other:_____

Note: This checklist provides a suggested format. The format may be altered to fit the needs of the site; however, all pertinent information should be presented.

Part 2		
CONTAMINANTS OF INTEREST		
Contaminants of Interest and *Ecological Stressors* (Types, names including CASRN, classes, or specific *hazardous substances* and non-chemical stressors either known or suspected)	Onsite (O) or Adjacent (A) to the site	Media (soil, sediment, wetland, surface water, ground water (seeps/springs))
Benzo(a)pyrene	Onsite, adjacent	soil, surface water
Benzo(b)fluoranthene	Onsite, adjacent	soil, surface water
Arsenic	Onsite. adjacent	soil
Cyanide	Onsite, adjacent	soil
Benzo(a)anthrecene	Onsite	surface water
Benzo(k)fluoranthene	Onsite	surface water
Indeno(1,2,3-cd)pyrene	Onsite	surface water
Mercury	Onsite	surface water
Zinc	Onsite, adjacent	soil, surface water
Dibenz(a,h)anthracene	Onsite, adjacent	soil
Chromium	Onsite, adjacent	soil

Part 3

SPECIFIC EVALUATION OF ECOLOGICAL RECEPTORS/HABITAT

Terrestrial – Wooded 45 % of site

Dominant vegetation (circle one):
Coniferous (Deciduous) Mixed

Dominant tree diameter
diameter at breast height (*dbh*): ____ (inches)

Evidence/observation of wildlife*: squirrels, deer, birds

Terrestrial - Shrub/scrub/grasses 2 % of site

Dominant vegetation (circle one):
shrub/scrub (grasses)

vegetation density: Dense, (Patchy), Sparse
Prominent height of shrub/scrub (<2', 2' to 5', >5')
Prominent height of grasses/herbs (<2') 2' to 5', >5')
Evidence/observation of wildlife*: birds

Terrestrial - Ruderal/Engineered 37 % of site

Dominant vegetation/surfaces (circle one):
Landscaped Agricultural Bare ground
(Parking lot) Artificial surfaces
Dominant vegetation height (0', >0' - 2', 2' - 5', >5')
Vegetation Density: Dense Patchy (Sparse)
Evidence/observation of wildlife*:
Bird calls

Aquatic - Non-Flowing (Lentic) ____% of site

Type: Lake Pond Vernal Pool Lagoon
Engineered** Impoundment Reservoir
Water source: Surface water Ground water
Industrial discharge Surface water runoff
Discharge Point: Surface water Ground water
Wetlands
Bottom Substrate***:
Vegetation: Submerged Emergent Floating
Wetland Present: (Yes/No)
Evidence/Observation of wildlife*:

Aquatic - Flowing (Lotic) 4 % of site
Aquatic Life Use Designation (if available) _____
Type: River Stream Intermittent Stream
(Ditch)
Water source: Surface Water Ground Water
Industrial discharge (seeps /springs)
Storm water runoff
Discharge Point: Surface water Ground water
(Wetlands) Impoundment
Bottom Substrate**:
Vegetation: Submerged Emergent Floating
Wetland Present: (Yes/No)
Evidence/Observation of Wildlife*: Ditch bypassed during site visit

Aquatic - Wetlands 12 % of site
Size 1.6 (acres)
Obvious or designated wetland: (Yes) / No)
Water source: (Surface Water) Ground Water
Industrial discharge Surface water runoff
Discharge Point: (Surface water) Ground water
Wetlands Impoundment
Bottom Substrate***: muck
Vegetation: Submerged Emergent Floating

Evidence/Observation of Wildlife*: Deer tracks, birds

* Wildlife includes: macroinvertebrates, reptiles, amphibians, birds, mammals, and fish.
** Engineered can mean any surface water body that has been artificially created or significantly altered.
*** Bottom substrate types include but not limited to: cobble, gravel, sand, silt, clay, muck, artificial (*e.g.*, concrete).

Part 4
Ecologically Important Resources Observed

Attachment D

Wetland Delineation Report

JURISDICTIONAL WATERS AND ISOLATED WETLANDS REPORT:

Mill Creek Metropark and Adjacent Area
Canfield, Ohio 44406

December 11, 2024

Prepared for:

Integral Consulting, Inc.
8472 E. Washington St. #115
Chagrin Falls, OH 44023

Prepared by:

MAD SCIENTIST ASSOCIATES LLC

Specialists in
Ecological & Wetland Consulting

253 North State Street, Suite 101 Westerville, Ohio 43081 (614) 818-9156 Fax (614) 818-9157 www.madscientistassociates.net

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EXECUTIVE SUMMARY

Integral Consulting, Inc. (Integral) contracted MAD Scientist Associates, LLC (MAD) to investigate and assess aquatic resources across a ~5-acre area located to the northwest of the Material Sciences Corporation building at 460 W. Main St, Canfield, Mahoning County, Ohio (hereafter referred to as the Delineation Area). The Delineation Area is centered approximately on the following coordinates: 41.027837°, -80.777932° (WGS 84). The primary objectives of this study were to identify the boundaries of any Jurisdictional Waters (*i.e.*, non-Isolated Wetlands, streams) or Isolated Wetlands and evaluate their quality using methods developed by the Ohio Environmental Protection Agency (Ohio EPA).

Field work was completed by MAD on November 21, 2024. Wetlands were identified and delineated at the Delineation Area. One (1) identified wetland feature (Wetlands A) amounted to approximately 6.92 acres across the Delineation Area. The wetland was scored using the Ohio Rapid Assessment Method (ORAM, version 5.0) and received a score of 47. This classifies Wetland A as a Category 2 wetland.

All jurisdictional and isolated surface water features identified in this report are regulated by the Ohio EPA or the United States Army Corps of Engineers (USACE). Permits from one or both these agencies may be required if impacts (*e.g.*, placement of fill material) are proposed for the identified features. The permit(s) needed are dependent on the acreage of impact and the type of wetlands or streams affected. The determination of jurisdictional status must be verified by the USACE.

According to the USFWS Information for Planning and Consultation (IPaC) resource list, there is one (1) T&E species—the Indiana Bat—that could be potentially impacted in the project vicinity. However, no critical habitat for either species is found at the Delineation Area. Four bat species are listed as state and/or federally threatened or endangered in Ohio. Specifically, tricolored bats (state endangered), northern long-eared bats (state E, federally threatened), Indiana bats (state and federally E) and little brown bats (state E) are listed and protected. Before any tree clearing occurs, correspondence with ODNR and/or USFWS should take place to avoid take of T&E species or their habitat. MAD is also currently awaiting results from the ODNR Natural Heritage Database to confirm whether any additional listed species may be present in the area and will submit the findings as an addendum to this report once a response is received.

JURISDICTIONAL WATERS AND ISOLATED WETLANDS REPORT
Mill Creek Metropark and Adjacent Area
MAHONING COUNTY, OHIO

1 INTRODUCTION

Integral Consulting, Inc. (Integral) hired MAD Scientist Associates, LLC (MAD) to investigate and assess aquatic resources across a ~5-acre area located the northwest of the Material Sciences Corporation building at 460 W. Main St, Canfield, Mahoning County, Ohio (hereafter referred to as the Delineation Area). The Delineation Area is centered approximately on the following coordinates: 41.027837°, -80.777932° (WGS 84). The Delineation Area is located on the Mill Creek Metroparks parcel to the northwest of Material Sciences Corporation (Figures 1 and 2).

A Jurisdictional Waters and Isolated Wetlands Investigation (full wetland delineation) was completed at the Delineation Area. The primary objectives of this study were to identify the boundaries of Jurisdictional Waters (*i.e.*, non-Isolated Wetlands, streams) or Isolated Wetlands and evaluate their quality using methods developed by the Ohio Environmental Protection Agency (Ohio EPA).

1.1 General Site Description

The Delineation Area and its aquatic resources fall within the Middle Meander Creek watershed (12-digit HUC: 050301030702). The Delineation Area slopes from 1119 feet above mean sea level (AMSL) in the southern forested portion to 1112 feet AMSL in the northern emergent portion, before rising back to 1116 feet AMSL in the north along the bike path. The forested portion is dominated by pin oak (*Quercus palustris*). At the time of the Delineation Area visit, there was no understory based on the late fall timing. North of the forest, the Delineation Area opens up into an emergent wetland dominated by invasive species including giant reed (*Phragmites australis*) and reed canarygrass (*Phalaris arundinacea*). Shrub species including red-osier dogwood (*Cornus sericea*) and bush honeysuckle (*Lonicera* spp.) were located along the border between the forest and the wetland in the eastern portion of the Delineation Area. One stream flowing west to east (Sawmill Creek) and a ditch flowing south to north, were observed flowing into and across Wetland A, converging in the eastern edge of the wetland before flowing offsite to the north. All

water flows offsite to the northeast through a culvert with a water control structure. General site photographs are presented in Appendix A.

1.2 Wetland Definition and Authority

The United States Army Corps of Engineers (USACE) uses the following definition of wetlands:

> *Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*

As a result of a 2001 Supreme Court decision (Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers, 531 U.S. 159 [2001]) further defined by a 2023 Supreme Court decision (Sackett et ux. V. Environmental Protection Agency et. al., 598 U.S.___[2023]) , the USACE no longer regulates Isolated Wetlands (those with no discernible surface connection to streams or rivers). In Ohio, this regulatory authority has been assumed by the Ohio EPA through its Isolated Wetlands Permit program.

Because Site conditions suggest that wetlands are present and federal and state regulations control the discharge of fill materials in such areas, the presence and extent of these wetlands has been determined.

2 OBJECTIVES

The primary objectives of this study were to determine the presence and quality of Jurisdictional Waters (non-Isolated Wetlands, streams) and Isolated Wetlands on the Delineation Area, mark their boundaries, and evaluate the habitat quality of each feature.

3 METHODS

This Jurisdictional Waters and Isolated Wetlands study consisted of two phases: (1) a review of the existing general literature via a desktop review and (2) a field investigation to “ground truth” existing data on the presence and extent of Jurisdictional Waters and Isolated Wetlands. Wetlands were identified according to the methods presented in the 1987 USACE Wetlands Delineation Manual (Environmental Laboratory, 1987; henceforth referred to as the 1987 Manual) and the

Northcentral and Northeast Regional Supplement Version 2.0 (USACE, 2012). If a wetland (either isolated or non-isolated) or stream was found, its extent was subsequently determined by defining its boundary. The methods and materials used are described in greater detail in the following sections.

3.1 Literature Review

The following data sources were reviewed and used as supplemental information on the vegetation, soils, hydrology, and land use cover types of the Delineation Area:

- Google Earth Library. 2024. USGS Topographic Maps. Warren, OH quadrangle.
- Google Earth Pro aerial photographs. 2024.
- Ohio Geographically Referenced Information Program (OGRIP). 2012. High Resolution Orthoimagery.
- OGRIP. 2012. LiDAR.
- Ohio Department of Natural Resources (ODNR). 2024. Natural Heritage Database.
- U.S. Department of Agriculture. 2024. Web Soil Survey 3.4.0 Soil Conservation Service, http://websoilsurvey.nrcs.usda.gov/ app/WebSoilSurvey.aspx.
- U.S. Department of Homeland Security. 2023. Flood Insurance Rate Map (FIRM) Panel 39099C0194D (effective as of 11/18/2009). Federal Emergency Management Agency.
- U.S. Fish and Wildlife Service, 2024. National Wetland Inventory (NWI) map layer for the Warren, OH quadrangle. Google Earth Pro.

3.2 Site Investigation for Wetlands

Field work was completed by MAD's Team, comprised of Certified Wetland Delineator, Lindsay Hanna on November 21, 2024. Weather conditions during field work were cold and snowy with 0.21 inches of precipitation throughout the day.

During field activities, the Team examined and evaluated the vegetation, soils, and hydrologic features of the Delineation Area to determine the presence of wetland conditions. Where wetlands were found, their boundaries were delineated. Throughout the Delineation Area, the Team recorded data on the three wetland parameters (vegetation, soils, and hydrology) within representative wetland and adjacent upland sample plots. The classification schemes of Cowardin *et al*. (1979) and Dahl *et al*. (2015) were used to generally describe wetland community types.

3.2.1 Vegetation

Plants that occur in wetlands (hydrophytes) must have specific physiological and morphological adaptations that allow them to germinate and survive under saturated or anaerobic conditions. The ability of plants to withstand the stresses presented by these conditions varies. This has led to the categorization of plants into indicator status groups by the USACE and the United States Fish and Wildlife Service (USFWS). These groupings (obligate, OBL; facultative wetland, FACW; facultative, FAC; facultative upland, FACU; and upland, UPL) reflect the estimated probability of occurrence in wetlands for each species. Table 1 presents the categories and their definitions.

TABLE 1. PLANT INDICATOR STATUS CATEGORIES (Lichvar *et al.*, 2016)

Indicator Category	Indicator Symbol	Definition
Obligate Wetland Plants	OBL	Plants that occur almost always (estimated probability >99%) in wetlands under natural conditions, but which may also occur rarely (estimated probability <1%) in non-wetlands. Examples: *Spartina alterniflora, Taxodium distichum*.
Facultative Wetland	FACW	Plants that occur usually (estimated probability >67% to 99%) in wetlands, but also occur (estimated probability 1% to 33%) in non-wetlands. Examples: *Fraxinus pennsylvanica, Cornus sericea*.
Facultative Plants	FAC	Plants with a similar likelihood (estimated probability 33% to 67%) of occurring in both wetlands and non-wetlands. Examples: *Gleditsia triacanthos, Smilax rotundifolia*.
Facultative Upland	FACU	Plants that occur sometimes (estimated probability 1% to <33%) in wetlands but occur more often (estimated probability >67% to 99%) in non-wetlands. Examples: *Quercus rubra, Potentilla arguta*.
Obligate Upland Plants	UPL	Plants that occur rarely (estimated probability <1%) in wetlands but occur almost always (estimated probability >99%) in non-wetlands under natural conditions. Examples: *Pinus echinata, Bromus mollis*.

In each sample plot, herbaceous species within a 5-foot radius of the plot center, woody shrubs and saplings within a 15-foot radius, and tree and vine species within a 30-foot radius of the plot center were identified and recorded. The indicator status of the dominant species was then used to determine the presence of wetland vegetation. If more than 50% of the dominant species in a sample plot consisted of plants with an indicator status of OBL, FACW, or FAC for the Northcentral and Northeast Region (USACE, 2010), the plot was considered to contain wetland vegetation. If this criterion was not met, alternative metrics defined in the Northcentral and

Northeast Regional Supplement were used to confirm the presence or absence of hydrophytic vegetation.

3.2.2 Soils

For the hydric soils parameter to be satisfied, soils must be saturated, flooded, or ponded for a sufficient portion of the growing season to develop anaerobic conditions in the upper layers of the soil profile (USDA, 2010). The Soil Conservation Service (SCS—now called the Natural Resource Conservation Service, NRCS) and the National Technical Committee for Hydric Soils, have compiled a list of hydric soils of the United States (USDA, 2015). This list identifies the NRCS-mapped soil series that meet hydric soil criteria. However, since upland soils may have hydric soil inclusions, and hydric soils may contain pockets of upland soils, field examination of soils is an important component of the field investigation.

Under saturated, reducing (anaerobic) conditions, hydric soils exhibit characteristics that allow them to be distinguished from drier, upland soils. These include high organic matter content, accumulation of sulfidic material, green- or blue-gray color formation (gleied soils), redoximorphic features (such as mottling, sometimes associated with oxidized root zones), and dark or gray (low value or chroma) soils.

During the Delineation Area investigation, sampling was accomplished by using a spade shovel to observe soils to a depth of at least 30 centimeters. All soils were examined for hydric indicators and data were recorded in the field. Soil colors were identified using a Munsell Soil Color Chart (Kollmorgen, 1992).

3.2.3 Hydrology

Hydrology is the single-most important determinant of the establishment and maintenance of specific types of wetlands and wetland processes (Mitsch and Gosselink, 1993). Although water must be present for wetlands to exist, it need not be present throughout the entire year. Wetland hydrology is considered to be present when an area is inundated either permanently or periodically at mean water depths less than 6.6 feet or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation (Environmental Laboratory, 1987). In Mahoning County, Ohio, the average growing season extends from April through October (USDA-NRCS, 2020).

Indicators of hydrologic conditions that occur in wetlands include, but are not limited to, drainage patterns, drift lines, sediment deposition, watermarks, stream gauge data and flood predictions, historic records, visual observation of saturated soils, and visual observation of inundation (Environmental Laboratory, 1987). These indicators, plus others, such as dry algae on bare soil, water-stained leaves, or oxidized zones along live root channels (forming mottles), were documented at each sampling plot where found.

Where positive indicators of wetland hydrology were observed, it was assumed that wetland hydrology was present for a significant period during the growing season. Table 2 summarizes the hydrologic regimes and associated probability of the presence of wetlands, as presented in the 1987 Manual.

3.2.4 Wetland Delineation

Vegetation, soil, and hydrology were examined at each sample plot, and field data forms were completed to document existing conditions. At locations where all three wetland parameters were satisfied, or under normal circumstances would have been satisfied, a positive wetland determination was made. After evaluating all sample plots, a boundary determination was made where a distinct transition from wetland to upland was observed. Where ambiguous, the boundaries were marked accordingly, using pink flagging tape. This boundary was then extended around areas with similar vegetation, soils, and hydrology indicators to encompass the entire wetland.

If any of the three wetland parameters failed to be satisfied, the area was considered an upland (non-wetland) community, unless it was significantly disturbed. Disturbed areas may lack field indicators of one or more of the wetland parameters, due to recent changes. These can include both wetlands and non-wetlands that have been modified by human activity (*e.g.*, clearing of original vegetation, filling, excavation, or construction), or natural events (*e.g.*, mudslides, fire, and beaver dam construction).

During the investigation, the Team took photographs to document the wetland and sample plot locations, and wetland boundaries were logged and mapped using a hand-held Trimble GeoExplorer 6000XH GPS unit. This unit is capable of sub-foot accuracy, with differential correction (post-processing) for improved accuracy. The precision of GPS data is subject to variation in canopy cover, atmospheric interference, and satellite configuration.

TABLE 2: NON-TIDAL HYDROLOGIC REGIMES AND THEIR ASSOCIATION WITH WETLAND HYDROLOGY

Degree of Inundation or Saturation	Duration of Inundation or Saturation*	Comments
Permanently inundated	100%	Inundation >6.6 ft mean water depth - deepwater wetland present (aquatic habitat)
Semi-permanently to nearly permanently inundated or saturated	>75 - <100%	Inundation defined as ≤ 6.6 ft mean water depth - wetland present
Regularly inundated or saturated	>25 - 75%	Areas with these hydrologic characteristics are usually wetlands
Seasonally inundated or saturated	>12.5 - 25%	Wetlands often present when these hydrologic characteristics exist
Irregularly inundated or saturated	≥ 5 - 12.5%	Many areas having these hydrologic characteristics are not wetlands
Intermittently or never inundated or saturated	<5%	Areas with these hydrologic characteristics are not wetlands

*Refers to duration of inundation and/or soil saturation during the growing season.
SOURCES: Adapted from Clark and Benforado (1981), and Environmental Laboratory (1987).

3.2.5 Wetland Assessment

To document the relative quality of the wetlands at the Delineation Area, the Ohio Rapid Assessment Method (ORAM, version 5.0) for wetlands was used to score the wetland and assign it to a wetland category (Ohio EPA, 2001). This method was developed by the Ohio EPA to evaluate flood/storm water control; water quality improvement; natural biological support; and overall and specific habitat values for Ohio wetlands. The qualitative portion of the ORAM also addresses the statewide scarcity of particular types of wetlands and the potential presence of Threatened or Endangered (T&E) species.

The Ohio EPA ranks wetlands as Category 1, 2, or 3, depending on their relative quality (based on size, habitat value, etc.), with Category 3 representing the highest quality wetlands in Ohio.

4 RESULTS

The literature findings and field observations have confirmed the presence of one (1) wetland within Delineation Area boundaries. These findings are discussed in greater detail in the following sections.

4.1 Literature Findings

Based on literature review, the Delineation Area contains a riverine (RuB) system mapped on the National Wetland Inventory. In addition, a palustrine forested (PFO) wetland is mapped offsite to the west of the Delineation Area (NWI; Figure 3). The wetland portion of the Delineation Area is located within 0.2% Annual Chance Flood Hazard area according to the Federal Emergency Management Agency (FEMA; Appendix B).

The UDSA-NRCS soil survey (Appendix C) indicates that the following soils are located onsite:

- Marengo silty clay loam (Mn)
- Rittman silt loam, 2 to 6 percent slopes (RsC2)

Marengo silty clay loam, which comprises the wetland area onsite, is considered hydric, while Rittman silt loam, which is located along the southern forested edge of the Delineation Area, is not considered hydric.

According to the USFWS Information for Planning and Consultation (IPaC) resource list and ODNR state listings, all counties in Ohio lie within the range of four rare Threatened and Endangered (T&E) bat species: Indiana bat (*Myotis sodalis;* federally and state endangered); northern long-eared bat (*Myotis septentrionalis;* federally threatened, state endangered), tricolored bat (*Perimyotis subflavus;* state endangered), and little brown bat (*Myotis lucifugus;* state endangered). In Ohio, these bats are assumed present wherever suitable habitat occurs unless a presence/absence survey has been performed to document absence. The USFWS also states that if a federal nexus exists for the project (*i.e.*, if federal permits are required to construct at the Site), "no tree clearing should occur on any portion of the project area until consultation under Section 7 of the Endangered Species Act (ESA), between the USFWS and the federal action agency, is completed."

Besides bats, the monarch butterfly (*Danaus plexippus*), a candidate species, is listed in the preliminary IPaC for this Delineation Area. Given their preferred habitat requirements, it is not expected that this species has great potential to be impacted onsite. Additionally, MAD has submitted a request for review from the ODNR Natural Heritage Database to confirm whether any additional listed species may be present in the area and will submit the findings as an addendum

to this report once a response is received. Agency response letters, including recommendations for avoidance and impact minimization, can be viewed in Appendix D.

4.2 Site Findings

A Jurisdictional Waters and Isolated Wetland investigation with field mapping was completed during the Delineation Area visits on November 21, 2024. Field tasks included documentation of general conditions, such as existing plant communities and the locations, sizes, and quality of all wetlands and streams. The findings are summarized in the following sections.

4.2.1 General Observations

The forested portion of the Delineation Area is dominated by pin oak. At the time of the Delineation Area visit, there was no understory based on the late fall timing. North of the forest, the Delineation Area opens up into an emergent wetland dominated by invasive species such as giant reed and reed canarygrass. Shrub species including red-osier dogwood and bush honeysuckle were located along the border between the forest and the wetland in the eastern portion of the Delineation Area. One stream flowing west to east (Sawmill Creek) and a ditch flowing south to north, were observed flowing into and across Wetland A, converging in the eastern edge of the wetland before flowing offsite to the north. All water flows offsite to the northeast through a culvert with a water control structure.

4.2.2 Wetlands

One (1) wetland—Wetland A—was delineated within the Delineation Area (Figure 4). The wetland is summarized in Table 3.

TABLE 3: WETLAND SUMMARY TABLE

Location ID	Size	Isolated/ Non-isolated*	Vegetation Type(s)	Cowardin *et al.* (1979) Classification	ORAM Score	Category**
Wetland A	6.92	Non-isolated	Emergent	PEM	47	2
				Category 2 Total Acreage		*6.92*

*Determination on isolation status, category must be verified by USACE and Ohio EPA, respectively.
**Ohio EPA requires that the higher Category be assigned for "gray zone" scores unless a lower category is substantiated through completion of a more detailed study such as a Vegetation Index of Biotic Integrity (VIBI) assessment.

Based on Delineation Area observations and literature review, Wetland A contains a surface water connection with a Water of the U.S., meaning it is most likely jurisdictional. Sample plot and ORAM data forms for this wetland are provided in Appendices E and F, respectively.

Wetland A Detailed Description

Wetland A totals approximately 6.92 acres onsite, located along the floodplain of Sawmill Creek. The wetland feature predominantly consists of emergent hydrophytic vegetation that is dominated by invasive reed canary grass and giant reed. A shrub buffer of red-osier dogwood is located along the southeastern edge of the wetland, and a few pin oak snags were observed within the wetland. Wetland hydrology indicators for the wetland include oxidized rhizospheres on living roots, saturation visible on aerial imagery, geomorphic position, and passage of the FAC-neutral test. Hydric soil indicators exhibited within Wetland A include a depleted matrix (F3).

Wetland A received an ORAM score of 47 overall, with poor individual metric scores for buffers, habitat development, and vegetation community. Wetland A is situated along the northwestern boundary of the Delineation Area, bordered by residential development to the north, east, and west, with a buffer of forested area to the south. The wetland has a number of hydrology inputs and appears to be largely unimpacted in its hydrology and substrate. However, the wetland is dominated by invasive species and contains moderate wildlife habitat.

4.2.4 Threatened and Endangered Species

The USFWS IPaC list indicates that there are the Indiana Bat was the only T&E species that could be present in the project vicinity. These can be found in the preliminary agency review in Appendix D. The monarch butterfly (*Danaus plexippus*), a candidate species, is also listed in the preliminary IPaC for this Delineation Area. Given the preferred habitat requirements of all three species, it is not expected that they have great potential to be impacted onsite.

Overall, four bat species—tricolored bats (State E), northern long-eared bats (State E and federally T), Indiana bats (State and Federally E) and little brown bats (State E)—are listed and protected in all Ohio counties. Should removal of any potential roost trees be necessary, agency correspondence with ODNR and USFWS should take place. A seasonal tree clearing window may be permissible, which recommends tree removal between October 1 and March 31, when these bats would likely not be present. The USFWS also states that if a federal nexus exists for the project (*i.e.,* if federal

permits are required to construct at the Site), "no tree clearing should occur on any portion of the project area until consultation under Section 7 of the Endangered Species Act (ESA), between the USFWS and the federal action agency, is completed." MAD is also currently awaiting results from the ODNR Natural Heritage Database to confirm whether any additional listed species may be present in the area and will submit the findings as an addendum to this report once a response is received.

5 SUMMARY & CONCLUSIONS

Wetlands: One wetland (Wetland A) was mapped and assessed at the Delineation Area. The total onsite wetland area is approximately 6.92 acres. The wetland was scored per the scoring boundary guidelines presented in the ORAM manual. Wetlands A was categorized as a Category 2 Wetland with an ORAM score of 47. Category 2 wetlands, meanwhile, are defined as those wetlands that "...support moderate wildlife habitat, or hydrological or recreational functions," and as wetlands which are "...dominated by native species but generally without the presence of, or habitat for, rare, T&E species; and wetlands which are degraded but have a reasonable potential for reestablishing lost wetland functions" (Ohio EPA, 2001).

Threatened and Endangered Species: The USFWS indicate that there is one (1) listed T&E species that could be present in the project vicinity, along with the monarch butterfly (a candidate species). These findings can be viewed in Appendix D. In addition, tricolored bats (state E), northern long-eared bats (state E and federally T), Indiana bats (state and federally E) and little brown bats (state E) are listed and protected in all Ohio counties. Before any tree clearing takes place, especially if there is a federal nexus for the Site, correspondence with USFWS should occur to follow recommendations for avoidance of take of T&E species or their habitat. A request for a Delineation Area review has been submitted to the Ohio Natural Heritage Database, but a response has not been received by MAD at the time of writing this report.

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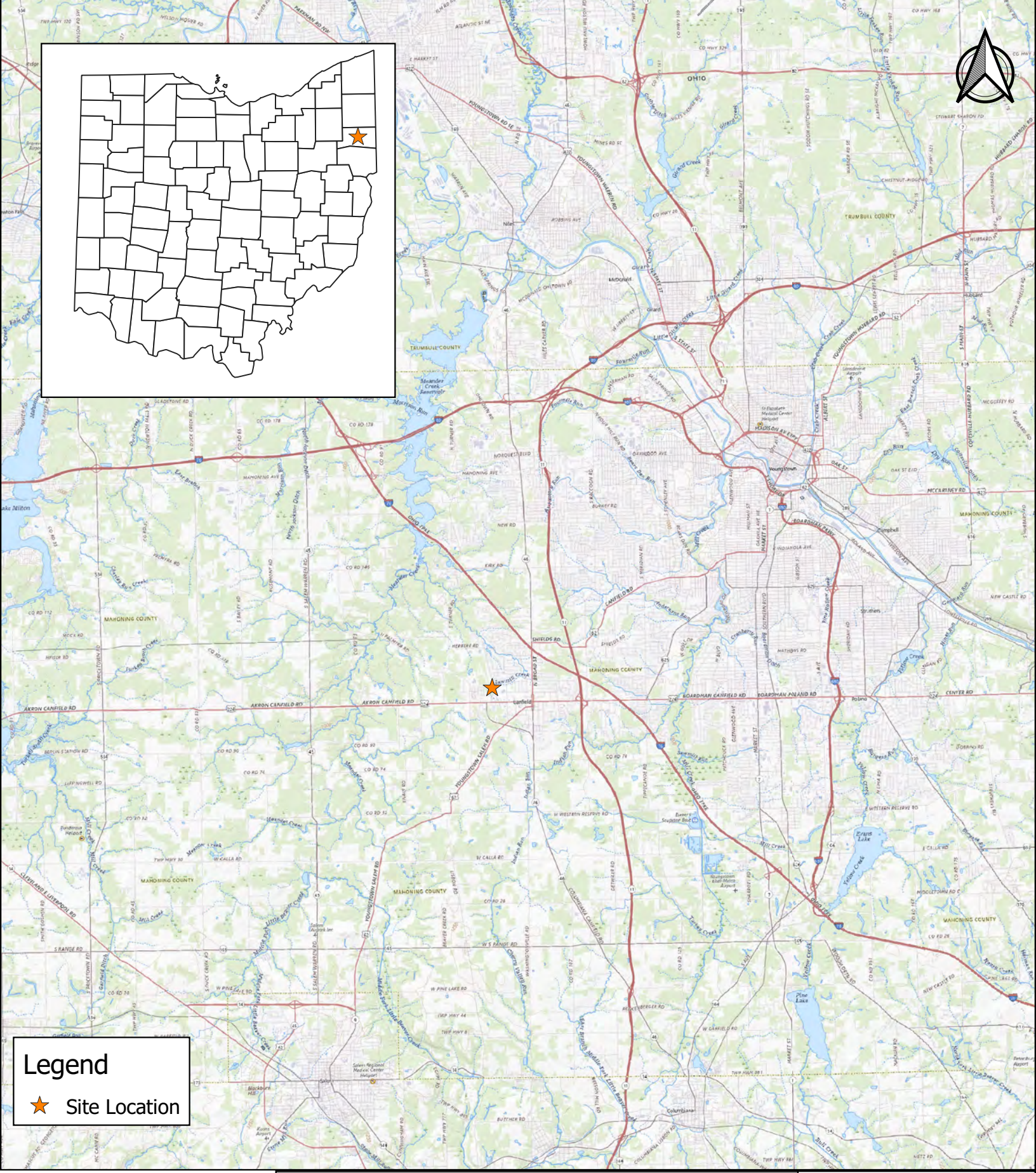
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FIGURES



MAD SCIENTIST ASSOCIATES LLC

Figure 1. Site Location
Integral Consulting, Canfield Site
Canfield, Ohio

Created by: Lindsay Hanna
Date: December 2, 2024

Data Sources: Google Satellite Imagery



MAD SCIENTIST ASSOCIATES LLC

Figure 2. Site Aerial
Integral Consulting, Canfield Site
Canfield, Ohio

250 0 250 500 750 ft

Created by: Lindsay Hanna
Date: December 2, 2024

Data Sources: Google Satellite Imagery



MAD SCIENTIST ASSOCIATES LLC

Figure 3. NWI-Mapped Waters
Integral Consulting, Canfield Site
Canfield, Ohio

250 0 250 500 750 ft

Created by: Lindsay Hanna
Date: December 2, 2024

Data Sources: Google Satellite Imagery
NWI-Mapped Imagery



MAD SCIENTIST ASSOCIATES LLC

Figure 4. Wetland Boundary
Integral Consulting, Canfield Site
Canfield, Ohio

100 0 100 200 300 ft

Created by: Lindsay Hanna
Date: December 2, 2024

Data Sources: Google Satellite Imagery

APPENDIX A

Photographs



MAD SCIENTIST ASSOCIATES LLC

Photo Locations
Integral Consulting, Canfield Site
Canfield, Ohio

50 0 50 100 150 ft

Created by: Lindsay Hanna
Date: December 2, 2024

Data Sources: Google Satellite Imagery



Photograph 1. Soil at sample point TP-1



Photograph 2. North view from TP-1.



Photograph 3. East view from TP-1.



Photograph 4. South view from TP-1.



Photograph 5. West view from TP-1.



Photograph 6. View of TP-1, facing northwest.



Photograph 7. Soil at sample point TP-2.



Photograph 8. Oxidized rhizospheres in lower soil layers at TP-2.



Photograph 9. North view from TP-2.



Photograph 10. East view from TP-2.



Photograph 11. South view from TP-2.



Photograph 12. West view from TP-2.



Photograph 13. Wetland edge on southeast side, facing south downstream.



Photograph 14. Wetland A interior facing northwest from southeast edge.



Photograph 15. Temporary disturbed area for response action within Wetland A.



Photograph 16. Wetland edge west of TP-1 facing northeast.



Photograph 17. Wetland interior facing west from edge.



Photograph 18. North view of Wetland A interior.



Photograph 19. East view of Wetland A interior.



Photograph 20. South view of Wetland A interior.



Photograph 21. West view of Wetland A interior.



Photograph 22. Upland edge of Wetland A, facing south.

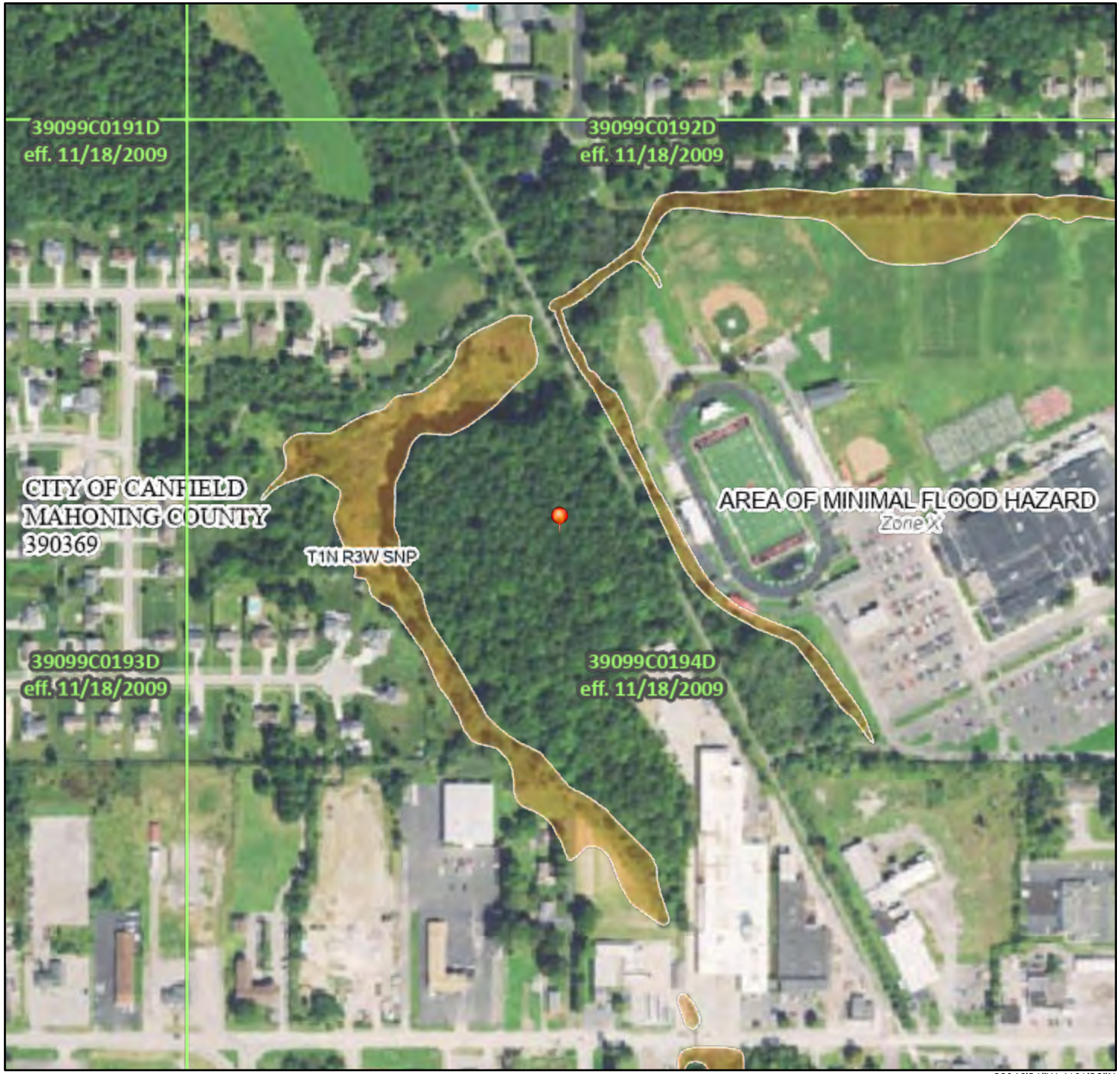
APPENDIX B

FEMA Floodplain Map

National Flood Hazard Layer FIRMette

FEMA

80°46'59"W 41°1'56"N



80°46'21"W 41°1'28"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

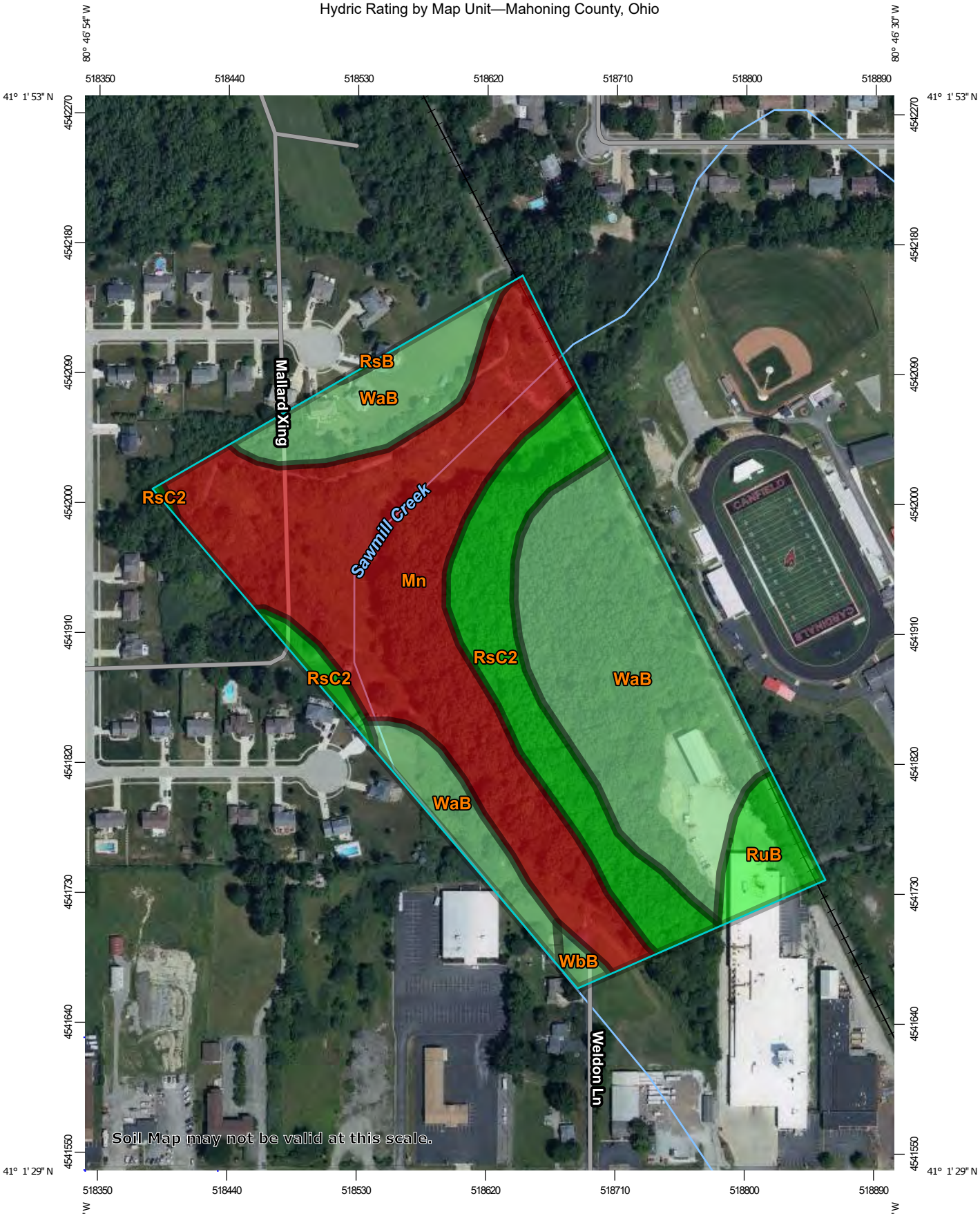
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/3/2024 at 3:22 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX C

Web Soil Survey – Hydric Rating Map


80° 46' 54" W
80° 46' 30" W
518350
518440
518530
518620
518710
518800
518890
41° 1' 53" N
41° 1' 29" N
4542270
4542180
4542090
4542000
4541910
4541820
4541730
4541640
4541550
RsB
WaB
RsC2
Mallard Xing
Sawmill Creek
Mn
RsC2
RsC2
WaB
WaB
RuB
WbB
Weldon Ln
Soil Map may not be valid at this scale.
Map Scale: 1:3,630 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0
50
100
200
300
Feet
0
150
300
600
900
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Hydric (100%)
- Hydric (66 to 99%)
- Hydric (33 to 65%)
- Hydric (1 to 32%)
- Not Hydric (0%)
- Not rated or not available

Soil Rating Lines
- Hydric (100%)
- Hydric (66 to 99%)
- Hydric (33 to 65%)
- Hydric (1 to 32%)
- Not Hydric (0%)
- Not rated or not available

Soil Rating Points
- Hydric (100%)
- Hydric (66 to 99%)
- Hydric (33 to 65%)
- Hydric (1 to 32%)
- Not Hydric (0%)
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Mahoning County, Ohio
Survey Area Data: Version 22, Aug 28, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 4, 2020—Aug 10, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydric Rating by Map Unit

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Mn	Marengo silty clay loam	100	10.7	39.2%
RsB	Rittman silt loam, 2 to 6 percent slopes	0	0.0	0.1%
RsC2	Rittman silt loam, 6 to 12 percent slopes, eroded	0	4.4	16.2%
RuB	Rittman-Urban land complex, 2 to 6 percent slopes	0	1.1	4.1%
WaB	Wadsworth silt loam, 2 to 6 percent slopes	8	10.9	39.7%
WbB	Wadsworth-Urban land complex, 2 to 6 percent slopes	5	0.2	0.7%
Totals for Area of Interest			**27.4**	**100.0%**

Description

This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit.

The thematic map is color coded based on the composition of hydric components. The five color classes are separated as 100 percent hydric components, 66 to 99 percent hydric components, 33 to 65 percent hydric components, 1 to 32 percent hydric components, and less than one percent hydric components.

In Web Soil Survey, the Summary by Map Unit table that is displayed below the map pane contains a column named 'Rating'. In this column the percentage of each map unit that is classified as hydric is displayed.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

Rating Options

Aggregation Method: Percent Present

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

APPENDIX D

State & Federal Agency Correspondence

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

NOT FOR CONSULTATION

Location

Mahoning County, Ohio



Local office

Ohio Ecological Services Field Office

(614) 416-8993
(614) 416-8994

4625 Morse Road, Suite 104

Columbus, OH 43230-8355

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

NOT FOR CONSULTATION

2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Indiana Bat Myotis sodalis Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5949	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

NOT FOR CONSULTATION

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to Bald Eagle Nesting and Sensitivity to Human Activity

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31

NOT FOR CONSULTATION

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

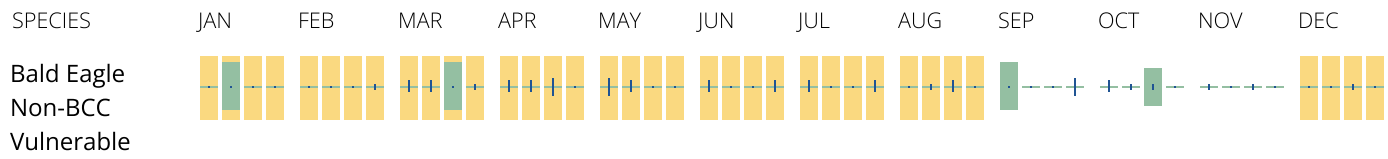
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

NOT FOR CONSULTATION

▪ probability of presence ▪ breeding season | survey effort – no data



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

NOT FOR CONSULTATION

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NOT FOR CONSULTATION

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31
Belted Kingfisher Megaceryle alcyon This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 15 to Jul 25

Blue-winged Warbler Vermivora cyanoptera — Breeds May 1 to Jun 30
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Bobolink Dolichonyx oryzivorus — Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Canada Warbler Cardellina canadensis — Breeds May 20 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Chimney Swift Chaetura pelagica — Breeds Mar 15 to Aug 25
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Eastern Meadowlark Sturnella magna — Breeds Apr 25 to Aug 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Red-headed Woodpecker Melanerpes erythrocephalus — Breeds May 10 to Sep 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Rose-breasted Grosbeak Pheucticus ludovicianus — Breeds May 15 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Wood Thrush Hylocichla mustelina — Breeds May 10 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

NOT FOR CONSULTATION

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

NOT FOR CONSULTATION

▪ probability of presence ▪ breeding season | survey effort – no data



NOT FOR CONSULTATION

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

NOT FOR CONSULTATION

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

NOT FOR CONSULTATION

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER FORESTED/SHRUB WETLAND

PSS1C

RIVERINE

R4SBC

NOT FOR CONSULTATION

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

APPENDIX E

Wetland Delineation Sample Plot Data Forms

Background Information

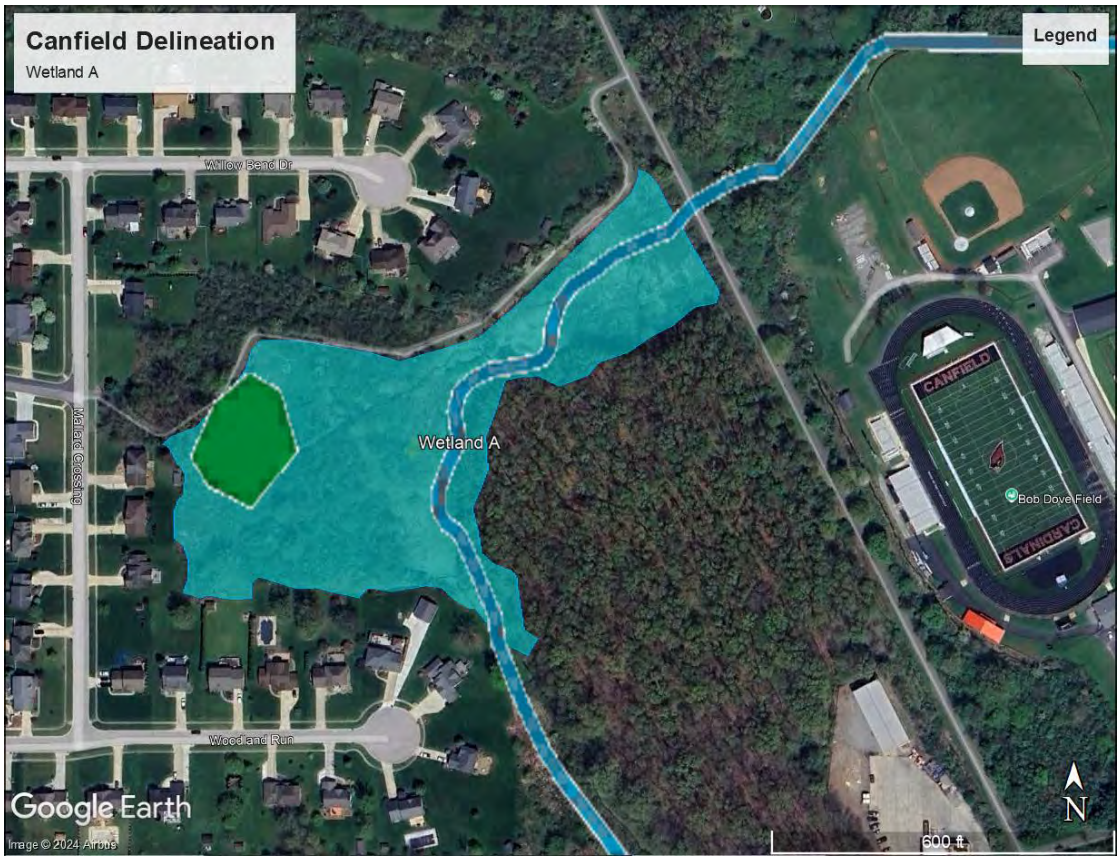
Name: Lindsay Hanna
Date: December 3 2024
Affiliation: MAD Scientist Associates
Address: 253 North State Street, Suite 101 Westerville, Ohio 43081
Phone Number: (614) 818-9156
e-mail address: Lindsay@madscientistassociates.net
Name of Wetland: Wetland A
Vegetation Communit(ies): Emergent
HGM Class(es): Riverine, Depressional
Location of Wetland: include map, address, north arrow, landmarks, distances, roads, etc.



Lat/Long or UTM Coordinate	WGS 84: 41.0259583 -80.7761918
USGS Quad Name	Warren
County	Mahoning
Township	
Section and Subsection	
Hydrologic Unit Code	050301030702
Site Visit	11/21/2024
National Wetland Inventory Map	-------
Ohio Wetland Inventory Map	-------
Soil Survey	Marengo silty clay loam
Delineation report/map	Yes

Name of Wetland:	Wetland A
Wetland Size (acres, hectares):	6.92 acres

Sketch: Include north arrow, relationship with other surface waters, vegetation zones, etc.



Comments, Narrative Discussion, Justification of Category Changes:

Wetland A totals approximately 6.92 acres, located along the floodplain of Sawmill Creek. The wetland feature predominantly consists of emergent hydrophytic vegetation that is dominated by invasive reed canary grass and giant reed. A shrub buffer of red-osier dogwood is located along the southeastern edge of the wetland, and a few pin oak snags were observed within the wetland. Wetland hydrology indicators for the wetland include oxidized rhizospheres on living roots, saturation visible on aerial imagery, geomorphic position, and passage of the FAC-neutral test. Hydric soil indicators exhibited within Wetland A include a depleted matrix (F3).

Final score : 47	**Category:**	2

Scoring Boundary Worksheet

INSTRUCTIONS. The initial step in completing the ORAM is to identify the "scoring boundaries" of the wetland being rated. In many instances this determination will be relatively easy and the scoring boundaries will coincide with the "jurisdictional boundaries." For example, the scoring boundary of an isolated cattail marsh located in the middle of a farm field will likely be the same as that wetland's jurisdictional boundaries. In other instances, however, the scoring boundary will not be as easily determined. Wetlands that are small or isolated from other surface waters often form large contiguous areas or heterogeneous complexes of wetland and upland. In separating wetlands for scoring purposes, the hydrologic regime of the wetland is the main criterion that should be used. Boundaries between contiguous or connected wetlands should be established where the volume, flow, or velocity of water moving through the wetland changes significantly. *Areas with a high degree of hydrologic interaction should be scored as a single wetland*. In determining a wetland's scoring boundaries, use the guidelines in the ORAM Manual Section 5.0. In certain instances, it may be difficult to establish the scoring boundary for the wetland being rated. These problem situations include wetlands that form a patchwork on the landscape, wetlands divided by artificial boundaries like property fences, roads, or railroad embankments, wetlands that are contiguous with streams, lakes, or rivers, and estuarine or coastal wetlands. These situations are discussed below, however, it is recommended that Rater contact Ohio EPA, Division of Surface Water, 401/Wetlands Section if there are additional questions or a need for further clarification of the appropriate scoring boundaries of a particular wetland.

#	Steps in properly establishing scoring boundaries	done?	not applicable
Step 1	Identify the wetland area of interest. This may be the site of a proposed impact, a reference site, conservation site, etc.	✔	
Step 2	Identify the locations where there is physical evidence that hydrology changes rapidly. Such evidence includes both natural and human-induced changes including, constrictions caused by berms or dikes, points where the water velocity changes rapidly at rapids or falls, points where significant inflows occur at the confluence of rivers, or other factors that may restrict hydrologic interaction between the wetlands or parts of a single wetland.	✔	
Step 3	Delineate the boundary of the wetland to be rated such that all areas of interest that are contiguous to and within the areas where the hydrology does not change significantly, i.e. areas that have a high degree of hydrologic interaction are included within the scoring boundary.	✔	
Step 4	Determine if artificial boundaries, such as property lines, state lines, roads, railroad embankments, etc., are present. These should not be used to establish scoring boundaries unless they coincide with areas where the hydrologic regime changes.	✔	
Step 5	In all instances, the Rater may enlarge the minimum scoring boundaries discussed here to score together wetlands that could be scored separately.		✔
Step 6	Consult ORAM Manual Section 5.0 for how to establish scoring boundaries for wetlands that form a patchwork on the landscape, divided by artificial boundaries, contiguous to streams, lakes or rivers, or for dual classifications.		✔

End of Scoring Boundary Determination. Begin Narrative Rating on next page.

Wetland A

Narrative Rating

INSTRUCTIONS. Answer each of the following questions. Questions 1, 2, 3 and 4 should be answered based on information obtained from the site visit or the literature *and* by submitting a Data Services Request to the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Natural Heritage Data Services, 1889 Fountain Square Court, Building F-1, Columbus, Ohio 43224, 614-265-6453 (phone), 614-265-3096 (fax), http://www.dnr.state.oh.us/dnap . The remaining questions are designed to be answered primarily by the results of the site visit. Refer to the User's Manual for descriptions of these wetland types. Note: "Critical habitat" is legally defined in the Endangered Species Act and is the geographic area containing physical or biological features essential to the conservation of a listed species or as an area that may require special management considerations or protection. The Rater should contact the Region 3 Headquarters or the Columbus Ecological Services Office for updates as to whether critical habitat has been designated for other federally listed threatened or endangered species. "Documented" means the wetland is listed in the appropriate State of Ohio database.

#	Question	Circle one	
1	**Critical Habitat.** Is the wetland in a township, section, or subsection of a United States Geological Survey 7.5 minute Quadrangle that has been designated by the U.S. Fish and Wildlife Service as "critical habitat" for any threatened or endangered plant or animal species? Note: as of January 1, 2001, of the federally listed endangered or threatened species which can be found in Ohio, the Indiana Bat has had critical habitat designated (50 CFR 17.95(a)) and the piping plover has had critical habitat proposed (65 FR 41812 July 6, 2000).	YES Wetland should be evaluated for possible Category 3 status Go to Question 2	(NO) Go to Question 2
2	**Threatened or Endangered Species.** Is the wetland known to contain an individual of, or documented occurrences of federal or state-listed threatened or endangered plant or animal species?	YES Wetland is a Category 3 wetland. Go to Question 3	(NO) Go to Question 3
3	**Documented High Quality Wetland.** Is the wetland on record in Natural Heritage Database as a high quality wetland?	YES Wetland is a Category 3 wetland Go to Question 4	(NO) Go to Question 4
4	**Significant Breeding or Concentration Area.** Does the wetland contain documented regionally significant breeding or nonbreeding waterfowl, neotropical songbird, or shorebird concentration areas?	YES Wetland is a Category 3 wetland Go to Question 5	(NO) Go to Question 5
5	**Category 1 Wetlands.** Is the wetland less than 0.5 hectares (1 acre) in size and **hydrologically isolated** and either 1) comprised of vegetation that is dominated (greater than eighty per cent areal cover) by *Phalaris arundinacea, Lythrum salicaria,* or *Phragmites australis*, or 2) an acidic pond created or excavated on mined lands that has little or no vegetation?	YES Wetland is a Category 1 wetland Go to Question 6	(NO) Go to Question 6
6	**Bogs.** Is the wetland a peat-accumulating wetland that 1) has no significant inflows or outflows, 2) supports acidophilic mosses, particularly *Sphagnum* spp., 3) the acidophilic mosses have >30% cover, 4) at least one species from Table 1 is present, and 5) the cover of invasive species (see Table 1) is <25%?	YES Wetland is a Category 3 wetland Go to Question 7	(NO) Go to Question 7
7	**Fens.** Is the wetland a carbon accumulating (peat, muck) wetland that is saturated during most of the year, primarily by a discharge of free flowing, mineral rich, ground water with a circumneutral ph (5.5-9.0) and with one or more plant species listed in Table 1 and the cover of invasive species listed in Table 1 is <25%?	YES Wetland is a Category 3 wetland Go to Question 8a	(NO) Go to Question 8a
8a	**"Old Growth Forest."** Is the wetland a forested wetland and is the forest characterized by, but not limited to, the following characteristics: overstory canopy trees of great age (exceeding at least 50% of a projected maximum attainable age for a species); little or no evidence of human-caused understory disturbance during the past 80 to 100 years; an all-aged structure and multilayered canopies; aggregations of canopy trees interspersed with canopy gaps; and significant numbers of standing dead snags and downed logs?	YES Wetland is a Category 3 wetland. Go to Question 8b	(NO) Go to Question 8b

8b	**Mature forested wetlands**. Is the wetland a forested wetland with 50% or more of the cover of upper forest canopy consisting of deciduous trees with large diameters at breast height (dbh), generally diameters greater than 45cm (17.7in) dbh?	YES Wetland should be evaluated for possible Category 3 status. Go to Question 9a	(NO) Go to Question 9a
9a	**Lake Erie coastal and tributary wetlands**. Is the wetland located at an elevation less than 575 feet on the USGS map, adjacent to this elevation, or along a tributary to Lake Erie that is accessible to fish?	YES Go to Question 9b	(NO) Go to Question 10
9b	Does the wetland's hydrology result from measures designed to prevent erosion and the loss of aquatic plants, i.e. the wetland is partially hydrologically restricted from Lake Erie due to lakeward or landward dikes or other hydrological controls?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 9c
9c	Are Lake Erie water levels the wetland's primary hydrological influence, i.e. the wetland is hydrologically unrestricted (no lakeward or upland border alterations), or the wetland can be characterized as an "estuarine" wetland with lake and river influenced hydrology. These include sandbar deposition wetlands, estuarine wetlands, river mouth wetlands, or those dominated by submersed aquatic vegetation.	YES Go to Question 9d	NO Go to Question 10
9d	Does the wetland have a predominance of native species within its vegetation communities, although non-native or disturbance tolerant native species can also be present?	YES Wetland is a Category 3 wetland Go to Question 10	NO Go to Question 9e
9e	Does the wetland have a predominance of non-native or disturbance tolerant native plant species within its vegetation communities?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 10
10	**Lake Plain Sand Prairies (Oak Openings)** Is the wetland located in Lucas, Fulton, Henry, or Wood Counties and can the wetland be characterized by the following description: the wetland has a sandy substrate with interspersed organic matter, a water table often within several inches of the surface, and often with a dominance of the gramineous vegetation listed in Table 1 (woody species may also be present). The Ohio Department of Natural Resources Division of Natural Areas and Preserves can provide assistance in confirming this type of wetland and its quality.	YES Wetland is a Category 3 wetland. Go to Question 11	(NO) Go to Question 11
11	**Relict Wet Prairies**. Is the wetland a relict wet prairie community dominated by some or all of the species in Table 1. Extensive prairies were formerly located in the Darby Plains (Madison and Union Counties), Sandusky Plains (Wyandot, Crawford, and Marion Counties), northwest Ohio (e.g. Erie, Huron, Lucas, Wood Counties), and portions of western Ohio Counties (e.g. Darke, Mercer, Miami, Montgomery, Van Wert etc.).	YES Wetland should be evaluated for possible Category 3 status Complete Quantitative Rating	(NO) Complete Quantitative Rating

Table 1. Characteristic plant species.

invasive/exotic spp	fen species	bog species	0ak Opening species	wet prairie species
Lythrum salicaria	*Zygadenus elegans var. glaucus*	*Calla palustris*	*Carex cryptolepis*	*Calamagrostis canadensis*
Myriophyllum spicatum	*Cacalia plantaginea*	*Carex atlantica var. capillacea*	*Carex lasiocarpa*	*Calamogrostis stricta*
Najas minor	*Carex flava*	*Carex echinata*	*Carex stricta*	*Carex atherodes*
Phalaris arundinacea	*Carex sterilis*	*Carex oligosperma*	*Cladium mariscoides*	*Carex buxbaumii*
Phragmites australis	*Carex stricta*	*Carex trisperma*	*Calamagrostis stricta*	*Carex pellita*
Potamogeton crispus	*Deschampsia caespitosa*	*Chamaedaphne calyculata*	*Calamagrostis canadensis*	*Carex sartwellii*
Ranunculus ficaria	*Eleocharis rostellata*	*Decodon verticillatus*	*Quercus palustris*	*Gentiana andrewsii*
Rhamnus frangula	*Eriophorum viridicarinatum*	*Eriophorum virginicum*		*Helianthus grosseserratus*
Typha angustifolia	*Gentianopsis spp.*	*Larix laricina*		*Liatris spicata*
Typha xglauca	*Lobelia kalmii*	*Nemopanthus mucronatus*		*Lysimachia quadriflora*
	Parnassia glauca	*Schechzeria palustris*		*Lythrum alatum*
	Potentilla fruticosa	*Sphagnum spp.*		*Pycnanthemum virginianum*
	Rhamnus alnifolia	*Vaccinium macrocarpon*		*Silphium terebinthinaceum*
	Rhynchospora capillacea	*Vaccinium corymbosum*		*Sorghastrum nutans*
	Salix candida	*Vaccinium oxycoccos*		*Spartina pectinata*
	Salix myricoides	*Woodwardia virginica*		*Solidago riddellii*
	Salix serissima	*Xyris difformis*		
	Solidago ohioensis			
	Tofieldia glutinosa			
	Triglochin maritimum			
	Triglochin palustre			

End of Narrative Rating. Begin Quantitative Rating on next page.

Site: Canfield Wetland A	**Rater(s):** LH	**Date:** December 3 2024

Metric 1. Wetland Area (size).

3	3
max 6 pts.	subtotal

Select one size class and assign score.

Wetland A

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [x] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [ ] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [ ] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

7	10
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [x] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [x] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [ ] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [x] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

22	32
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [x] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [x] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- [ ] 100 year floodplain (1)
- [x] Between stream/lake and other human use (1)
- [ ] Part of wetland/upland (e.g. forest), complex (1)
- [x] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

- [x] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [ ] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

- [x] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3)
- [ ] Seasonally inundated (2)
- [ ] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- [ ] None or none apparent (12)
- [x] Recovered (7)
- [ ] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [x] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [x] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

13	45
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

- [ ] None or none apparent (4)
- [x] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [x] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.

- [ ] None or none apparent (9)
- [x] Recovered (6)
- [ ] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [x] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

45
subtotal this page

last revised 1 February 2001 jjm

Site: Canfield Wetland A	**Rater(s):** LH	**Date:** December 3 2024

45
subtotal first page

Metric 5. Special Wetlands.

Wetland A

0 max 10 pts. | 45 subtotal

Check all that apply and score as indicated.

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

Metric 6. Plant communities, interspersion, microtopography.

2 max 20 pts. | 47 subtotal

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [1] Emergent
- [0] Shrub
- [0] Forest
- [ ] Mudflats
- [ ] Open water
- [ ] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high(4)
- [✔] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

- [✔] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

- [1] Vegetated hummucks/tussucks
- [1] Coarse woody debris >15cm (6in)
- [1] Standing dead >25cm (10in) dbh
- [0] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

47

End of Quantitative Rating. Complete Categorization Worksheets.

Wetland A

ORAM Summary Worksheet

		circle answer or insert score	Result
Narrative Rating	Question 1 Critical Habitat	YES (NO)	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES (NO)	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES (NO)	If yes, Category 3.
	Question 4. Significant bird habitat	YES (NO)	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES (NO)	If yes, Category 1.
	Question 6. Bogs	YES (NO)	If yes, Category 3.
	Question 7. Fens	YES (NO)	If yes, Category 3.
	Question 8a. Old Growth Forest	YES (NO)	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES (NO)	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES (NO)	If yes, Category 3
	Question 11. Relict Wet Prairies	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	3	
	Metric 2. Buffers and surrounding land use	7	
	Metric 3. Hydrology	22	
	Metric 4. Habitat	13	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	2	
	TOTAL SCORE	47	Category based on score breakpoints 2

Complete Wetland Categorization Worksheet.

Wetland A **Wetland Categorization Worksheet**

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	(NO)	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	(NO)	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	(NO)	Is quantitative rating score *greater* than the Category 2 scoring threshold *(including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	(YES) Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	(NO)	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	(NO) Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category

Choose one	Category 1	(Category 2)	Category 3

End of Ohio Rapid Assessment Method for Wetlands.


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Attachment E

Letters to and from USFWS and ODNR, Responding to Queries about Threatened and Endangered Species

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

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Location

Mahoning County, Ohio



Local office

Ohio Ecological Services Field Office

(614) 416-8993
(614) 416-8994

4625 Morse Road, Suite 104
Columbus, OH 43230-8355

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Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office

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of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Indiana Bat Myotis sodalis Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5949	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

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Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider

implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to Bald Eagle Nesting and Sensitivity to Human Activity

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31

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Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey

effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

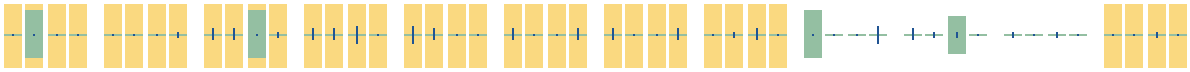
No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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Bald Eagle
Non-BCC
Vulnerable



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

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Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

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NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31
Belted Kingfisher *Megaceryle alcyon* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 15 to Jul 25

Blue-winged Warbler Vermivora cyanoptera This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds May 1 to Jun 30
Bobolink Dolichonyx oryzivorus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
Canada Warbler Cardellina canadensis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Chimney Swift Chaetura pelagica This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Eastern Meadowlark Sturnella magna This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Apr 25 to Aug 31
Red-headed Woodpecker Melanerpes erythrocephalus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rose-breasted Grosbeak Pheucticus ludovicianus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds May 15 to Jul 31
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

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Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (▪)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are

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based on all years of available data, since data in these areas is currently much more sparse.



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Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds

are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);

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2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation

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measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

RIVERINE

R4SBC

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A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

Ohio Department of Natural Resources
Divisions of Wildlife and Natural Areas & Preserves
Ohio Natural Heritage Program
2045 Morse Road Bldg. G-3 • Columbus, OH 43229-6693
Email: NHDRequest@dnr.ohio.gov • Voicemail: 614-265-6818

Ohio Natural Heritage Data Request

DNR 5203 (R0824)

Ohio Natural Heritage Database (ONHD) stand-alone data requests are processed for projects that meet one of these criteria:

- Academic research projects
- Other non-development or non-construction projects

Search results include records for state and federal listed plants and animals, high-quality plant communities, geologic features, and breeding animal concentrations.

If your project meets none of these criteria and you are requesting ONHD data for ORAM verification, please fill out and sign this form and submit it for ODNR Environmental Review as instructed at ohiodnr.gov/environmentalreview

Data within the project site will automatically be searched. Data within an additional 1-mile radius of the project site may be provided upon request. Because the ONHD contains sensitive information, it is our policy to provide only the data needed to complete your specific project.

Results are listed in a letter format and include a shapefile/map. Data requests will be completed within approximately 30 days. There is currently no charge to process requests.

INSTRUCTIONS

- Please complete all fields on this form.
- Submit a map detailing your project site boundaries. Please include at least one digital map (shapefile, .kmz, or .gdb) or allow extra time for processing.
- If you have questions, please visit ohiodnr.gov/onhd before submitting your request.
- Sign this form (required) and email with other attachments to NHDRequest@dnr.ohio.gov.

DATE:	12/13/2024	COMPANY NAME:	Integral Consulting Inc.
NAME OF PERSON RESPONSE LETTER SHOULD BE ADDRESSED TO:	Cristal Reagh		
STREET ADDRESS:	1903 7th Street		
CITY:	Berkeley	STATE: CA	ZIP: 94710
PHONE:	7075086105	E-MAIL ADDRESS:	creagh@integral-corp.com
PROJECT NAME:	C4272 Canfield Ohio Level I and II Report		
SITE ADDRESS:	460 West Main Street, Canfield, Ohio		
SITE COUNTY:	Mahoning	CITY/VILLAGE/TOWNSHIP:	Canfield
SITE LATITUDE:	41.025958384688074	SITE LONGITUDE:	-80.77619185992408

BRIEF DESCRIPTION OF WORK TO BE PERFORMED AT THE PROJECT SITE:

– Review environmental history and other publicly available data (e.g., state habitat monitoring, water quality)
– Conduct a site investigation
– Identify and delineate potential wetlands
– Evaluate quality of any wetlands identified during the site inspection
– Establish GIS project
– Prepare Level I report in accordance with OEPA (2018) including an Ecological Scoping Checklist and an

HOW DO YOU WANT YOUR DATA REPORTED? ***CHOOSE ONE:***

◯ **DIGITAL SHAPEFILE** ☐ **PDF MAP**

Both formats provide the same data. If you request a digital shapefile, we will send you a letter with a list of species/features found and a shapefile of record locations and details. The PDF Map is only recommended for those who cannot use digital map data. With the PDF option we will send you a letter with a list of species/features found and a map showing their location. It may take longer to fill your request if you choose the PDF Map.

The standard data we search includes state and federal listed plants and animals, high-quality plant communities, geologic features, and breeding animal concentrations within 1 mile of your project area boundaries (as specified on the map/shapefile you attach to this request). We provide a list of the above species and features found within 1 mile of your project area and may provide specific locations for these and other features that occur within or adjacent to your project area.

PLEASE LIST ANY INFORMATION *IN ADDITION TO THIS* THAT YOU REQUIRE:

A list of species and other resources such as critical habitat that are known or suspected to be on or near the project area. Thank you so much!

HOW WILL THIS INFORMATION BE USED?

This information will be used in accordance with the Ohio Environmental Protection Agency's Ecological Risk Assessment Guidance Document to complete a Level I and Level II Ecological Risk Assessment.

The chief of the Division of Wildlife has determined that the release of the ONHD data you have requested could be detrimental to the conservation of a species or unique natural feature. Pursuant to section 1531.04 of the Ohio Revised Code, this information is not subject to section 149.43 of the Revised Code. By signing below, you certify that the data provided will not be disclosed, published, or distributed beyond the scope of your project.

SIGNATURE: Cristal Reagh **DATE:** 12/13/2024

Integral Consulting Inc.
8742 E. Washington St.
Suite 115
Chagrin Falls, OH 44022

telephone: 303.404.2944
www.integral-corp.com

May 9, 2025

Project No. C4274

Office of Real Estate & Land Management
Ohio Department of Natural Resources
2045 Morse Road, E-2
Columbus, OH 43229
environmentalreviewrequest@dnr.ohio.gov

Submitted via email

Subject: **MSC Site, Canfield, Mahoning County, Ohio Environmental Review Request**

To Whom It May Concern:

Per your email request, Integral Consulting Inc. (Integral) is submitting this request for an environmental review of the Site located at and adjacent to 460 W. Main St, Canfield, Mahoning County, Ohio (approximately centered on 41.027837°, -80.777932° in WGS 84). The Site boundaries are provided in the attached shapefile. The subject area includes an on-site area (including Material Sciences Corporation parcel and portions of the Mill Creek Metroparks parcel) and an off-site area (including additional parcels along Sawmill Creek). This request includes both Material Sciences Corporation (MSC) parcel and wetland and portions of Sawmill Creek in order to consolidate requests for the environmental review. The on-site MSC parcel and wetland habitat includes approximately 4.9 acres of developed/industrial areas, 6.0 acres of upland forest, 1.6 acres of wetland, and 0.5 acres of a ditch.

The environmental review will be used to support the wetland delineation, ORAM form completion, and ecological risk assessment associated with the spill and response activities at the site.[1] Investigation and remedial actions led by August Mack (on behalf of Material Sciences Corporation) will be conducted in close coordination with Ohio EPA under the RCRA program.

This letter constitutes Integral's fulfillment of required information to complete ODNR's environmental review request. If there is additional information that would prove helpful, please do not hesitate to reach out.

[1] https://www.mscresponse.com/

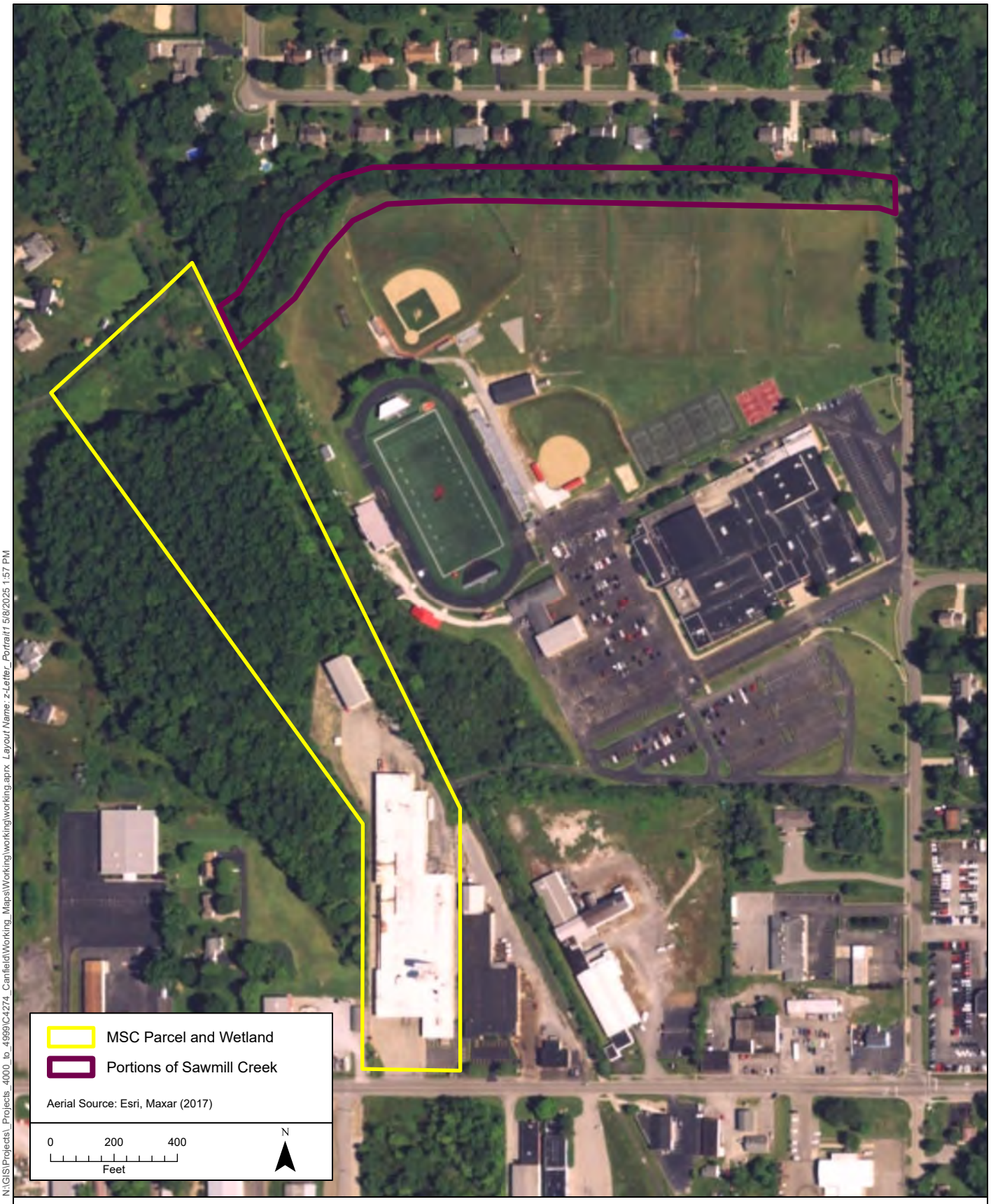
Thank you for your consideration of our request. We look forward to hearing from you.

Sincerely,

Cristal Reagh

Cristal Reagh
Scientist

Enclosure: Shapefile



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integral consulting inc.

Figure 1.
Site Boundaries
Material Science Corporation
Canfield OH

Outlook

Confirmation Receipt for ODNR Environmental Review Request Submission

From EnvironmentalReviewRequest@dnr.ohio.gov <EnvironmentalReviewRequest@dnr.ohio.gov>
Date Fri 5/9/2025 1:14 PM
To Cristal Reagh <creagh@integral-corp.com>

[CAUTION: External email. Think before you click links or open attachments.]

Thank you for contacting the Ohio Department of Natural Resources. This email is your receipt that we have received your message and/or project review request.
We aim to provide a completed Environmental Review comment letter within 45-60 calendar days, however, during periods of high volume or other extenuating circumstances, it may be longer. If you have any questions please contact Mike.Pettegrew@dnr.ohio.gov

Level I Ecological Risk Assessment

Sawmill Creek, Canfield, Ohio

Prepared for
August Mack Environmental
7830 North Central Drive, Suite B
Lewis Center, OH 43035

Prepared by

Integral Consulting Inc.
8742 E. Washington, #115
Chagrin Falls, OH 44022

May 2025

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Figure 4. Ecological Habitats within Assessment Area

ACRONYMS AND ABBREVIATIONS

August Mack	August Mack Environmental
EPA	U.S. Environmental Protection Agency
Integral	Integral Consulting Inc.
MSC	Material Sciences Corporation
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

1 INTRODUCTION

Integral Consulting Inc. (Integral) has prepared this Level I ecological risk assessment on behalf of August Mack Environmental (August Mack) for a portion of Sawmill Creek in Canfield, Ohio (Figures 1 and 2).

Material Sciences Corporation (MSC) operates a metal plating facility, at 460 West Main St., which specializes in electro galvanizing, chemical coating, and painting. In July 2024, an incident occurred at the facility that prompted additional investigation and interim remediation of chemicals within the MSC parcel and along Adjacent Ditch.[1] This Level I ecological risk assessment has been conducted to support the investigation and remediation efforts that may be necessary downstream of the MSC facility in Sawmill Creek. For the purposes of this Level I ecological risk assessment, the term "site" refers to the MSC parcel and the term "assessment area" refers to the portion of Sawmill Creek (including its riparian floodplain) from the Mill Creek Metroparks bikeway to Cardinal Drive (Figure 3). This risk assessment complements the MSC parcel and adjacent wetland Level I ecological risk assessment (Integral 2025).

A Level I ecological risk assessment is a scoping level assessment that is used to evaluate whether significant ecological resources are present (or could be present) in the assessment area and whether site releases of chemicals have occurred. This report follows the Ohio Environmental Protection Agency (Ohio EPA) guidance and report outline (Ohio EPA 2018).

[1] https://www.mscresponse.com/

2 EXISTING DATA SUMMARY

In accordance with Ohio EPA guidance (Ohio EPA 2018), this assessment was based on existing data, including the August Mack Initial Site Investigation Report (August Mack 2024), photos of the assessment area, aerial imagery, and a site visit, which included a habitat evaluation.

2.1 ASSESSMENT AREA LOCATION

The assessment area is located in Mahoning County, Canfield, Ohio (centered at 41.03069444, –80.7745944) from the Mill Creek Metroparks Bikeway to Cardinal Drive (Figure 3). Sawmill Creek is bordered to the north by residential properties and to the south by the Cardinal High School athletic fields. The 3.6-acre assessment area includes approximately 1 acre of forested habitat, 2.5 acres of residential yards, 0.1 acres of scrub-shrub habitat, and <0.1 acres of stream habitat (Figure 4).

2.2 SITE HISTORY

The MSC Canfield facility building was constructed in 1950 for the Life Time Products Corporation, Coated Steel Division (Ohio EPA and MSC 2024). Manufacturing operations included surface coating, machining, spray painting, and metal fabricating (Ohio EPA and MSC 2024). In the 1950s or 1960s, the facility became known as Canfield Steel, which was purchased by Pittsburgh Steel Corporation in 1968 to form the Pittsburgh-Canfield Corporation. The facility was acquired in 2013 by New Star Metals, a predecessor to MSC.[2] The facility is still operational.

2.3 ASSESSMENT AREA LAND AND WATER USES

The assessment area includes Sawmill Creek and the riparian floodplain. The terrestrial portion of the assessment area includes undeveloped forested habitat and residential lawns and borders the high school baseball and soccer fields.

Sawmill Creek enters the assessment area through a culvert under the bikeway and joins an unnamed ditch that runs along the eastern side of the bikeway on school property. The creek flows to the east until it enters a culvert under Cardinal Drive.

There are three footbridges across the creek that allow access between the residential neighborhood and the high school.

[2] The facility also previously operated as the Canfield Coating Company.

MSC does not expect changes to land or water uses in Sawmill Creek or the adjacent floodplain.

2.4 KNOWN OR SUSPECTED HAZARDOUS SUBSTANCE RELEASES

In 2024, MSC and state and local agencies responded to a report of a release of process fluids into Adjacent Ditch. MSC, the Ohio EPA, and the Cardinal Joint Fire Department collected and contained the fluid as part of an emergency response. However, during the emergency response, the responders observed conditions that indicated some fluid had leaked from the facility over a period of several years and required additional emergency response actions. The initial investigation conducted as part of the emergency response indicated that some chemicals from the site may have migrated into Adjacent Ditch and the wetland before entering the assessment area.

2.5 CHEMICALS OF INTEREST

In 2024, August Mack conducted soil[3] and surface water sampling to investigate the nature and extent of chemicals present in the downstream portion of Sawmill Creek. Sample-specific results are presented in Attachment A and in the Initial Site Investigation Report (August Mack 2024). Surface water and soil data from August Mack (2024) indicated the following:[4]

- Primary chemicals of concern in the assessment area were cyanide, zinc, hexavalent chromium, and trichloroethene.
- Chemicals that exceeded the U.S. Environmental Protection Agency (EPA) residential regional screening levels (RSLs) for soil were cyanide, zinc, hexavalent chromium, benz[*a*]anthracene, benzo[*a*]pyrene, benzo[*b*]fluoranthene, dibenz[*a,h*]anthracene, and indeno[1,2,3-*cd*]pyrene.
- Benzo[*b*]fluoranthene exceeded the Ohio River Basin Human Health Tier I Criteria for non-drinking water.
- Arsenic in the downstream portion of Sawmill Creek exceeded the residential and industrial RSLs for soil but has not historically been used at the site.

2.6 THREATENED AND ENDANGERED SPECIES

Integral requested information from the U.S. Fish and Wildlife Service (USFWS) and Ohio Department of Natural Resources (ODNR) on the presence and distribution of threatened

[3] The initial sampling classified all solids samples as soil. However, for the purposes of the ecological risk assessment, solids within the Sawmill Creek area are considered to be sediment.
[4] These data were not compared to ecological toxicity benchmarks in August Mack (2024).

and/or endangered species in the assessment area. The information obtained from this request is included in Attachment B.[5]

Based on the information received, the assessment area is located within the range of four federally listed species: tricolored bat (*Perimyotis subflavus*, state endangered), northern long-eared bat (*Myotis septentrionalis*, federally threatened and state endangered), Indiana bat (*M. sodalis*, federally and state endangered), and little brown bat (*M. lucifugus*, state endangered). USFWS has previously stated that Indiana bats are assumed to be present in Ohio during the summer wherever suitable habitat occurs unless a presence/absence survey has been performed to document their absence (USFWS 2007).

In addition to the four bat species, the monarch butterfly (*Danaus plexippus*) is a candidate federally listed species that may be present in the area.

[5] The ODNR environmental review has not been received at the time of this report.

3 SITE VISIT SUMMARY

Integral and August Mack conducted a site visit on April 2, 2025. Integral identified type and extent of habitat, species present in the assessment area or in the vicinity, and/or signs of ecological use. A photo log is included as Attachment C, and the ecological scoping checklist is provided in Attachment D.

3.1 ECOLOGICAL AND HABITAT FEATURES

Terrestrial wooded habitat makes up 1 acre (27 percent) of the assessment area. This deciduous forested habitat is dominated by oaks (*Quercus* spp.), hickories (*Carya* spp.), and maples (*Acer* spp.). The mature trees have a typical diameter at breast height of 6–8 in. Squirrels and deer signs (game paths, prints) were noted in the forested area. Birds seen or heard during the site visit included northern cardinal, American robin, and mallard.

Residential yards are present in 2.5 acres (68 percent) of the assessment area. In some portions of the assessment area, mowed lawns extend to the edge of the creek bank, while in others there are limited areas of juvenile and mature trees and shrubs. Along the high school, there are pine trees planted in a row next to the baseball field. A few small burrows were observed along the southern bank of the creek.

The Sawmill Creek channel is less than 0.1 acres (approximately 1,750 linear feet) and makes up 2 percent of the assessment area. The creek ranges in width from 1 to 4 ft and is generally shallow, ranging from 6 to 12 in. depth throughout the assessment area. Large boulders and concrete debris are scattered around the upstream culvert. There is a moderate degree of embeddedness in the substrate of the creek, which is dominated by cobble at the western extent of the assessment area and by silt and muck at the eastern extent of the assessment area. Debris was observed throughout the assessment area.

The stream banks show substantial signs of erosion with undercutting and incision. Along the western portion of the assessment area, the banks range from 1 to 7 ft higher in elevation than the creek channel. In this area, there are a number of mature trees with exposed roots due to the bank undercutting. Towards the eastern extent of the assessment area, the banks are lower in elevation.

Approximately 175 ft upstream of Cardinal Drive, there was a debris pile that appeared to be a remnant beaver dam.

Vegetation conditions observed in the assessment area were characteristic of the spring season. Because the site visit occurred in early April, many understory trees and emergent vegetation had not yet leafed out.

3.2 ECOLOGICALLY IMPORTANT SPECIES/HABITATS

No rare, threatened, or endangered species were observed during the site visit.

3.3 EXPOSURE PATHWAYS

Ecological stressors may potentially be present in floodplain soil, surface water, and sediment throughout Sawmill Creek assessment area. The evaluation of potential harm is provided in Attachment E.

4 RECOMMENDATIONS

Based upon the known release of hazardous substances that were detected in Adjacent Ditch and the wetland area, Integral recommends a Level II ecological risk assessment to screen for potential risk to ecological receptors.

5 REFERENCES

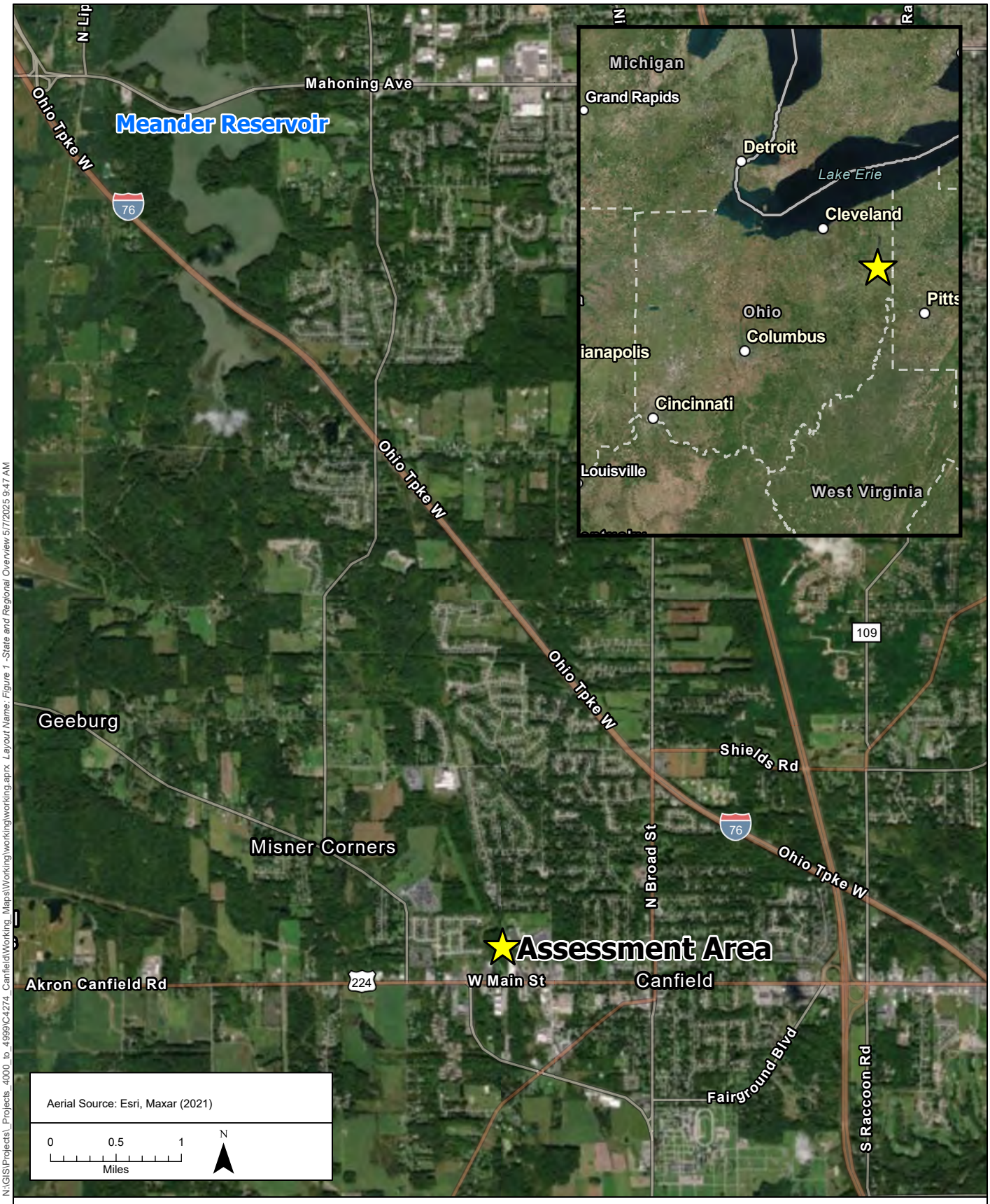
August Mack. 2024. Initial site investigation report. Material Sciences Corporation. August Mack Environmental. December 12.

Ohio EPA. 2018. Ecological risk assessment guidance document. Ohio Environmental Protection Agency, Division of Environmental Response and Revitalization Assessment, Remediation and Corrective Action Section. July.

Ohio EPA and MSC. 2024. Directors final findings and orders in the matter of Material Sciences Corporation. Ohio Environmental Protection Agency and Material Sciences Corporation. December 31.

USFWS. 2007. Biological opinion on the Ohio Department of Transportation's Statewide Transportation Program for the federally listed endangered Indiana bat (*Myotis sodalis*). Submitted to the Federal Highway Administration. U.S. Fish and Wildlife Service. January 26.

FIGURES



integral consulting inc.

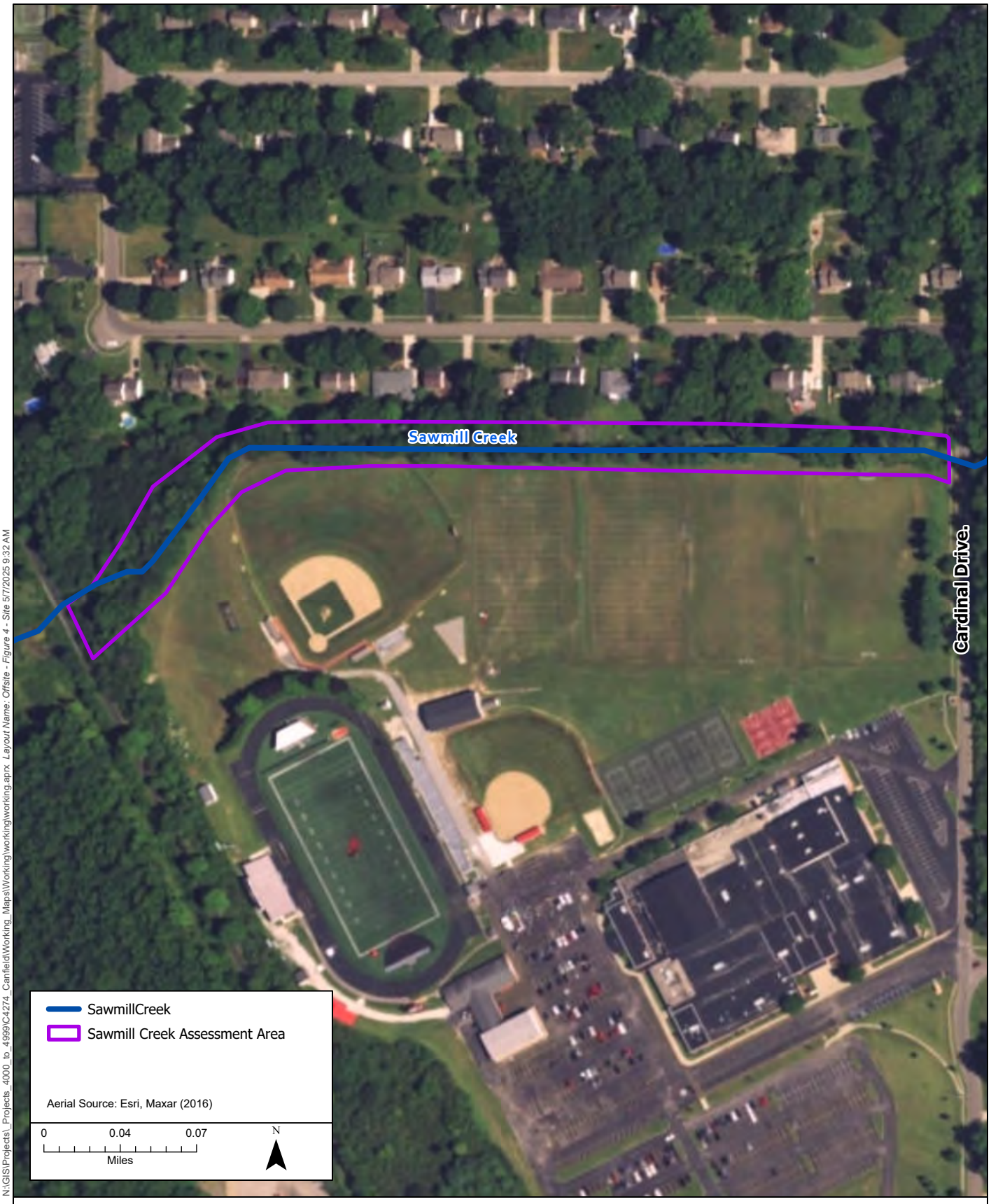
Figure 1. Regional Map of Assessment Area
Canfield, Ohio



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integral consulting inc.

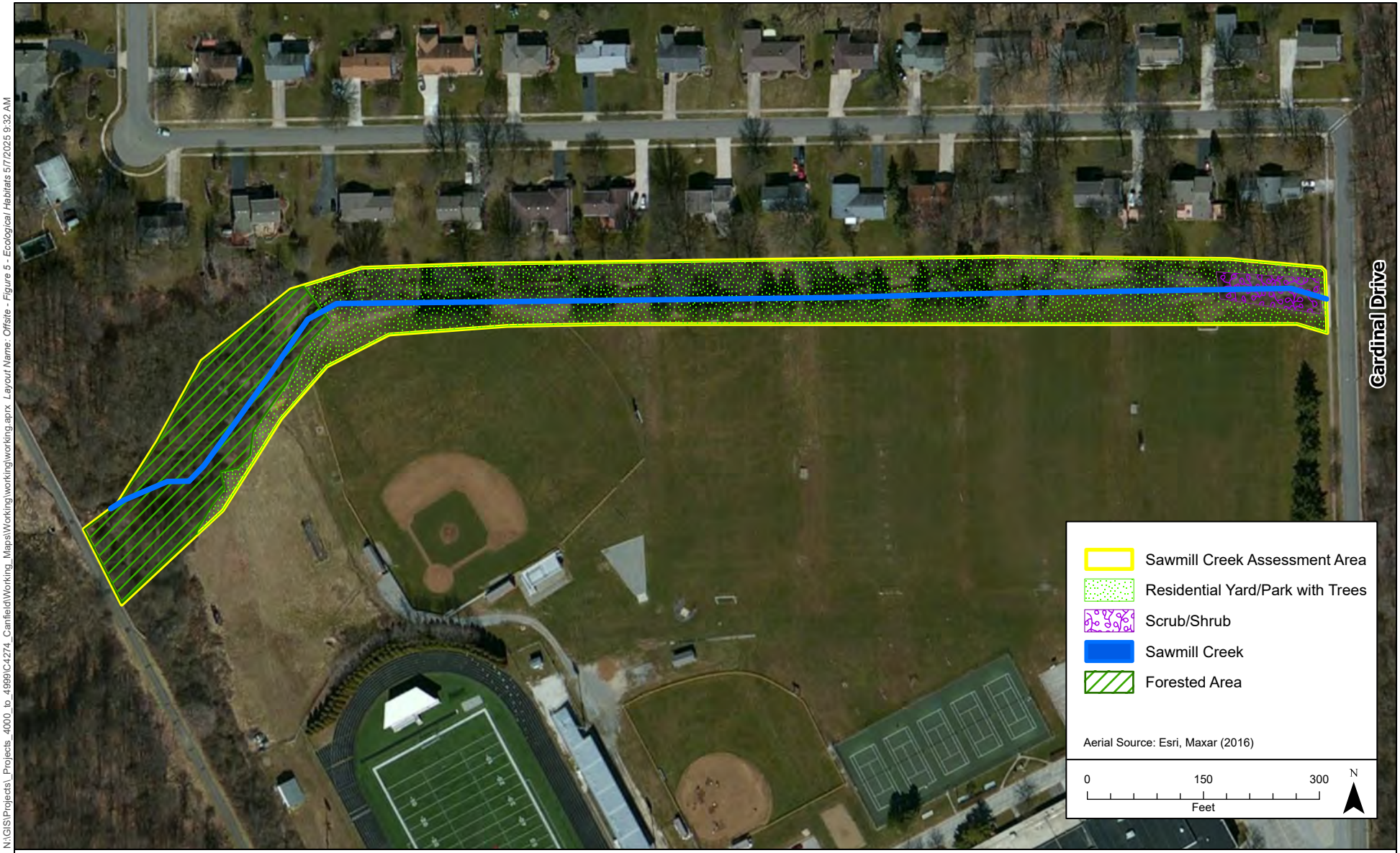
Figure 2. Local Map of Assessment Area and Adjacent Properties
Canfield, Ohio



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integral consulting inc.

Figure 3. Assessment Area Features
Sawmill Creek
Canfield, Ohio



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integral consulting inc.

Figure 4. Ecological Habitats within Assessment Area
Sawmill Creek
Canfield, Ohio

Attachment A

Extent of Hazardous Substances in the Assessment Area

Transect 100	North Bank		South Bank	
Depth (feet):	0.0-0.5		0.0-0.5	2.0-2.5
Sample Date:	10/25/2024		10/25/2024	10/28/2024
Parameters				
BaA	1.5	*	0.740	<0.052
BaP	1.9	*	0.910	* <0.052
BbF	2.9	*	1.3	* <0.052
DBA	0.310	*	0.140	* <0.052
IP	1.2	*	0.590	<0.052
As	13.0	*	11.0	* 14.0 *
Cr IV	<0.180		0.220	<0.520
Zn	1,200		1,000	55.0
Total CN	7.7	*	130	* 0.660

Transect 375	North Bank		Center		South Bank	
Depth (feet):	0.0-0.5		0.0-0.5		0.0-0.5	2.0-2.5
Sample Date:	10/25/2024		10/25/2024		10/25/2024	10/25/2024
Parameters						
BaA	0.570		0.210		0.300	<0.020
BaP	0.730	*	0.270	*	0.430	* 0.021
BbF	1.1	*	0.450		0.720	0.035
DBA	0.140	*	0.064		0.120	* <0.020
IP	0.560		0.230		0.370	0.016
As	9.9	*	12.0	*	12.0	* 5.3 *
Cr IV	<0.170		<0.200		<0.260	<0.180
Zn	740		2,400	*	4,800	* 140
Total CN	57.6	*	190	*	270	* 40.0 *

Transect 625	North Bank		South Bank	
Depth (feet):	0.0-0.5		0.0-0.5	2.0-2.5
Sample Date:	10/24/2024		10/24/2024	10/24/2024
Parameters				
BaA	0.039		0.320	0.024
BaP	0.050		0.330	* 0.026
BbF	0.078		0.530	0.044
DBA	<0.021		0.060	<0.015
IP	0.036		0.230	0.020
As	1 16.0	*	9.8	* 13.0 *
Cr IV	<0.190		<0.150	<0.170
Zn	130		1,300	140
Total CN	11.0	*	21.0	* 26.0 *

Transect 875	North Bank			Center		South Bank	
Depth (feet):	0.0-0.5		2.0-2.5	1.0-1.5		0.0-0.5	1.5-2.0
Sample Date:	10/21/2024		10/24/2024	10/24/2024		10/23/2024	10/23/2024
Parameters							
BaA	<0.020		<0.020	<0.019		0.550	0.024
BaP	<0.018		<0.018	<0.018		0.740 *	0.020
BbF	<0.016		<0.016	0.016		1.2 *	0.041
DBA	<0.020		<0.020	<0.019		0.110 *	<0.019
IP	<0.016		<0.016	<0.015		0.400	0.017
As	13.0	*	11.0 *	14.0	*	11.0 *	19.0 *
Cr IV	<0.180		<0.180	<0.170		<0.210	<0.170
Zn	160		68.0	120		1,300	53.0
Total CN	24.0	*	1.1	1.3		160 *	8.2 *

Transect 1125	North Bank		South Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/21/2024	10/21/2024	10/21/2024	10/21/2024
Parameters				
BaA	0.650	0.022	0.590	0.026
BaP	0.910 *	0.021	0.800 *	0.034
BbF	1.6 *	0.041	1.5 *	0.050
DBA	0.130 *	<0.019	0.140 *	<0.019
IP	0.520	<0.015	0.600	0.021
As	13.0 *	16.0 *	13.0 *	11.0 *
Cr IV	<0.250	<0.180	<0.210	<0.170
Zn	1,300	90.0	1,900	73.0
Total CN	<42.0	230 *	49.0 *	240 *

Transect 1375	North Bank		South Bank/DUP-2	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/22/2024	10/23/2024	10/22/2024	10/22/2024
Parameters				
BaA	0.550	0.069	0.020	<0.019
BaP	0.810 *	0.094	0.024	<0.018
BbF	1.3 *	0.140	0.046	<0.016
DBA	0.140 *	<0.019	<0.020	<0.019
IP	0.590	0.057	0.022	<0.016
As	14.0 *	17.0 *	14.0 *	11.0 *
Cr IV	<0.260	<0.170	<0.150	<0.170
Zn	3,700 *	77.0	150	72.0
Total CN	350 *	5.9 *	21.0 *	1.8

Transect 1625	North Bank			Center		South Bank / DUP-3	
Depth (feet):	0.0-0.5		2.0-2.5	2.0-2.5		0.0-0.5	2.0-2.5
Sample Date:	10/23/2024		10/23/2024	10/23/2024		10/23/2024	10/23/2024
Parameters							
BaA	0.210		<0.020	<0.020		0.390	0.029
BaP	0.280		<0.018	<0.018		0.550 *	0.038
BbF	0.520		<0.016	<0.016		1.0	0.069
DBA	0.061		<0.020	<0.020		0.087	0.020
IP	0.240		<0.016	<0.016		0.420	0.027
As	9.9	*	50.0 *	7.5	*	12.0 *	8.6 *
Cr IV	<0.240		<0.180	<0.190		<0.180	<0.170
Zn	2,300	*	58.0	58.0		1,200	84.0
Total CN	220	*	3.9 *	150	*	37.0 *	1.2

U.S. EPA 2024 RSLs	RESIDENT SOIL RSLs (1)
Semi-Volatile Organic Compounds (sVOCs)	
Benzo(a)anthracene (BaA)	7.1
Benzo(a)pyrene (BaP)	0.11
Benzo(b)fluoranthene (BbF)	1.1
Dibenz(a,h)anthracene (DBA)	0.11
Indeno(1,2,3-cd)pyrene (IP)	1.1
All Other Analyzed sVOCs	Varies
Metals	
Arsenic (As)	0.68
Chromium (Hexavalent) (CrVI)	0.3
Zinc (Zn)	2,300
All Other Analyzed Metals	Varies
Cyanide	
Free Cyanide (CN)	NE
Total Cyanide (CN)	2.3

Abbreviations & Notes:
BRL = Below Laboratory Reporting Limits
RSLs = Regional Screening Levels
U.S. EPA = United States Environmental Protection Agency
All results and U.S. EPA Screening Levels are reported in milligrams per kilogram (mg/kg).
U.S. EPA RSLs are based on the Regional Screening Levels Generic Tables April 2024 Update.
RSLs are based on a 1E-6 target cancer risk and a 0.1 target hazard quotient (THQ)
The following denote the color of screening level exceedances:
* = At or Above U.S. EPA 2024 Resident Soil RSLs

Transect 0	North Bank		South Bank/ DUP-7	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/28/2024	10/28/2024	10/28/2024	10/28/2024
Parameters				
BaA	0.100	<0.053	<0.019	<0.048
BaP	0.130 *	<0.053	<0.049	<0.048
BbF	0.210	<0.053	<0.049	<0.048
DBA	0.033	<0.053	<0.049	<0.048
IP	0.095	<0.053	<0.049	<0.048
As	17.0 *	11.0 *	18.0 *	28.0 *
Cr IV	<0.610	0.910 *	1.8 *	<0.450
Zn	2,100	68.0	100	65.0
Total CN	230 *	1.1	49.0 *	1.6

Transect 250	North Bank / DUP-6		South Bank	
Depth (feet):	0.0-0.5	1.0-1.5	0.0-0.5	
Sample Date:	10/25/2024	10/25/2024	10/25/2024	
Parameters				
BaA	2.0 *	0.027	0.410	
BaP	2.8 *	0.034	0.460 *	
BbF	3.8 *	0.057	0.620	
DBA	0.400 *	<0.018	0.081	
IP	1.7 *	0.025	0.310	
As	13.0 *	15.0 *	12.0 *	
Cr IV	<0.240	<0.170	<0.150	
Zn	4,100 *	86.0	230	
Total CN	170 *	31.0 *	33.0 *	

Transect 500	North Bank		South Bank / DUP-5	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/24/2024	10/25/2024	10/24/2024	10/25/2024
Parameters				
BaA	0.062	<0.020	0.130	<0.020
BaP	0.072	<0.018	0.150 *	<0.018
BbF	0.100	<0.016	0.210	<0.016
DBA	<0.020	<0.020	0.030	<0.020
IP	0.053	<0.016	0.088	<0.016
As	11.0 *	8.0 *	15.0 *	15.0 *
Cr IV	<0.180	<0.150	<0.150	<0.150
Zn	260	61.0	680	60.0
Total CN	31.0 *	<0.720	57.0 *	<0.750

Transect 750	North Bank / DUP-4		South Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/24/2024	10/24/2024	10/24/2021	10/24/2024
Parameters				
BaA	1.5 *	<0.019	0.400	0.025
BaP	1.4 *	<0.018	0.460 *	0.028
BbF	2.0 *	<0.015	0.740	0.045
DBA	0.210 *	<0.019	0.084	<0.018
IP	0.880	<0.015	0.320	0.019
As	12.0 *	7.7 *	12.0 *	16.0 *
Cr IV	0.470 *	<0.170	<0.200	<0.170
Zn	220	74.0	470	80.0
Total CN	72.0 *	0.730	110 *	4.9 *

Transect 1000	North Bank		Center		South Bank / DUP-1	
Depth (feet):	0.0-0.5		2.0-2.5		0.0-0.5	2.0-2.5
Sample Date:	10/21/2024		10/21/2024		10/21/2024	10/21/2024
Parameters						
BaA	0.033		1.4 *	0.024	0.900	0.092
BaP	0.045		1.7 *	0.032	1.3 *	0.120 *
BbF	0.061		2.4 *	0.060	2.1 *	0.180
DBA	<0.020		0.280 *	<0.019	0.190 *	0.027
IP	0.028		1.1 *	0.020	0.780	0.070
As	13.0 *		27.0 *	12.0 *	10.0 *	11.0 *
Cr IV	<0.190		<0.170	<0.150	<0.150	<0.220
Zn	71.0		730	63.0	500	86.0
TotalCN	9.2 *		250 *	29.0 *	89.0 *	93.0 *

Transect 1250	North Bank		South Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/22/2024	10/22/2024	10/21/2024	10/22/2024
Parameters				
BaA	0.510	<0.019	0.690	0.170
BaP	0.620 *	<0.017	0.920 *	0.230 *
BbF	1.2 *	<0.015	1.6 *	0.310
DBA	0.100	<0.019	0.150 *	0.045
IP	0.510	<0.015	0.630	0.130
As	11.0 *	9.5 *	11.0 *	12.0 *
Cr IV	<0.210	<0.150	1.7 *	<0.150
Zn	1,400	71.0	4,300 *	130
Total CN	220 *	29.0 *	<47.0	43.0 *

Transect 1500	North Bank		South Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/22/2024	10/22/2024	10/22/2024	10/22/2024
Parameters				
BaA	0.980	<0.018	<0.018	<0.019
BaP	1.1 *	<0.017	<0.017	<0.018
BbF	1.6 *	0.020	<0.014	<0.015
DBA	0.160 *	<0.018	<0.018	<0.019
IP	0.680	<0.014	<0.014	<0.015
As	8.7 *	13.0 *	11.0 *	13.0 *
Cr IV	<0.200	<0.170	<0.170	<0.170
Zn	1,100	66.0	80.0	61.0
Total CN	120 *	3.2 *	7.0 *	<0.530

Transect 1750	North Bank		South Bank	
Depth (feet):	0.0-0.5		0.0-0.5	
Sample Date:	10/23/2024		10/23/2024	
Parameters				
BaA	0.850		0.420	
BaP	1.2 *		0.530 *	
BbF	1.8 *		0.790	
DBA	0.190 *		0.096	
IP	0.850		0.350	
As	11.0 *		7.3 *	
Cr IV	0.460 *		0.490 *	
Zn	230		220	
Total CN	15.0 *		2.2	

Transect 1820	North Bank		Center		South Bank	
Depth (feet):	0.0-0.5		1.0-1.5		0.0-0.5	2.0-2.5
Sample Date:	10/23/2024		10/23/2024		10/23/2024	10/23/2024
Parameters						
BaA	4.9 *		0.610		0.570	0.190
BaP	5.5 *		0.530 *		0.710 *	0.170 *
BbF	7.7 *		0.740		1.0	0.250
DBA	0.930 *		0.077		0.100	0.036
IP	3.3		0.280		0.420	0.050
As	7.8 *		16.0 *		16.0 *	12.0 *
Cr IV	<0.220		<0.170		<0.170	<0.170
Zn	160		92.0		150	61.0
Total CN	11.0 *		1.5		1.4	<0.560

S Briarcliff Dr

Cardinal Dr

T2-0 T2-100 T2-250 T2-375 T2-500 T2-625 T2-750 T2-875 T2-1000 T2-1125 T2-1250 T2-1375 T2-1500 T2-1625 T2-1750 T2-1820

Subject Property
Sawmill Creek
Soil Sample

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation - Canfield

Sawmill Creek -
Soil Analytical Results Map

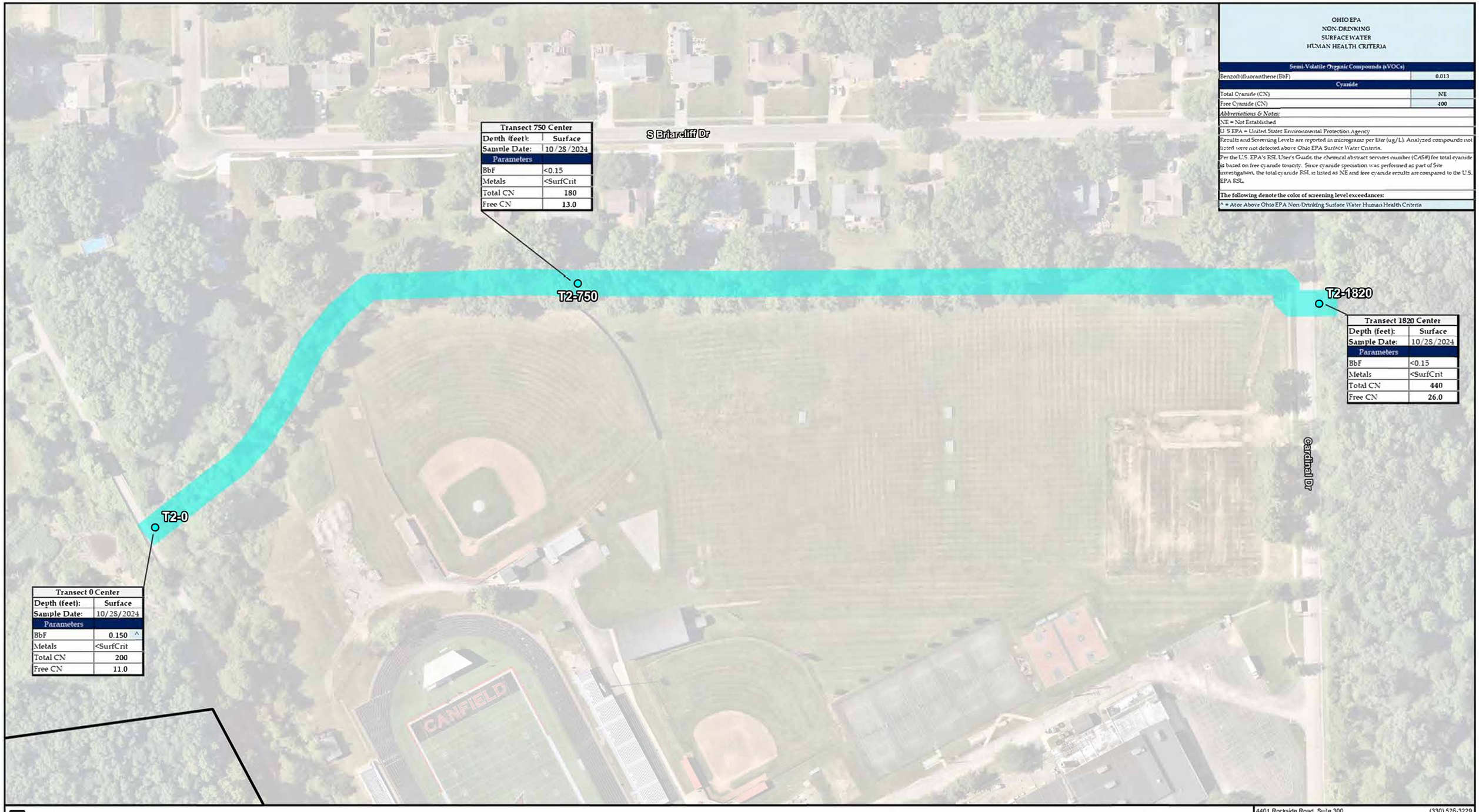
460 West Main Street
Canfield, Ohio 44406

N

0 75 150 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372
DATE: 12/12/2024
FIGURE: 7
SCALE: 1:1,500
CREATED BY: CC



Transect 750 Center	
Depth (feet):	Surface
Sample Date:	10/28/2024
Parameters	
BbF	<0.15
Metals	<SurfCrit
Total CN	180
Free CN	13.0

Transect 1820 Center	
Depth (feet):	Surface
Sample Date:	10/28/2024
Parameters	
BbF	<0.15
Metals	<SurfCrit
Total CN	440
Free CN	26.0

Transect 0 Center	
Depth (feet):	Surface
Sample Date:	10/28/2024
Parameters	
BbF	0.150 ^
Metals	<SurfCrit
Total CN	200
Free CN	11.0

OHIO EPA NON-DRINKING SURFACE WATER HUMAN HEALTH CRITERIA

Semi-Volatile Organic Compounds (sVOCs)	
Benzo(b)fluoranthene (BbF)	0.013
Cyanide	
Total Cyanide (CN)	NE
Free Cyanide (CN)	400

Abbreviations & Notes:

NE = Not Established

U S EPA = United States Environmental Protection Agency

Results and Screening Levels are reported in micrograms per liter (ug/L). Analyzed compounds not listed were not detected above Ohio EPA Surface Water Criteria.

Per the U.S. EPA's RSL User's Guide, the chemical abstract services number (CAS#) for total cyanide is based on free cyanide toxicity. Since cyanide speciation was performed as part of Site investigation, the total cyanide RSL is listed as NE and free cyanide results are compared to the U.S. EPA RSL.

The following denote the color of screening level exceedances:

^ = Ator Above Ohio EPA Non-Drinking Surface Water Human Health Criteria

Subject Property

Sawmill Creek

Neannap Aerial Imagery: June 15, 2024

Material Sciences Corporation - Canfield

Sawmill Creek - Surface Water Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 75 150 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372	DATE: 12/12/2024
	SCALE: 1:1,500
FIGURE: 10	CREATED BY: CC

Attachment B

Letters to and from USFWS and ODNR, Responding to Queries about Threatened and Endangered Species

IPaC

U.S. Fish & Wildlife Service

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

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Location

Mahoning County, Ohio



Local office

Ohio Ecological Services Field Office

(614) 416-8993
(614) 416-8994

4625 Morse Road, Suite 104
Columbus, OH 43230-8355

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Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Indiana Bat Myotis sodalis Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5949	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

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Bald & Golden Eagles

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their nests, should follow appropriate regulations and implement required avoidance and minimization measures, as described in the various links on this page.

The data in this location indicates that no eagles have been observed in this area. This does

not mean eagles are not present in your project area, especially if the area is difficult to survey. Please review the 'Steps to Take When No Results Are Returned' section of the Supplemental Information on Migratory Birds and Eagles document to determine if your project is in a poorly surveyed area. If it is, you may need to rely on other resources to determine if eagles may be present (e.g. your local FWS field office, state surveys, your own surveys).

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Bald and Golden Eagle information is not available at this time

Bald & Golden Eagles FAQs

What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are an eagle (Bald and Golden Eagle Protection Act requirements may apply).

Proper interpretation and use of your eagle report

On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort line or no data line (red horizontal) means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide you in knowing when to implement avoidance and minimization measures to eliminate or reduce potential impacts from your project activities or get the appropriate permits should presence be confirmed.

How do I know if eagles are breeding, wintering, or migrating in my area?

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To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If an eagle on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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Migratory birds

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the

Department of Interior U.S. Fish and Wildlife Service (FWS). The incidental take of migratory birds is the injury or death of birds that results from, but is not the purpose, of an activity. The FWS interprets the MBTA to prohibit incidental take.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Migratory bird information is not available at this time

Migratory Bird FAQs

Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Avoidance & Minimization Measures for Birds describes measures that can help avoid and minimize impacts to all birds at any location year-round. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is one of the most effective ways to minimize impacts. To see when birds are most likely to occur and breed in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location, such as those listed under the Endangered Species Act or the Bald and Golden Eagle Protection Act and those species marked as “Vulnerable”. See the FAQ “What are the levels of concern for migratory birds?” for more information on the levels of concern covered in the IPaC migratory bird species list.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) with which your project intersects. These species have been identified as warranting special attention because they are BCC species in that area, an eagle (Bald and Golden Eagle Protection Act requirements

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may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, and to verify survey effort when no results present, please visit the Rapid Avian Information Locator (RAIL) Tool.

Why are subspecies showing up on my list?

Subspecies profiles are included on the list of species present in your project area because observations in the AKN for **the species** are being detected. If the species are present, that means that the subspecies may also be present. If a subspecies shows up on your list, you may need to rely on other resources to determine if that subspecies may be present (e.g. your local FWS field office, state surveys, your own surveys).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Bald and Golden Eagle Protection Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to avoid and minimize impacts to all birds, efforts should be made, in particular, to

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avoid and minimize impacts to the birds on this list, especially BCC species. For more information on avoidance and minimization measures you can implement to help avoid and minimize migratory bird impacts, please see the FAQ “Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds”.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Proper interpretation and use of your migratory bird report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list does not represent all birds present in your project area. It is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide implementation of avoidance and minimization measures to eliminate or reduce potential impacts from your project activities, should presence be confirmed. To learn more about avoidance and minimization measures, visit the FAQ "Tell me about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:

The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

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The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under

Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

RIVERINE
R4SBC

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

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Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe

wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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Ohio Department of Natural Resources
Divisions of Wildlife and Natural Areas & Preserves
Ohio Natural Heritage Program
2045 Morse Road Bldg. G-3 • Columbus, OH 43229-6693
Email: NHDRequest@dnr.ohio.gov • Voicemail: 614-265-6818

Ohio Natural Heritage Data Request

DNR 5203 (R0824)

Ohio Natural Heritage Database (ONHD) stand-alone data requests are processed for projects that meet one of these criteria:

- Academic research projects
- Other non-development or non-construction projects

Search results include records for state and federal listed plants and animals, high-quality plant communities, geologic features, and breeding animal concentrations.

If your project meets none of these criteria and you are requesting ONHD data for ORAM verification, please fill out and sign this form and submit it for ODNR Environmental Review as instructed at ohiodnr.gov/environmentalreview

Data within the project site will automatically be searched. Data within an additional 1-mile radius of the project site may be provided upon request. Because the ONHD contains sensitive information, it is our policy to provide only the data needed to complete your specific project.

Results are listed in a letter format and include a shapefile/map. Data requests will be completed within approximately 30 days. There is currently no charge to process requests.

INSTRUCTIONS

- Please complete all fields on this form.
- Submit a map detailing your project site boundaries. Please include at least one digital map (shapefile, .kmz, or .gdb) or allow extra time for processing.
- If you have questions, please visit ohiodnr.gov/onhd before submitting your request.
- Sign this form (required) and email with other attachments to NHDRequest@dnr.ohio.gov.

DATE:	12/13/2024	COMPANY NAME:	Integral Consulting Inc.
NAME OF PERSON RESPONSE LETTER SHOULD BE ADDRESSED TO:	Cristal Reagh		
STREET ADDRESS:	1903 7th Street		
CITY:	Berkeley	STATE: CA	ZIP: 94710
PHONE:	7075086105	E-MAIL ADDRESS:	creagh@integral-corp.com
PROJECT NAME:	C4272 Canfield Ohio Level I and II Report		
SITE ADDRESS:	460 West Main Street, Canfield, Ohio		
SITE COUNTY:	Mahoning	CITY/VILLAGE/TOWNSHIP:	Canfield
SITE LATITUDE:	41.025958384688074	SITE LONGITUDE:	-80.77619185992408

BRIEF DESCRIPTION OF WORK TO BE PERFORMED AT THE PROJECT SITE:

– Review environmental history and other publicly available data (e.g., state habitat monitoring, water quality)
– Conduct a site investigation
– Identify and delineate potential wetlands
– Evaluate quality of any wetlands identified during the site inspection
– Establish GIS project
– Prepare Level I report in accordance with OEPA (2018) including an Ecological Scoping Checklist and an

HOW DO YOU WANT YOUR DATA REPORTED? ***CHOOSE ONE:***

◯ **DIGITAL SHAPEFILE** ☐ **PDF MAP**

Both formats provide the same data. If you request a digital shapefile, we will send you a letter with a list of species/features found and a shapefile of record locations and details. The PDF Map is only recommended for those who cannot use digital map data. With the PDF option we will send you a letter with a list of species/features found and a map showing their location. It may take longer to fill your request if you choose the PDF Map.

The standard data we search includes state and federal listed plants and animals, high-quality plant communities, geologic features, and breeding animal concentrations within 1 mile of your project area boundaries (as specified on the map/shapefile you attach to this request). We provide a list of the above species and features found within 1 mile of your project area and may provide specific locations for these and other features that occur within or adjacent to your project area.

PLEASE LIST ANY INFORMATION *IN ADDITION TO THIS* THAT YOU REQUIRE:

A list of species and other resources such as critical habitat that are known or suspected to be on or near the project area. Thank you so much!

HOW WILL THIS INFORMATION BE USED?

This information will be used in accordance with the Ohio Environmental Protection Agency's Ecological Risk Assessment Guidance Document to complete a Level I and Level II Ecological Risk Assessment.

The chief of the Division of Wildlife has determined that the release of the ONHD data you have requested could be detrimental to the conservation of a species or unique natural feature. Pursuant to section 1531.04 of the Ohio Revised Code, this information is not subject to section 149.43 of the Revised Code. By signing below, you certify that the data provided will not be disclosed, published, or distributed beyond the scope of your project.

SIGNATURE: Cristal Reagh **DATE:** 12/13/2024

Integral Consulting Inc.
8742 E. Washington St.
Suite 115
Chagrin Falls, OH 44022

telephone: 303.404.2944
www.integral-corp.com

May 9, 2025

Project No. C4274

Office of Real Estate & Land Management
Ohio Department of Natural Resources
2045 Morse Road, E-2
Columbus, OH 43229
environmentalreviewrequest@dnr.ohio.gov

Submitted via email

Subject: **MSC Site, Canfield, Mahoning County, Ohio Environmental Review Request**

To Whom It May Concern:

Per your email request, Integral Consulting Inc. (Integral) is submitting this request for an environmental review of the Site located at and adjacent to 460 W. Main St, Canfield, Mahoning County, Ohio (approximately centered on 41.027837°, -80.777932° in WGS 84). The Site boundaries are provided in the attached shapefile. The subject area includes an on-site area (including Material Sciences Corporation parcel and portions of the Mill Creek Metroparks parcel) and an off-site area (including additional parcels along Sawmill Creek). This request includes both Material Sciences Corporation (MSC) parcel and wetland and portions of Sawmill Creek in order to consolidate requests for the environmental review. The on-site MSC parcel and wetland habitat includes approximately 4.9 acres of developed/industrial areas, 6.0 acres of upland forest, 1.6 acres of wetland, and 0.5 acres of a ditch.

The environmental review will be used to support the wetland delineation, ORAM form completion, and ecological risk assessment associated with the spill and response activities at the site.[1] Investigation and remedial actions led by August Mack (on behalf of Material Sciences Corporation) will be conducted in close coordination with Ohio EPA under the RCRA program.

This letter constitutes Integral's fulfillment of required information to complete ODNR's environmental review request. If there is additional information that would prove helpful, please do not hesitate to reach out.

[1] https://www.mscresponse.com/

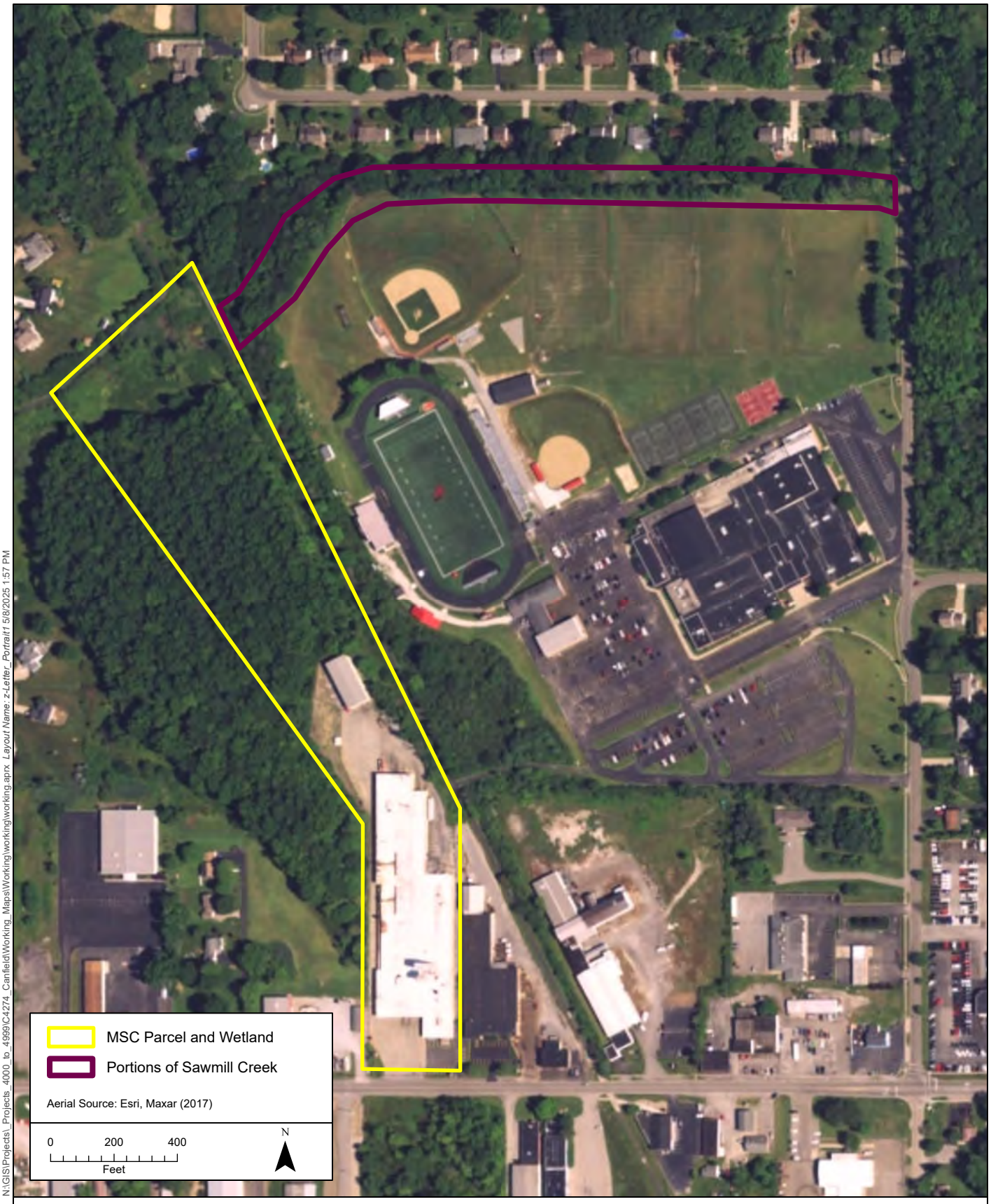
Thank you for your consideration of our request. We look forward to hearing from you.

Sincerely,

Cristal Reagh

Cristal Reagh
Scientist

Enclosure: Shapefile



N:\GIS\Projects_Projects_4000_to_4999\C4274_Canfield\Working_Maps\Working\working\working.aprx Layout Name: z-Letter_Portrait1 5/8/2025 1:57 PM

integral consulting inc.

Figure 1.
Site Boundaries
Material Science Corporation
Canfield OH

Outlook

Confirmation Receipt for ODNR Environmental Review Request Submission

From EnvironmentalReviewRequest@dnr.ohio.gov <EnvironmentalReviewRequest@dnr.ohio.gov>
Date Fri 5/9/2025 1:14 PM
To Cristal Reagh <creagh@integral-corp.com>

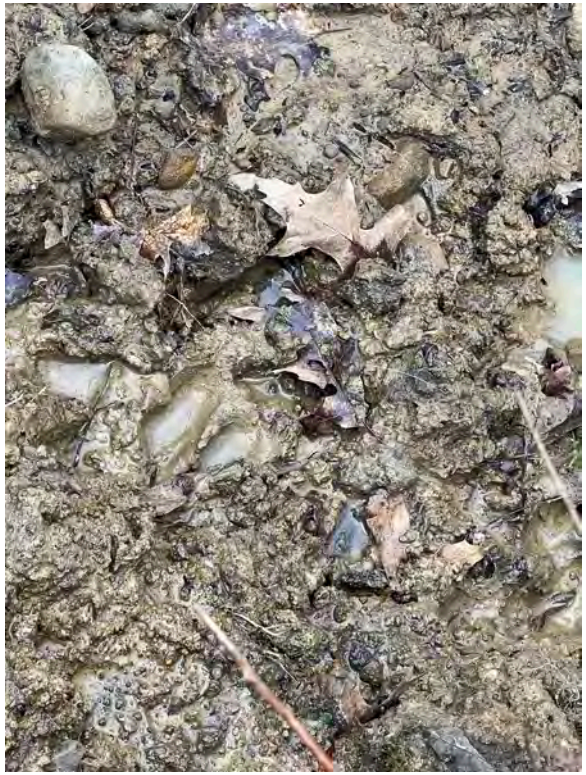
[CAUTION: External email. Think before you click links or open attachments.]

Thank you for contacting the Ohio Department of Natural Resources. This email is your receipt that we have received your message and/or project review request.
We aim to provide a completed Environmental Review comment letter within 45-60 calendar days, however, during periods of high volume or other extenuating circumstances, it may be longer. If you have any questions please contact Mike.Pettegrew@dnr.ohio.gov

Attachment C

April 2025 Photo Log





File Name: IMG_1109
DateTime: 2025:04:01 10:37:15
Latitude: 41.03008611
Longitude: -80.77742778
Description: Floodplain soil including deer tracks and leaf litter.



File Name: IMG_1115
DateTime: 2025:04:01 10:40:57
Latitude: 41.0299
Longitude: -80.77776389
Description: Shallow creek that runs along the high school to the west of the trail.



File Name: IMG_1117
DateTime: 2025:04:01 10:44:34
Latitude: 41.03011389
Longitude: -80.77787778
Description: Dilapidated wooden footbridge that crosses over the high school creek. Facing the culvert under the trail.



File Name: IMG_1118
DateTime: 2025:04:01 10:44:43
Latitude: 41.02989444
Longitude: -80.77777222
Description: Debris and rocks at base of culvert beneath the bike trail.



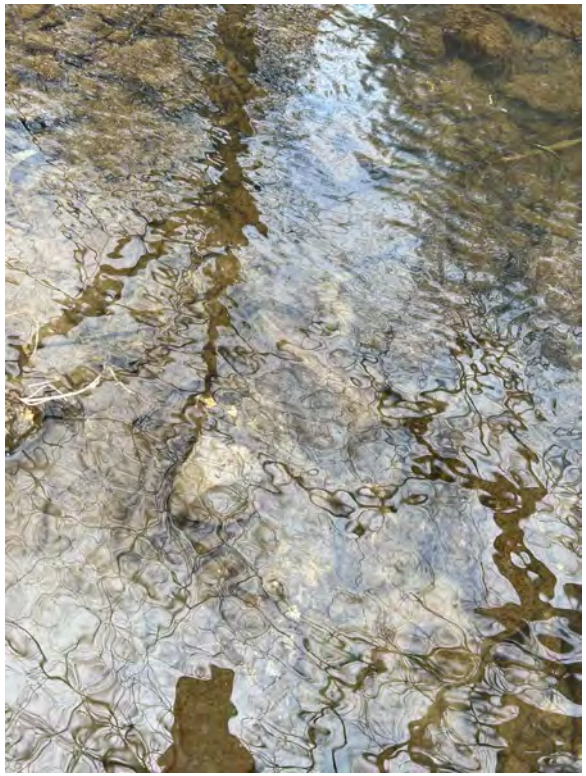
File Name: IMG_1119
DateTime: 2025:04:01 10:46:21
Latitude: 41.03001111
Longitude: -80.77769444
Description: Sawmill creek near culvert. Large rocks, small cobbles, miscellaneous debris, and floodplain characterized by erosion with exposed roots on southern bank.



File Name: IMG_1120
DateTime: 2025:04:01 10:46:31
Latitude: 41.02998333
Longitude: -80.77774722
Description: Sawmill Creek looking downstream.



File Name: IMG_1121
DateTime: 2025:04:01 10:46:32
Latitude: 41.02997222
Longitude: -80.77773333
Description: Sawmill Creek looking upstream.



File Name: IMG_1123
DateTime: 2025:04:01 10:47:05
Latitude: 41.029975
Longitude: -80.77771111
Description: Clear, shallow Sawmill Creek with visible rocky substrate.



File Name: IMG_1125
DateTime: 2025:04:01 10:49:33
Latitude: 41.03001111
Longitude: -80.77771667
Description: Sawmill Creek facing downstream.



File Name: IMG_1127
DateTime: 2025:04:01 10:49:38
Latitude: 41.02998611
Longitude: -80.77771111
Description: Sawmill Creek facing downstream, connected floodplain on northern bank, substantial erosion and undercutting on southern bank.



File Name: IMG_1128
DateTime: 2025:04:01 10:49:42
Latitude: 41.02998333
Longitude: -80.77771111
Description: Debris along southern eroded bank.



File Name: IMG_1135
DateTime: 2025:04:01 10:51:50
Latitude: 41.02995
Longitude: -80.77763333
Description: Dense thicket of leafless shrubs and trees with visible ground littered with dry leaves observed in a wooded area during late winter or early spring.



File Name: IMG_1136
DateTime: 2025:04:01 10:51:51
Latitude: 41.02995278
Longitude: -80.77759444
Description: Dense understory vegetation and leafless deciduous trees with scattered fallen branches are present in a woodland area during early spring.



File Name: IMG_1137
DateTime: 2025:04:01 10:52:32
Latitude: 41.030125
Longitude: -80.77733611
Description: Creek and floodplain facing north.



File Name: IMG_1139
DateTime: 2025:04:01 10:52:44
Latitude: 41.03012778
Longitude: -80.77738056
Description: Undercutting and exposed tree roots.



File Name: IMG_1140
DateTime: 2025:04:01 10:53:34
Latitude: 41.03019722
Longitude: -80.77731389
Description: Sawmill Creek and floodplain facing north.



File Name: IMG_1141
DateTime: 2025:04:01 10:53:40
Latitude: 41.03019722
Longitude: -80.77729722
Description: Overhanging vegetation along floodplain.



File Name: IMG_1143
DateTime: 2025:04:01 10:54:51
Latitude: 41.03026944
Longitude: -80.77705278
Description: Floodplain of Sawmill Creek (facing downstream).



File Name: IMG_1144
DateTime: 2025:04:01 10:54:54
Latitude: 41.03027778
Longitude: -80.77706944
Description: Floodplain of Sawmill Creek (facing upstream).



File Name: IMG_1156
DateTime: 2025:04:01 11:12:52
Latitude: 41.03080833
Longitude: -80.77648889
Description: Sawmill Creek floodplain and creek. Residential area in background.



File Name: IMG_1157
DateTime: 2025:04:01 11:12:55
Latitude: 41.03068611
Longitude: -80.77651944
Description: Riparian zone adjacent to Sawmill Creek.



File Name: IMG_1159
DateTime: 2025:04:01 11:13:28
Latitude: 41.03062778
Longitude: -80.77629722
Description: A wooden footbridge with rusted metal railings spanning Sawmill Creek.



File Name: IMG_1161
DateTime: 2025:04:01 11:13:40
Latitude: 41.03065556
Longitude: -80.77632778
Description: View of northern floodplain from footbridge.



File Name: IMG_1163
DateTime: 2025:04:01 11:13:50
Latitude: 41.03066389
Longitude: -80.77629722
Description: Looking upstream from footbridge. Pine needles scattered along floodplain.



File Name: IMG_1166
DateTime: 2025:04:01 11:14:32
Latitude: 41.03063889
Longitude: -80.77628333
Description: Base of footbridge with erosion.



File Name: IMG_1169
DateTime: 2025:04:01 11:14:37
Latitude: 41.03064722
Longitude: -80.77626667
Description: The ground surface in a forested area is covered with dry pine needles, numerous pinecones, small patches of grass, and a few scattered sticks.



File Name: IMG_1170
DateTime: 2025:04:01 11:15:06
Latitude: 41.03064444
Longitude: -80.77610833
Description: A burrow entrance surrounded by dry leaves and pine needles is observed on the forest floor.



File Name: IMG_1171
DateTime: 2025:04:01 11:15:09
Latitude: 41.03065556
Longitude: -80.77608611
Description: Sawmill Creek floodplain with exposed roots.



File Name: IMG_1172
DateTime: 2025:04:01 11:15:21
Latitude: 41.03063333
Longitude: -80.77604722
Description: Sawmill Creek and a residential area in the background.



File Name: IMG_1173
DateTime: 2025:04:01 11:17:07
Latitude: 41.03067778
Longitude: -80.77584167
Description: Sawmill Creek, looking upstream.



File Name: IMG_1174
DateTime: 2025:04:01 11:17:10
Latitude: 41.03068611
Longitude: -80.77581667
Description: Sawmill Creek, looking downstream near 452 Briarcliff.



File Name: IMG_1175
DateTime: 2025:04:01 11:17:14
Latitude: 41.03068056
Longitude: -80.77583333
Description: Sawmill Creek (looking upstream) and floodplain. Fencing near high school baseball field in background.



File Name: IMG_1176
DateTime: 2025:04:01 11:17:16
Latitude: 41.03067778
Longitude: -80.775825
Description: Sawmill Creek (looking downstream) and floodplain. Fencing near high school baseball field in background.



File Name: IMG_1178
DateTime: 2025:04:01 11:18:21
Latitude: 41.03068889
Longitude: -80.77576389
Description: Sawmill Creek and floodplain.



File Name: IMG_1179
DateTime: 2025:04:01 11:18:24
Latitude: 41.03068889
Longitude: -80.77566667
Description: Sawmill Creek and floodplain. Residential area in background.



File Name: IMG_1180
DateTime: 2025:04:01 11:19:23
Latitude: 41.03062778
Longitude: -80.77514722

Description: An exposed animal burrow.



File Name: IMG_1181
DateTime: 2025:04:01 11:19:34
Latitude: 41.03062778
Longitude: -80.77512222
Description: Potential burrow, exposed tree roots, scattered pine needles, fallen leaves, and several pinecones.



File Name: IMG_1182
DateTime: 2025:04:01 11:19:43
Latitude: 41.03064444
Longitude: -80.77510833
Description: A black culvert pipe is situated on the bank of a shallow, leaf-littered stream flowing through a residential area with sparsely vegetated ground and overhanging deciduous trees.



File Name: IMG_1183
DateTime: 2025:04:01 11:20:00
Latitude: 41.030625
Longitude: -80.77505556
Description: A small drainage pipe discharges into a shallow, leaf-strewn creek with overhanging trees and residential structures visible in the background.



File Name: IMG_1185
DateTime: 2025:04:01 11:20:21
Latitude: 41.030625
Longitude: -80.77499444
Description: A small animal burrow entrance surrounded by pine needles and pinecones is observed on the forest floor, with visible tree roots and minimal vegetation.



File Name: IMG_1186
DateTime: 2025:04:01 11:20:37
Latitude: 41.03063611
Longitude: -80.77485556
Description: Footbridge #2 (foreground) and Footbridge #3 (background).



File Name: IMG_1187
DateTime: 2025:04:01 11:21:52
Latitude: 41.03064444
Longitude: -80.77456667
Description: Shallow and narrow section of Sawmill Creek. Grass next to residential area.



File Name: IMG_1189
DateTime: 2025:04:01 11:22:18
Latitude: 41.03064722
Longitude: -80.77440556
Description: Sawmill Creek floodplain (looking downstream).



File Name: IMG_1190
DateTime: 2025:04:01 11:22:36
Latitude: 41.03063889
Longitude: -80.77427778
Description: Sawmill Creek.



File Name: IMG_1191
DateTime: 2025:04:01 11:23:04
Latitude: 41.03065556
Longitude: -80.77411667
Description: Sawmill Creek.



File Name: IMG_1192
DateTime: 2025:04:01 11:23:31
Latitude: 41.03071111
Longitude: -80.77406389
Description: Sawmill Creek (looking downstream)



File Name: IMG_1193
DateTime: 2025:04:01 11:24:28
Latitude: 41.03054444
Longitude: -80.77350556
Description: Sawmill Creek (looking upstream)



File Name: IMG_1194
DateTime: 2025:04:01 11:24:31
Latitude: 41.03060556
Longitude: -80.77349167
Description: Debris in Sawmill Creek.



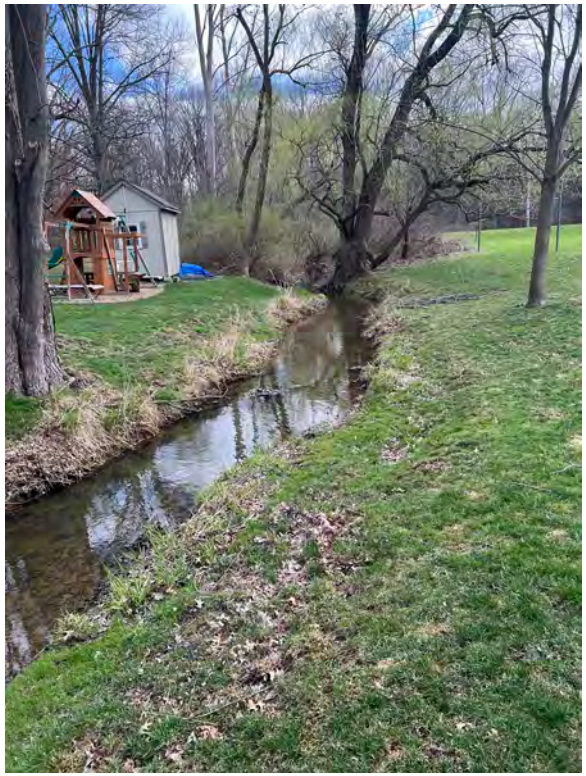
File Name: IMG_1195
DateTime: 2025:04:01 11:24:34
Latitude: 41.03063611
Longitude: -80.77348333
Description: Substrate in Sawmill Creek.



File Name: IMG_1196
DateTime: 2025:04:01 11:25:48
Latitude: 41.03069722
Longitude: -80.77281944
Description: Footbridge #4 (looking upstream).



File Name: IMG_1197
DateTime: 2025:04:01 11:25:50
Latitude: 41.03068889
Longitude: -80.77281944
Description: Northern stream bank and floodplain.



File Name: IMG_1198
DateTime: 2025:04:01 11:25:53
Latitude: 41.03068056
Longitude: -80.77281111
Description: Sawmill Creek (looking downstream).



File Name: IMG_1199
DateTime: 2025:04:01 11:26:29
Latitude: 41.03058889
Longitude: -80.77268333
Description: Sawmill Creek (looking downstream).



File Name: IMG_1200
DateTime: 2025:04:01 11:26:45
Latitude: 41.03059444
Longitude: -80.77253056
Description: Debris along floodplain.



File Name: IMG_1202
DateTime: 2025:04:01 11:28:26
Latitude: 41.03044167
Longitude: -80.77231667
Description: A black corrugated plastic drainage pipe discharges into Sawmill Creek.



File Name: IMG_1203
DateTime: 2025:04:01 11:28:28
Latitude: 41.03049444
Longitude: -80.772225
Description: Culvert under Cardinal Road.



File Name: IMG_1208
DateTime: 2025:04:01 11:32:46
Latitude: 41.03052222
Longitude: -80.77262222
Description: Floodplain (looking upstream) from high school soccer fields.

Attachment D

Ecological Scoping Checklist

Level I Attachment B
Ecological Scoping Checklist

Part 1			
SITE INFORMATION			
Site Name: Sawmill Creek		Date: 04/02/25	
Personnel: Jen Lyndall (Integral, lead) and Elisabeth Webber (August Mack) (Identify team leader)		Time Arrived: 10:27 Time Departed: 11:50	
Site Address: Canfield, OH 44406			
Site Location:	Latitude: 41.03069444	Longitude: -80.7745944	
Site Size (acres): Approx. 3.6 acres			
Weather Conditions (note any unusual conditions): Cloudy, scattered snow.			
Land uses at and adjacent to the site: (Circle all that apply and record at or adjacent)			
Residential Adjacent	Commercial	Recreational Adjacent	Industrial
Agricultural	Urban	Green-Space/ Undeveloped At/adjacent	Other:_____

Note: This checklist provides a suggested format. The format may be altered to fit the needs of the site; however, all pertinent information should be presented.

Part 2		
CONTAMINANTS OF INTEREST		
Contaminants of Interest and *Ecological Stressors* (Types, names including CASRN, classes, or specific *hazardous substances* and non-chemical stressors either known or suspected)	Onsite (O) or Adjacent (A) to the site	Media (soil, sediment, wetland, surface water, ground water (seeps/springs))
Benzo(a)pyrene	Onsite, adjacent	soil
Benzo(b)fluoranthene	Onsite, adjacent	soil, surface water
Arsenic	Onsite, adjacent	soil
Cyanide	Onsite, adjacent	soil
Benzo(a)anthrecene	Onsite, adjacent	soil
Dibenz(a,h)anthracene	Onsite, adjacent	soil
Indeno(1,2,3-cd)pyrene	Onsite, adjacent	soil
Chromium	Onsite, adjacent	soil
Zinc	Onsite adjacent	soil

Part 3

SPECIFIC EVALUATION OF ECOLOGICAL RECEPTORS/HABITAT a,

Terrestrial – Wooded _27___%of site

Dominant vegetation (circle one):
Coniferous (Deciduous) Mixed

Dominant tree diameter
diameter at breast height (*dbh*): ____ (inches)

Evidence/observation of wildlife*: squirrels, deer, birds

Terrestrial - Shrub/scrub/grasses __3__% of site

Dominant vegetation (circle one):
(shrub/scrub) grasses

vegetation density: (Dense) Patchy, Sparse
Prominent height of shrub/scrub (<2', (2' to 5', >5')
Prominent height of grasses/herbs (<2', 2' to 5', >5')
Evidence/observation of wildlife*:

Terrestrial - Ruderal/Engineered 68___% of site

Dominant vegetation/surfaces (circle one):
(Landscaped) Agricultural Bare ground
Parking lot Artificial surfaces
Dominant vegetation height (0', >0' - 2', 2' - 5', >5')
Vegetation Density: (Dense) Patchy Sparse
Evidence/observation of wildlife*:
Bird calls, squirrels

Aquatic - Non-Flowing (Lentic) ____% of site

Type: Lake Pond Vernal Pool Lagoon
Engineered** Impoundment Reservoir
Water source: Surface water Ground water
Industrial discharge Surface water runoff
Discharge Point: Surface water Ground water
Wetlands
Bottom Substrate***:
Vegetation: Submerged Emergent Floating
Wetland Present: (Yes/No)
Evidence/Observation of wildlife*:

Aquatic - Flowing (Lotic) _2___% of site

Aquatic Life Use Designation (if available) _____
Type: River (Stream) Intermittent Stream
Ditch
Water source: (Surface Water) Ground Water
Industrial discharge (seeps /springs)
Storm water runoff
Discharge Point: (Surface water) Ground water
Wetlands Impoundment
Bottom Substrate**:
Vegetation: Submerged Emergent Floating
Wetland Present: (Yes/No)
Evidence/Observation of Wildlife*:Bird calls, deer sign

Aquatic - Wetlands ____% of site

Size _____ (acres)
Obvious or designated wetland: (Yes / No)
Water source: Surface Water Ground Water
Industrial discharge Surface water runoff
Discharge Point: Surface water Ground water
Wetlands Impoundment
Bottom Substrate***:
Vegetation: Submerged Emergent Floating

Evidence/Observation of Wildlife*:

* Wildlife includes: macroinvertebrates, reptiles, amphibians, birds, mammals, and fish.
** Engineered can mean any surface water body that has been artificially created or significantly altered.
*** Bottom substrate types include but not limited to: cobble, gravel, sand, silt, clay, muck, artificial (*e.g.*, concrete).

Part 4
Ecologically Important Resources Observed

Attachment E

Evaluation of Potential Ecological Harm

Level I Attachment C

EVALUATION OF POTENTIAL ECOLOGICAL HARM		**Y**	**N**	**U**
Are ecological stressors present or potentially present in:				
a	Soil	X		
b	Surface Water	X		
c	Sediment	X		
d	Ground Water			X
e	Other (biotic media)			X
f	Are important ecological resources located at, or in the locality of the site?			X

"Y" = yes; "N" = No, "U" = Unknown (counts as a "Y")

When answering the above questions, consider the following:

X Known or suspected presence of ecological stressors stored, used or manufactured at the site.
X Ability of ecological stressors to migrate from one medium to another.
X The mobility of the various media.
X Transfer of contaminants through food webs and uptake of chemicals by organisms.
X The presence of important ecological resources, including surface waters on or in the locality of the site.

(a) If "Y" or "U" boxes in Attachment C are checked for row f and any other row, then a recommendation to move to Level II should be made for an assessment of the appropriate aquatic and/or terrestrial habitat. In completing this attachment, a lack of knowledge, presence of high uncertainty, or any "unknown" circumstances should be tabulated as a "U".

(b) If all of the "No" boxes in Attachment C are checked, or if only row f, or only rows a through e are checked “No”, then the site is highly unlikely to present significant risks to important ecological receptors and a recommendation for no further ecological investigations should be made.

Level II Ecological Risk Assessment

Sawmill Creek, Canfield, Ohio

Prepared for
August Mack Environmental
7830 North Central Drive, Suite B
Lewis Center, OH 43035

Prepared by

Integral Consulting Inc.
8742 E. Washington, #115
Chagrin Falls, OH 44022

May 2025

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ACRONYMS AND ABBREVIATIONS

August Mack	August Mack Environmental
COPEC	chemicals of potential ecological concern
CSM	conceptual site model
EDR	Environmental Data Resources, Inc.
EPA	U.S. Environmental Protection Agency
Integral	Integral Consulting Inc.
MSC	Material Sciences Corporation
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
PBT	persistent, bioaccumulative, toxic
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
TEC	threshold effect concentration
USFWS	U.S. Fish and Wildlife Service

1 INTRODUCTION AND BACKGROUND

Integral Consulting Inc. (Integral) has prepared this Level II ecological risk assessment on behalf of August Mack Environmental (August Mack) for a portion of Sawmill Creek in Canfield, Ohio (Figures 1 and 2).

The assessment area is located in Mahoning County, Canfield, Ohio (centered at 41.03069444, –80.7745944) and includes the portion of Sawmill Creek (including its riparian floodplain) from the Mill Creek Metroparks bikeway to Cardinal Drive (Figure 2). The creek is bordered to the north by residential properties and to the south by the Cardinal High School athletic fields. The 3.6-acre assessment area includes approximately 1 acre of forested habitat, 2.5 acres of residential yards, 0.1 acres of scrub-shrub habitat, and less than 0.1 acres of stream habitat (Figure 3).

- **Terrestrial habitat:** Approximately 3.5 acres of the Sawmill Creek assessment area consists of forested upland habitat, residential riparian zones, and scrub-shrub habitat.
- **Aquatic habitat:** Within the assessment area, Sawmill Creek flows from the Mill Creek Metroparks bikeway in a northeasterly direction along the northern border of the Canfield High School parcel.

In July 2024, an incident occurred at the Material Sciences Corporation (MSC) facility—upstream of the assessment area—that prompted additional investigation and interim remediation of chemicals along the Adjacent Ditch.[1] As part of that investigation, the Ohio Environmental Protection Agency (Ohio EPA) requires an evaluation of potential ecological risk at the site and the assessment area.

This Level II ecological risk assessment builds on the previous scoping analysis presented in the Level I ecological risk assessment (Integral 2025). A Level II ecological risk assessment is a screening level assessment that is used to evaluate whether chemicals present at the site may pose risk to ecological resources in the Sawmill Creek assessment area. This report follows the Ohio EPA guidance and report outline (Ohio EPA 2018). For the purposes of this Level II ecological risk assessment, the term "site" refers to the MSC parcel and the term "assessment area" refers to the portion of Sawmill Creek from the bikeway to Cardinal Drive (Figure 3).

In accordance with Ohio EPA guidance (Ohio EPA 2018), this assessment was based on existing data, including the Initial Site Investigation Report (August Mack 2024), assessment area photos, aerial imagery, and a site visit, which included an evaluation of habitat type and extent, observations of species present, and signs of ecological use in the assessment area. In

[1] https://www.mscresponse.com/

addition, the following documents, maps, or other publications were reviewed in the preparation of this report:

- Environmental Data Resources, Inc. (EDR), The EDR Aerial Photo Decade Package, Inquiry Number 7821917.5, dated November 14, 2024
- EDR, The EDR-City Directory Image Report, Inquiry Number 7821917.8, dated November 18, 2024
- EDR, The EDR Radius Map with GeoCheck, Inquiry Number 07821917.2r, dated November 14, 2024
- EDR, Certified Sanborn Map Report, Inquiry Number 7821917.3, dated November 14, 2024
- Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Maps
- U.S. Department of Agriculture, Soil Conservation Service, Soil Surveys
- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory database, http://www.fws.gov/wetlands/Data/Mapper.html.
- U.S. Geological Survey, Topographic Maps
- U.S. Department of the Interior, Fish and Wildlife Service, National Wetlands Inventory Map.

1.1 SITE HISTORY

The MSC Canfield facility building was constructed in 1950 for the Life Time Products Corporation, Coated Steel Division (Ohio EPA and MSC 2024). Manufacturing operations included surface coating, machining, spray painting, and metal fabricating (Ohio EPA and MSC 2024). In the 1950s or 1960s, the facility became known as Canfield Steel, which was purchased by Pittsburgh Steel Corporation in 1968 to form the Pittsburgh-Canfield Corporation. The facility was acquired in 2013 by New Star Metals, a predecessor to MSC.[2] The facility is still operational.

The coating and electro galvanizing processes use multiple solvents and metals, and the facility is classified as a large quantity generator (EPA ID: OHD000810283). During normal operations, waste is disposed of offsite at an appropriate disposal facility.[3] Chemicals listed on the Toxic Release Inventory forms are cyanide, xylene, ethylbenzene, methyl isobutyl ketone, n-butyl alcohol, 1,2,4-trimethylbenzene, nitric acid, phosphoric acid, sodium hydroxide, toluene, and methyl ethyl ketone.

[2] The facility also previously operated as the Canfield Coating Company.
[3] https://enviro.epa.gov/facts/tri/ef-facilities/#/Water/44406CNFLD460WE

The facility operates under an approved 80 percent synthetic minor air permit (OH0000000250030020).[4]

1.2 HISTORICAL REGULATORY STATUS

There have been no historical regulatory actions in the assessment area.

1.3 CURRENT REGULATORY STATUS

In July 2024, MSC and state and local agencies responded to a report of a release of process fluids in the Adjacent Ditch. During the initial response, personnel observed conditions that indicated some fluid had leaked from the facility into groundwater and sediment of the Adjacent Ditch. It is unclear how long the release had occurred. Emergency response was immediately initiated, in close coordination with Ohio EPA and other agencies. Initial sampling indicated the presence of "residual byproducts from the metal coating process, including elevated levels of sodium hydroxide, zinc, chromium and cyanide."[5] The emergency response included placing temporary fencing; sealing drains, pipes, and manholes; bypassing the adjacent ditch; extracting potentially contaminated water; and placing a liner in the ditch to prevent contact of surface water with impacted sediments.

The site was transferred into the Resource Conservation and Recovery Act (RCRA) program to address potential longer-term investigation and remediation following the completed emergency interim response. Ohio EPA issued an administrative consent order on December 31, 2024, to conduct corrective actions necessary at the site.

August Mack conducted an initial site investigation to analyze chemical concentrations at the site and throughout the assessment area, specifically in groundwater, soil, and surface water samples. The results are summarized in August Mack (2024). Selected figures from that report are reproduced in Attachment A. Surface water and sediment data from August Mack (2024) indicated the following:

- Primary chemicals of concern in the assessment area were cyanide, zinc, hexavalent chromium, and trichloroethene.
- Chemicals that exceeded the EPA residential regional screening levels (RSLs) for soil were cyanide, zinc, hexavalent chromium, benz[*a*]anthracene, benzo[*a*]pyrene, benzo[*b*]fluoranthene, dibenz[*a,h*]anthracene, and indeno[1,2,3-*cd*]pyrene.
- Benzo[*b*]fluoranthene exceeded the Ohio River Basin Human Health Tier I Criteria for non-drinking water.

[4] https://enviro.epa.gov/envirofacts/icis-air/plant?handlerId=OH0000000250030020
[5] https://www.mscresponse.com/

- Arsenic in the downstream portion of Sawmill Creek exceeded the residential and industrial RSLs for soil, but has not historically been used at the site.

1.4 LEVEL I REPORT

The Level I ecological risk assessment report (Integral 2025) indicates that there are chemicals of interest detected in environmental media in the assessment area that have the potential to pose a risk to ecological receptors. Chemicals of interest identified in the Level I ecological risk assessment are screened in the Level II ecological risk assessment to determine if they are chemicals of potential ecological concern (COPECs). Integral (2025) concluded that:

- Chemicals were present in sediment[6] and surface water in the assessment area (August Mack 2024).
- Ecological habitat (including habitat that may be used by threatened and endangered species) is present in the assessment area.
- Signs of relevant ecological receptors were observed in the assessment area, but the timing of the site visit prohibited a full ecological characterization.

Because site-related chemicals were detected in environmental media that may be used by ecological receptors, the Level I ecological risk assessment concluded that a Level II ecological risk assessment was needed.

[6] The initial sampling classified all solids samples as soil. However, for the purposes of the ecological risk assessment, solids within the wetland and ditch areas are considered to be sediment.

2 SITE SURVEY AND DESCRIPTION

A detailed site survey was conducted on April 2, 2025, to gather qualitative and semiquantitative data necessary for identifying relevant and complete exposure pathways in the Sawmill Creek assessment area. The site survey included GIS mapping and analysis, confirmation of habitat within the assessment area, terrestrial receptor inventory based on visual observations, and an avian inventory using the Merlin app. Site habitats are summarized in Figure 4, a photo log is provided in Attachment B, and the ecological scoping checklist is provided in Attachment C. Observations from each of the main habitat areas are described below.

Terrestrial wooded habitat makes up 1 acre (27 percent) of the assessment area. This deciduous forested habitat is dominated by oaks (*Quercus* spp.), hickories (*Carya* spp.), and maples (*Acer* spp.). The mature trees have a typical diameter at breast height of 6–8 in. Squirrels and deer signs (game paths, prints) were noted in the forested area. Birds seen or heard during the site visit included northern cardinal, American robin, and mallard.

Residential yards are present in 2.5 acres (68 percent) of the assessment area. In some portions of the assessment area, mowed lawns extend to the edge of the creek bank, while in others there are limited areas of juvenile and mature trees and shrubs. Along the high school, there are pine trees planted in a row next to the baseball field. A few small burrows were observed along the southern bank of the creek.

Approximately 0.1 acres (3 percent) of scrub-shrub habitat is present at the eastern extent of the assessment area near the culvert under Cardinal Drive. Additionally, approximately 175 ft upstream of Cardinal Drive, there was a debris pile that appeared to be a remnant beaver dam.

This portion of Sawmill Creek is less than 0.1 acres (approximately 1,750 linear feet) and makes up 2 percent of the assessment area. The creek ranges in width from 1 to 4 ft and is generally shallow, ranging from 6 to 12 in. throughout the assessment area. Large boulders and concrete debris are scattered around the upstream culvert. There is a moderate degree of embeddedness in the substrate of the creek, which is dominated by cobble at the western extent of the assessment area and by silt and muck at the eastern extent of the assessment area. Debris was observed throughout the assessment area.

The streambanks show substantial signs of erosion with undercutting and incision. Along the western portion of the assessment area, the banks range from 1 to 7 ft higher in elevation than the creek channel. In this area, there are a number of mature trees with exposed roots due to the undercutting banks. Towards the eastern extent of the assessment area, the banks are lower in elevation.

Vegetation conditions observed in the assessment area were characteristic of the spring season. Because the site visit occurred in early April, many understory trees and emergent vegetation had not yet leafed out.

3 LEVEL II SCREENING RESULTS

This Level II ecological risk assessment identified the environmental media of interest in the assessment area and then identified COPECs as those present at concentrations above ecotoxicological benchmarks. The results of the COPEC screening and investigation were used to develop a conceptual site model (CSM), including the identification of relevant and complete exposure pathways, ecological receptors of interest, and candidate assessment endpoints. The results of each of these steps are detailed in the following sections.

3.1 ENVIRONMENTAL MEDIA

Consistent with Ohio EPA guidance (Ohio EPA 2018), environmental media of interest for the ecological risk assessment are surface soil, surface sediment, and surface water. The initial investigation of the facility evaluated chemical concentrations in groundwater, surface soil and sediment, subsurface soil and sediment, and surface water; however, the evaluation of the assessment area was limited to sediment and surface water (August Mack 2024) so this Level II ecological risk assessment is limited to the aquatic exposure area in Sawmill Creek. The relevant environmental media for the ecological risk assessment are:

- Surface water
- Surface sediment (0–15 cm) based on the bioactive zone as defined in Ohio EPA (2018)
- Wildlife tissue from food items (e.g., invertebrates).

3.2 CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN

The analytical chemistry results were screened against relevant ecotoxicological benchmarks to identify COPECs for each environmental medium. Soil data were not available for the assessment area so were not screened for this assessment. The screening process followed the procedure in Ohio EPA (2018). Any chemical that met one or both of the following criteria was not of ecological concern and therefore was removed from further evaluation:

- The maximum detected concentration is less than the ecotoxicological screening benchmark.
- The maximum detection limit of a nondetected chemical is less than its screening benchmark.

A chemical was retained as a COPEC for further evaluation if it met one or both of the following criteria:

- The maximum detected concentration exceeds the screening benchmark.

- Ohio EPA (2018) defines the chemical as persistent, bioaccumulative, and toxic (PBT).

Ohio EPA (2018) also allows removal of a detected chemical if it is present at a low frequency of detection (<5 percent). This criterion did not apply to the screening evaluation for surface water because the Sawmill Creek-specific data set contained fewer than 20 samples within the assessment boundary. No chemicals were excluded as a COPEC in sediment samples due to their frequency of detection.

3.2.1 Surface Water

Chemicals detected in surface water were compared to the outside mixing zone maximum chemical criteria presented in OAC 3745-1-35. Metals with hardness-dependent criteria were evaluated based on a water hardness value of 200 mg/L, which is representative of aquatic systems in the area that ranged from 140 to 330 mg/L (Ohio EPA 1996). For surface water screening, total and dissolved analytical results for metals were screened separately. The surface water COPEC screening is summarized in Table 3.

Integral identified free cyanide as a COPEC in surface water samples (Table 2). Free cyanide exceeds the relevant screening values.

3.2.2 Surface Sediment

Chemicals detected in sediment were compared to the consensus-based threshold effect concentrations (TECs) from MacDonald et al. (2000) in accordance with Ohio EPA (2018). TECs are available only for select metals and PAHs. When sediment screening benchmarks were not available in MacDonald et al. (2000), Integral used the EPA Region 4 sediment screening values for hazardous waste sites: non-narcotic modes of action (Table 2a in USEPA 2018).

Integral identified 16 COPECs in sediment samples including metals and PAHs because of either exceedances of the screening value or their status as PBT compounds (Table 2).

3.3 CONCEPTUAL SITE MODEL

A CSM provides a framework for understanding how COPECs interact with the environment by defining the source, release and transport mechanisms, exposure routes, and potential ecological receptors. It helps identify areas where exposure may occur and informs risk assessment and management decisions. CSMs are dynamic tools that evolve over time, incorporating new data through an iterative process to refine the understanding of chemical behavior and ecological risk.

Figure 5 presents the preliminary CSM, which illustrates the relationships between potentially affected environmental media (i.e., surface water, sediment, tissue) and major ecological

receptor groups (i.e., communities of invertebrates, plants, birds, and mammals) that may be exposed to COPECs in these media via direct contact, incidental ingestion, or dietary ingestion.

3.3.1 Relevant and Complete Exposure Pathways

An exposure pathway is considered complete if an ecological receptor could contact one or more COPECs in one or more environmental media via one or more exposure routes (e.g., ingestion).

The relevant and complete exposure pathways for the assessment area are presented in the CSM in Figure 5. Aquatic receptors may be exposed to chemicals by direct contact (i.e., skin contact or respiration through gills) with environmental media, incidental ingestion, or dietary exposure. Wildlife exposure to sediment and surface water via direct contact are complete pathways but are likely to be insignificant based on the duration of exposure; dietary exposures are considered to be a more significant exposure pathway for wildlife. Amphibian exposures to chemicals via sediment ingestion is considered a complete exposure pathway, but ingestion is incidental and therefore would not be a significant pathway. The fish that are likely to be present in the assessment area may encounter sediment, resulting in a complete exposure pathway, but this exposure pathway is considered insignificant because these fish species are not bottom dwellers so contact with sediment would be variable. The CSM will be updated based on any additional biological data that is collected in the assessment area.

3.3.2 Selected Ecological Receptors

Ecological data from the site survey and publicly available information were used to identify potential ecological receptors of interest in the assessment area. Ecological receptors are defined as those observed or potentially present in habitats in the assessment area. Receptors of interest are populations, communities, and/or relevant trophic guilds that are sensitive and/or susceptible to toxic effects from exposure to COPECs. These receptors have been well-researched and have large toxicity data sets available in the peer-reviewed literature and guidance. Integral selected ecological receptors after consideration of potentially threatened and endangered species, species observed in the assessment area, and species known to be present in the vicinity of the assessment area.

3.3.2.1 Threatened and Endangered Species

Integral requested information from the U.S. Fish and Wildlife Service (UFWS) and the Ohio Department of Natural Resources (ODNR) on the presence and distribution of threatened and/or endangered species in the assessment area. The information obtained from this

request is included in Attachment D.[7] Integral also requested an ODNR environmental review, which has not been received from the agency at the time of this report.

Based on the information received, the assessment area is located within the range of four federally listed species: tricolored bat (*Perimyotis subflavus*, state endangered), northern long-eared bat (*Myotis septentrionalis*, federally threatened and state endangered), Indiana bat (*M. sodalis*, federally and state endangered), and little brown bat (*M. lucifugus*, state endangered). USFWS has previously stated that Indiana bats are assumed to be present in Ohio during the summer wherever suitable habitat occurs unless a presence/absence survey has been performed to document their absence (USFWS 2007).

In addition to the four bat species, the monarch butterfly (*Danaus plexippus*) is a candidate federally listed species that may be present in the area.

No threatened or endangered species were observed during the site visit. However, because presence/absence surveys have not been conducted for threatened or endangered species in the assessment area, their potential use of the assessment area cannot be ruled out.

The focus of the risk assessment is on ecological receptors that are likely to use the assessment area, with the expectation that protection of those ecological receptors will also be protective of the habitat that could be used by potentially threatened and endangered species.

3.3.2.2 Selected Ecological Receptors

Section 2 provides summaries of the assessment area observations in April 2025. Due to the timing of the site visit, this should be considered an initial species list and not a comprehensive list of assessment area ecological receptors. The selection of ecological receptors focuses on those with complete exposure pathways and those that are representative of key feeding guilds. It is not feasible to evaluate risk for every species that may use the assessment area, so surrogate species are used to represent different avian and mammalian feeding guilds.

Aquatic receptors in Sawmill Creek may include aquatic vegetation, macroinvertebrates, amphibians, and fish communities. In this Level II aquatic risk assessment, Integral selected the following aquatic ecological receptors:

- Aquatic vegetation community
- Invertebrate community
- Fish community
- Amphibian community

[7] The ODNR environmental review has not been received at the time of this report.

- Small semiaquatic wildlife species with restricted home ranges and high incidental sediment ingestion rates including:
  - Mallard (avian omnivore)
  - Heron (avian piscivore)
  - Muskrat (mammalian herbivore)
  - Mink (mammalian piscivore).

Aquatic vegetation, invertebrates, fish, amphibians, birds, and mammals are the focus of this evaluation because these receptors provide a comprehensive assessment of chemical exposure and risk.

3.3.3 Candidate Assessment Endpoints

Assessment endpoints represent an expression of the key ecological resources to be protected from harm. They generally reflect sensitive populations, communities, or trophic guilds. Ecological resources should have relevance, be susceptible to the stressors of concern, have biological, social, and/or economic value, and be applicable to the risk management goals for the assessment area. Candidate assessment endpoints would be used in the Level III evaluation to evaluate the targeted resource groups in the aquatic exposure areas. The selected assessment endpoints are as follows:

- Semiaquatic avian abundance
- Semiaquatic mammalian abundance
- Aquatic vegetation community structure and function
- Benthic invertebrate community structure and function
- Fish community structure and function
- Amphibian community structure and function.

These assessment endpoints may be updated if a Level III ecological risk assessment is conducted.

4 CONCLUSIONS AND RECOMMENDATIONS

This Level II ecological risk assessment was based on a CSM that includes the identified environmental media (sediment, surface water, and tissue), complete exposure pathways, and environmental receptors of interest. COPECs were identified by screening maximum detected concentrations in each environmental medium against ecological screening benchmarks. Chemicals that exceeded the screening values and those identified as PBT compounds were retained as COPECs for further evaluation. The Level II ecological risk assessment could not rule out the potential for adverse ecological risk due to the presence of multiple COPECs at concentrations that exceeded screening thresholds, indicating the potential for risk in surface sediment and surface water.

Interim remedial actions are already under way at the site; however, we recommend that a Level III ecological assessment be conducted to evaluate site-specific risk to determine the adequacy of the interim actions and determine if additional action is warranted. Additional data collection efforts may be needed to provide a more intensive habitat and biological evaluation, to collect additional soil and sediment data, and to collect additional background data.

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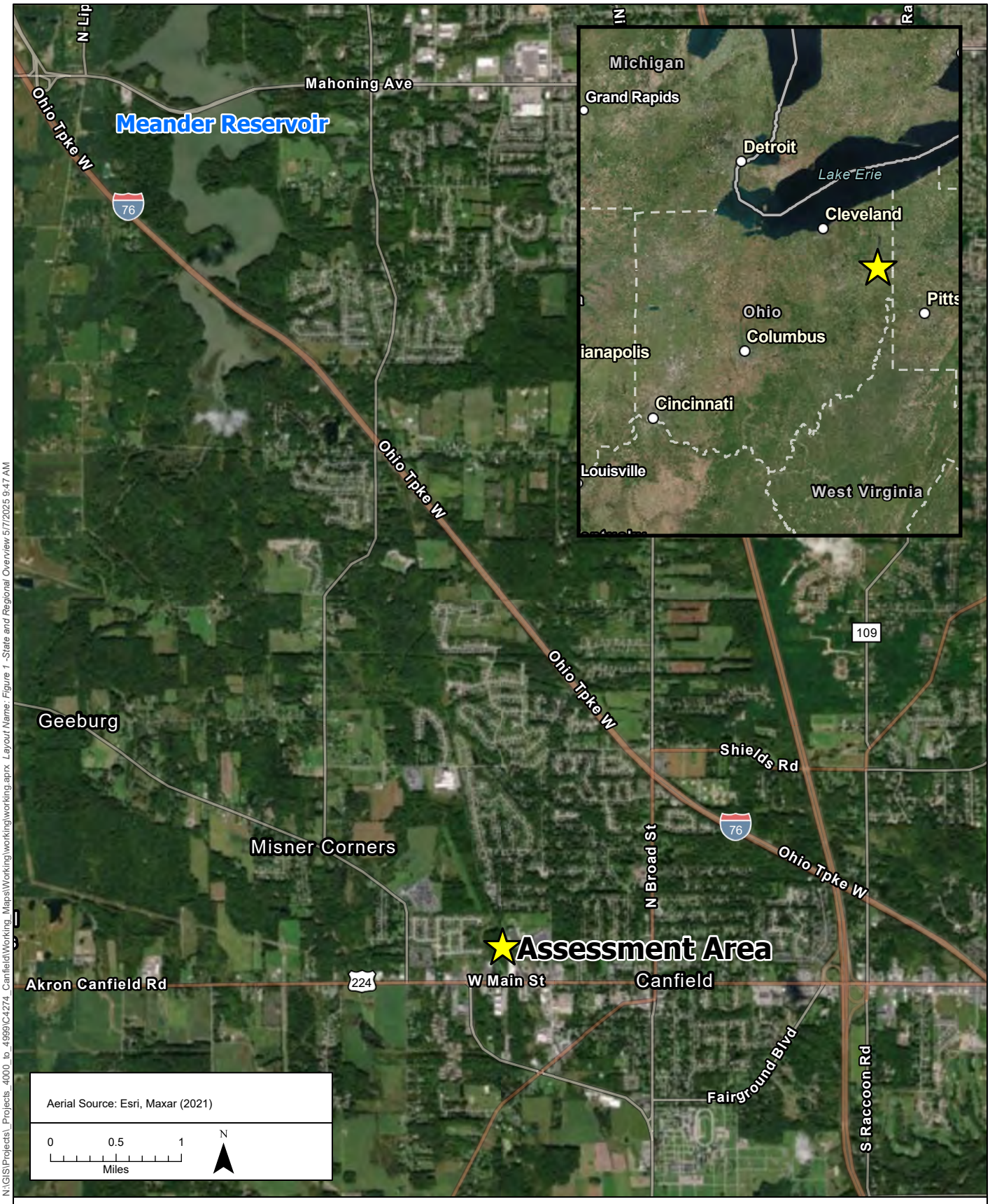
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FIGURES



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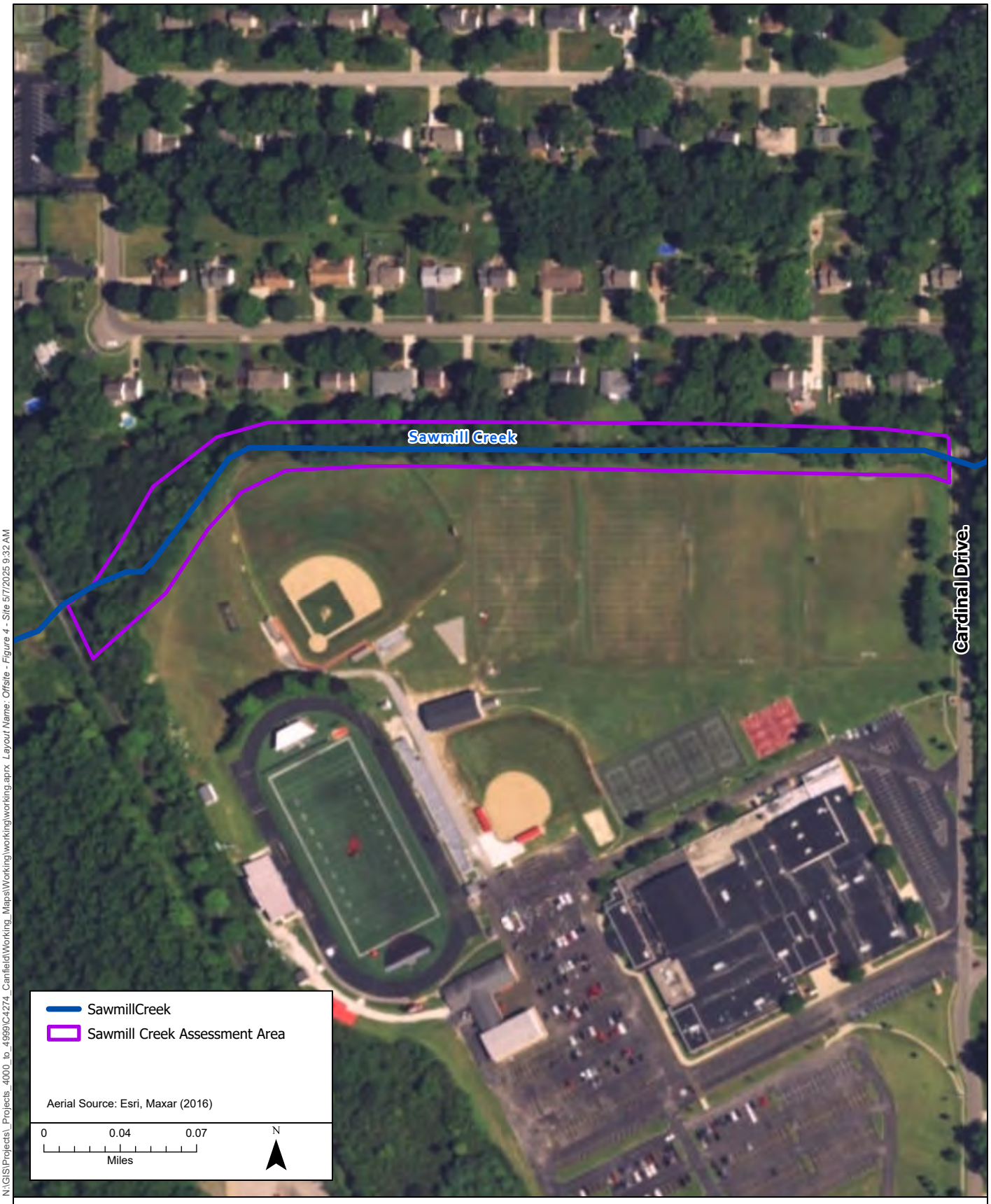
Figure 1 - Regional Map of Assessment Area
Canfield, Ohio



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integral consulting inc.

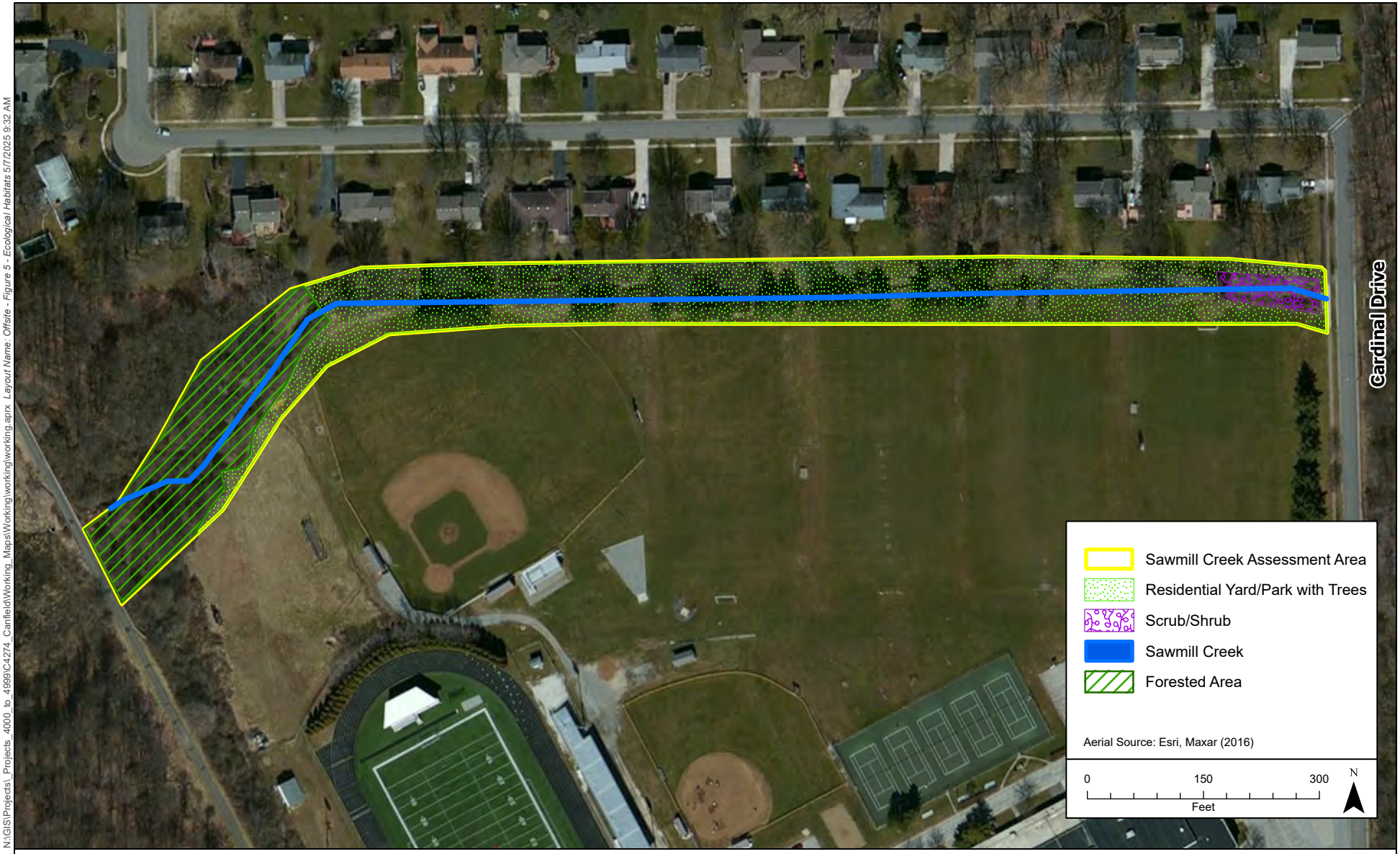
Figure 2 - Local Map of Assessment Area and Adjacent Properties
Canfield, Ohio



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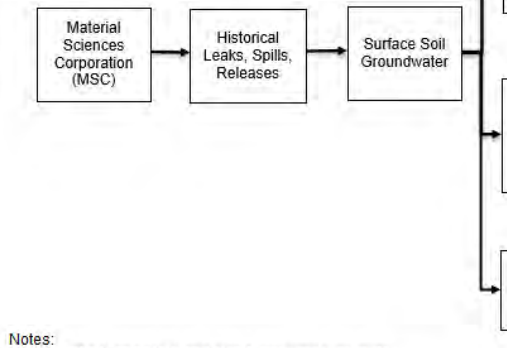
Figure 3 -Assessment Area Features
Sawmill Creek
Canfield, Ohio



N:\GIS\Projects_Projects_4000_to_4999\C4274_Canfield\Working_Maps\Working\working\working.aprx Layout Name: Offsite - Figure 5 - Ecological Habitats 5/7/2025 9:32 AM

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Figure 4 - Ecological Habitats within Assessment Area.
Sawmill Creek
Canfield, Ohio



		Potentially Exposed Ecological Receptors						
		Terrestrial			Aquatic			
Exposure Media	Exposure Route	Vegetation	Invertebrates	Wildlife	Vegetation	Invertebrates	Amphibians	Fish
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA
	Direct Contact	NA	NA	NA	NA	NA	NA	NA
Sediment	Ingestion	NA	NA	●	NA	●	◍	NA
	Direct Contact	NA	NA	◍	●	●	●	◍
Surface Water	Ingestion	NA	NA	●	NA	NA	NA	NA
	Direct Contact	NA	NA	◍	●	NA	●	●
Tissue	Ingestion	NA	NA	●	NA	NA	NA	NA

Notes:
● Potentially complete and significant exposure route
◍ Exposure route potentially complete but insignificant
NA Not Applicable - receptor is not potentially exposed via this pathway

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Figure 5 – Conceptual Site Model
Sawmill Creek Assessment Area
Canfield, Ohio

Tables

Table 1. COPEC Summary

COPEC	Sediment	Surface Water
Metals		
Arsenic	x	
Barium	x	
Lead	x	
Mercury	x	
Selenium	x	
Zinc	x	
PAHs		
Anthracene	x	
Benzo[a]anthracene	x	
Benzo[a]pyrene	x	
Chrysene	x	
Dibenz[a,h]anthracene	x	
Fluoranthene	x	
Fluorene	x	
Naphthalene	x	
Phenanthrene	x	
Pyrene	x	
Physico-chemical Measurements		
Free Cyanide		x

Notes:
COPEC = chemical of potential ecological concern
PAH = polycyclic aromatic hydrocarbon

Table 2. COPEC Screening for Surface Water

Chemical	Fraction	CAS Number	FOD	Maximum Detected Concentration (µg/L)		Maximum Reporting Limit (µg/L)	Location of Maximum Detected Concentration	Screening Value (µg/L)	Screening Value Source	PBT (Yes/No) [a]	COPEC (Yes/No)	Reason for Selection or Deletion [b]
Metals												
Arsenic	D	7440-38-2	0 / 4			15		340	Rule 3745-1-35 (OMZM)	No	No	ND1
Arsenic	T	7440-38-2	0 / 4			15		340	Rule 3745-1-35 (OMZM)	No	No	ND1
Barium	D	7440-39-3	4 / 4	70	J	200	T2-1820-C-SW; T2-1820-C-SW	220	USEPA (2018)	No	No	BSV
Barium	T	7440-39-3	4 / 4	73	J	200	T2-1820-C-SW; T2-1820-C-SW	220	USEPA (2018)	No	No	BSV
Cadmium	D	7440-43-9	0 / 4			5		9.3	Rule 3745-1-35 (OMZM)	No	No	ND1
Cadmium	T	7440-43-9	0 / 4			5		9.9	Rule 3745-1-35 (OMZM)	No	No	ND1
Chromium	D	7440-47-3	3 / 4	10	J	10	T2-1820-C-SW; T2-1820-C-SW	1000	Rule 3745-1-35 (OMZM)	No	No	BSV
Chromium	T	7440-47-3	3 / 4	10	J	10	T2-1820-C-SW; T2-1820-C-SW	3200	Rule 3745-1-35 (OMZM)	No	No	BSV
Chromium (VI)	D	18540-29-9	0 / 4			20		11	USEPA (2024)	No	No	ND2
Chromium (VI)	T	18540-29-9	0 / 4			20		11	USEPA (2024)	No	No	ND2
Copper	D	7440-50-8	0 / 4			25		26	Rule 3745-1-35 (OMZM)	No	No	ND1
Copper	T	7440-50-8	0 / 4			25		27	Rule 3745-1-35 (OMZM)	No	No	ND1
Lead	D	7439-92-1	0 / 4			10		230	Rule 3745-1-35 (OMZM)	Yes	No	ND1
Lead	T	7439-92-1	0 / 4			10		300	Rule 3745-1-35 (OMZM)	Yes	No	ND1
Mercury	D	7439-97-6	0 / 4			0.2		1.4	Rule 3745-1-35 (OMZM)	Yes	No	ND1
Mercury	T	7439-97-6	0 / 4			0.2		1.7	Rule 3745-1-35 (OMZM)	Yes	No	ND1
Selenium	D	7782-49-2	0 / 4			20		5	USEPA (2003)	No	No	ND2
Selenium	T	7782-49-2	0 / 4			20		5	USEPA (2003)	No	No	ND2
Silver	D	7440-22-4	0 / 4			10		3.2	USEPA (2024)	No	No	ND2
Silver	T	7440-22-4	0 / 4			10		3.2	USEPA (2024)	No	No	ND2
Zinc	D	7440-66-6	2 / 4	50		50		210	Rule 3745-1-35 (OMZM)	No	No	BSV
Zinc	T	7440-66-6	3 / 4	130		50	T2-750-C-SW; T2-750-C-SW	220	Rule 3745-1-35 (OMZM)	No	No	BSV
PAHs												
Acenaphthene	T	83-32-9	0 / 4			0.2		38	USEPA (2003)	No	No	ND1
Acenaphthylene	T	208-96-8	0 / 4			0.2		4840	USEPA (2003)	No	No	ND1
Anthracene	T	120-12-7	0 / 4			0.2		0.035	USEPA (2003)	No	No	ND2
Benzo[a]anthracene	T	56-55-3	0 / 4			0.2		0.025	USEPA (2003)	No	No	ND2
Benzo[a]pyrene	T	50-32-8	0 / 4			0.2		0.014	USEPA (2003)	No	No	ND2
Benzo[b]fluoranthene	T	205-99-2	1 / 4	0.2	J	0.2	T2-0-C-SW	9.07	USEPA (2003)	No	No	BSV
Benzo[ghi]perylene	T	191-24-2	0 / 4			0.2		0.012	USEPA (2018)	No	No	ND2
Benzo[k]fluoranthene	T	207-08-9	0 / 4			0.2		0.06	USEPA (2018)	No	No	ND2
Chrysene	T	218-01-9	0 / 4			0.2		4.7	USEPA (2018)	No	No	ND1
Dibenz[a,h]anthracene	T	53-70-3	0 / 4			0.2		0.012	USEPA (2018)	No	No	ND2
Fluoranthene	T	206-44-0	1 / 4	0.21		0.2	T2-0-C-SW	1.9	USEPA (2003)	No	No	BSV
Fluorene	T	86-73-7	0 / 4			0.2		19	USEPA (2003)	No	No	ND1
Indeno[1,2,3-cd]pyrene	T	193-39-5	0 / 4			0.2		0.012	USEPA (2018)	No	No	ND2
Naphthalene	T	91-20-3	1 / 4	1.6		0.2	T2-0-C-SW	13	USEPA (2003)	No	No	BSV
Phenanthrene	T	85-01-8	1 / 4	0.2	J	0.2	T2-0-C-SW			No	No	NSV
Pyrene	T	129-00-0	1 / 4	0.2	J	0.2	T2-0-C-SW	4.6	USEPA (2018)	No	No	BSV

Table 2. COPEC Screening for Surface Water

Chemical	Fraction	CAS Number	FOD	Maximum Detected Concentration (µg/L)	Maximum Reporting Limit (µg/L)	Location of Maximum Detected Concentration	Screening Value (µg/L)	Screening Value Source	PBT (Yes/No) [a]	COPEC (Yes/No)	Reason for Selection or Deletion [b]
Physico-chemical Measurements											
Free Cyanide	T	57-12-5	4 / 4	26	6	T2-1820-C-SW	5.2	USEPA (2024)	No	Yes	ASV
Total Cyanide	T	57-12-5	4 / 4	440	10	T2-1820-C-SW			No	No	NSV

Sources:

USEPA. 2003. Region 5 RCRA ecological screening levels. U.S. Environmental Protection Agency. August 22.

USEPA. 2018. Region 4 ecological risk assessment supplemental guidance. March Update. Available at: https://www.epa.gov/sites/default/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf. U.S. Environmental Protection Agency.

USEPA 2024. National recommended water quality criteria - Aquatic life criteria table. Available at: www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table#table. Last updated on October 9, 2024. U.S. Environmental Protection Agency.

Notes:

Highlighted chemicals are retained as sediment COPECs for further evaluation

COPEC = chemical of potential ecological concern

D = dissolved

FOD = frequency of detection

Ohio EPA = Ohio Environmental Protection Agency

OMZM = outside mixing zone maximum

PAH = polycyclic aromatic hydrocarbon

PBT = persistent, bioaccumulative, and toxic

PCB = polychlorinated biphenyl

T = total

Data Qualifier:

J = estimated concentration

[a] Persistent, bioaccumulative, and toxic pollutant as identified in Ohio EPA (2018)

[b] Reason for selection or deletion

Selection reason : **ASV**: maximum detected concentration is above the screening value; **PBT**: chemical is detected and listed as persistent, bioaccumulative, and toxic

Deletion reason : **BSV**: maximum detected concentration falls below screening value; **NSV**: chemical detected but no screening value available (see Uncertainty Analysis); **ND1**: chemical not detected and reporting limit falls below screening value; **ND2**: chemical not detected but reporting limit exceeds screening value (see Uncertainty Analysis); **ND3**: chemical not detected and lacks screening value

Table 3. COPEC Screening for Surface Sediment

Chemical	CAS Number	FOD	Maximum Detected Concentration (mg/kg)		Maximum Reporting Limit (mg/kg)	Location of Maximum Detected Concentration	Screening Value (mg/kg)	Screening Value Source	Ohio EPA SRV [a]	PBT (Yes/No) [b]	COPEC (Yes/No)	Reason for Selection or Deletion [c]
Metals												
Arsenic	7440-38-2	41 / 41	27		2.9	T2-1000-C-0.0	9.79	MacDonald et al. 2000	25	No	Yes	ASV
Barium	7440-39-3	41 / 41	93		39	T2-0-S-0.0; T2-1500-S-0.0	20	EPA Region 4, 2018	190	No	Yes	ASV
Cadmium	7440-43-9	40 / 41	0.58	J	0.98	T2-375-S-0.0	0.99	MacDonald et al. 2000	0.79	No	No	BSV
Chromium	7440-47-3	41 / 41	40		2	T2-250-N-0.0	43.4	MacDonald et al. 2000	29	No	No	BSV
Chromium (VI)	18540-29-9	8 / 41	2.8	J	4.1	T2-1250-S-0.0		NSV		No	No	NSV
Copper	7440-50-8	41 / 41	20		4.9	T2-250-2-0.0; T2-625-N-0.0	31.6	MacDonald et al. 2000	32	No	No	BSV
Lead	7439-92-1	41 / 41	30		2	T2-250-N-0.0	35.8	MacDonald et al. 2000	47	Yes	Yes	PBT
Mercury	7439-97-6	23 / 41	0.22	J	0.23	T2-100-N-0.0	0.18	MacDonald et al. 2000	0.12	Yes	Yes	PBT
Selenium	7782-49-2	29 / 41	3.6	J	3.9	T2-250-N-0.0	0.72	EPA Region 4, 2018	1.7	No	Yes	ASV
Silver	7440-22-4	0 / 41			2		1	EPA Region 4, 2018	0.43	No	No	ND2
Zinc	7440-66-6	41 / 41	4800		38	T2-375-S-0.0	121	MacDonald et al. 2000	160	No	Yes	ASV
PAHs												
Acenaphthene	83-32-9	14 / 41	0.37		0.31	T2-1820-N-0.0		NSV		No	No	NSV
Acenaphthylene	208-96-8	10 / 41	0.31		0.31	T2-100-N-0.0; T2-875-S-0.0		NSV		No	No	NSV
Anthracene	120-12-7	30 / 41	1.3		0.31	T2-1820-N-0.0	0.0572	MacDonald et al. 2000		No	Yes	ASV
Benzo[a]anthracene	56-55-3	37 / 41	4.9		0.31	T2-1820-N-0.0	0.108	MacDonald et al. 2000		No	Yes	ASV
Benzo[a]pyrene	50-32-8	37 / 41	5.5		0.31	T2-1820-N-0.0	0.15	MacDonald et al. 2000		No	Yes	ASV
Benzo[b]fluoranthene	205-99-2	38 / 41	7.7		0.31	T2-1820-N-0.0		NSV		No	No	NSV
Benzo[ghi]perylene	191-24-2	34 / 41	4		0.31	T2-1820-N-0.0		NSV		No	No	NSV
Benzo[k]fluoranthene	207-08-9	36 / 41	3		0.31	T2-1820-N-0.0		NSV		No	No	NSV
Chrysene	218-01-9	37 / 41	6.6		0.31	T2-1820-N-0.0	0.166	MacDonald et al. 2000		No	Yes	ASV
Dibenz[a,h]anthracene	53-70-3	32 / 41	0.93		0.31	T2-1820-N-0.0	0.033	MacDonald et al. 2000		No	Yes	ASV
Fluoranthene	206-44-0	38 / 41	17		0.31	T2-1820-N-0.0	0.423	MacDonald et al. 2000		No	Yes	ASV
Fluorene	86-73-7	20 / 41	0.6		0.31	T2-1820-N-0.0	0.0774	MacDonald et al. 2000		No	Yes	ASV
Indeno[1,2,3-cd]pyrene	193-39-5	37 / 41	3.3		0.31	T2-1820-N-0.0		NSV		No	No	NSV
Naphthalene	91-20-3	20 / 41	0.31		0.31	T2-100-N-0.0	0.176	MacDonald et al. 2000		No	Yes	ASV
Phenanthrene	85-01-8	35 / 41	9.6		0.31	T2-1820-N-0.0	0.204	MacDonald et al. 2000		No	Yes	ASV
Pyrene	129-00-0	37 / 41	12		0.31	T2-1820-N-0.0	0.195	MacDonald et al. 2000		No	Yes	ASV
Physico-chemical measurements												
Total Cyanide		39 / 41	350		47	T2-1375-N-0.0		NSV		No	No	NSV

Sources:

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. *Arch. Environ. Contam. Toxicol*. 39:20-31.

Ohio EPA. 2018. Ecological risk assessment guidance document. Ohio Environmental Protection Agency, Division of Environmental Response and Revitalization Assessment, Remediation and Corrective Action Section. July.

USEPA. 2018. Region 4 ecological risk assessment supplemental guidance. March Update. Available at: https://www.epa.gov/sites/default/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf. U.S. Environmental Protection Agency.

Notes:

Highlighted chemicals are retained as sediment COPECs for further evaluation

COPEC = chemical of potential ecological concern

FOD = frequency of detection

Ohio EPA = Ohio Environmental Protection Agency

PAH = polycyclic aromatic hydrocarbon

Data Qualifier:

J = estimated concentration

[a] Ohio-specific sediment reference values for Erie-Ontario Lake Plain (Ohio EPA 2018)

[b] Persistent, bioaccumulative, and toxic pollutant as identified in Ohio EPA (2018)

[c] Reason for selection or deletion

Table 3. COPEC Screening for Surface Sediment

Chemical	CAS Number	FOD	Maximum Detected Concentration (mg/kg)	Maximum Reporting Limit (mg/kg)	Location of Maximum Detected Concentration	Screening Value (mg/kg)	Screening Value Source	Ohio EPA SRV [a]	PBT (Yes/No) [b]	COPEC (Yes/No)	Reason for Selection or Deletion [c]

PBT = persistent, bioaccumulative, toxic
PCB = polychlorinated biphenyls
SRV = sediment reference value

Selection reason : **ASV**: maximum detected concentration is above the screening value; **PBT**: chemical is detected and listed as persistent, bioaccumulative, and toxic

Deletion reason : **BSV**: maximum detected concentration falls below screening value; **NSV**: chemical detected but no screening value available (see Uncertainty Analysis); **FOD:** chemical was detected but the frequency of detection was <5%; **ND1**: chemical not detected and RL falls below screening value; **ND2**: chemical not detected but RL exceeds screening value (see Uncertainty Analysis); **ND3**: chemical not detected and lacks screening value

Attachment A

Extent of Hazardous Substances in the Assessment Area

Transect 100	North Bank		South Bank	
Depth (feet):	0.0-0.5		0.0-0.5	2.0-2.5
Sample Date:	10/25/2024		10/25/2024	10/28/2024
Parameters				
BaA	1.5	*	0.740	<0.052
BaP	1.9	*	0.910	* <0.052
BbF	2.9	*	1.3	* <0.052
DBA	0.310	*	0.140	* <0.052
IP	1.2	*	0.590	<0.052
As	13.0	*	11.0	* 14.0 *
Cr IV	<0.180		0.220	<0.520
Zn	1,200		1,000	55.0
Total CN	7.7	*	130	* 0.660

Transect 375	North Bank		Center		South Bank	
Depth (feet):	0.0-0.5		0.0-0.5		0.0-0.5	2.0-2.5
Sample Date:	10/25/2024		10/25/2024		10/25/2024	10/25/2024
Parameters						
BaA	0.570		0.210		0.300	<0.020
BaP	0.730	*	0.270	*	0.430	* 0.021
BbF	1.1	*	0.450		0.720	0.035
DBA	0.140	*	0.064		0.120	* <0.020
IP	0.560		0.230		0.370	0.016
As	9.9	*	12.0	*	12.0	* 5.3 *
Cr IV	<0.170		<0.200		<0.260	<0.180
Zn	740		2,400	*	4,800	* 140
Total CN	57.6	*	190	*	270	* 40.0 *

Transect 625	North Bank		South Bank	
Depth (feet):	0.0-0.5		0.0-0.5	2.0-2.5
Sample Date:	10/24/2024		10/24/2024	10/24/2024
Parameters				
BaA	0.039		0.320	0.024
BaP	0.050		0.330	* 0.026
BbF	0.078		0.530	0.044
DBA	<0.021		0.060	<0.015
IP	0.036		0.230	0.020
As	1 16.0	*	9.8	* 13.0 *
Cr IV	<0.190		<0.150	<0.170
Zn	130		1,300	140
Total CN	11.0	*	21.0	* 26.0 *

Transect 875	North Bank			Center		South Bank	
Depth (feet):	0.0-0.5		2.0-2.5	1.0-1.5		0.0-0.5	1.5-2.0
Sample Date:	10/21/2024		10/24/2024	10/24/2024		10/23/2024	10/23/2024
Parameters							
BaA	<0.020		<0.020	<0.019		0.550	0.024
BaP	<0.018		<0.018	<0.018		0.740 *	0.020
BbF	<0.016		<0.016	0.016		1.2 *	0.041
DBA	<0.020		<0.020	<0.019		0.110 *	<0.019
IP	<0.016		<0.016	<0.015		0.400	0.017
As	13.0	*	11.0 *	14.0	*	11.0 *	19.0 *
Cr IV	<0.180		<0.180	<0.170		<0.210	<0.170
Zn	160		68.0	120		1,300	53.0
Total CN	24.0	*	1.1	1.3		160 *	8.2 *

Transect 1125	North Bank		South Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/21/2024	10/21/2024	10/21/2024	10/21/2024
Parameters				
BaA	0.650	0.022	0.590	0.026
BaP	0.910 *	0.021	0.800 *	0.034
BbF	1.6 *	0.041	1.5 *	0.050
DBA	0.130 *	<0.019	0.140 *	<0.019
IP	0.520	<0.015	0.600	0.021
As	13.0 *	16.0 *	13.0 *	11.0 *
Cr IV	<0.250	<0.180	<0.210	<0.170
Zn	1,300	90.0	1,900	73.0
Total CN	<42.0	230 *	49.0 *	240 *

Transect 1375	North Bank		South Bank/DUP-2	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/22/2024	10/23/2024	10/22/2024	10/22/2024
Parameters				
BaA	0.550	0.069	0.020	<0.019
BaP	0.810 *	0.094	0.024	<0.018
BbF	1.3 *	0.140	0.046	<0.016
DBA	0.140 *	<0.019	<0.020	<0.019
IP	0.590	0.057	0.022	<0.016
As	14.0 *	17.0 *	14.0 *	11.0 *
Cr IV	<0.260	<0.170	<0.150	<0.170
Zn	3,700 *	77.0	150	72.0
Total CN	350 *	5.9 *	21.0 *	1.8

Transect 1625	North Bank			Center		South Bank / DUP-3	
Depth (feet):	0.0-0.5		2.0-2.5	2.0-2.5		0.0-0.5	2.0-2.5
Sample Date:	10/23/2024		10/23/2024	10/23/2024		10/23/2024	10/23/2024
Parameters							
BaA	0.210		<0.020	<0.020		0.390	0.029
BaP	0.280		<0.018	<0.018		0.550 *	0.038
BbF	0.520		<0.016	<0.016		1.0	0.069
DBA	0.061		<0.020	<0.020		0.087	0.020
IP	0.240		<0.016	<0.016		0.420	0.027
As	9.9	*	50.0 *	7.5	*	12.0 *	8.6 *
Cr IV	<0.240		<0.180	<0.190		<0.180	<0.170
Zn	2,300	*	58.0	58.0		1,200	84.0
Total CN	220	*	3.9 *	150	*	37.0 *	1.2

U.S. EPA 2024 RSLs	RESIDENT SOIL RSLs (1)
Semi-Volatile Organic Compounds (sVOCs)	
Benzo(a)anthracene (BaA)	7.1
Benzo(a)pyrene (BaP)	0.11
Benzo(b)fluoranthene (BbF)	1.1
Dibenz(a,h)anthracene (DBA)	0.11
Indeno(1,2,3-cd)pyrene (IP)	1.1
All Other Analyzed sVOCs	Varies
Metals	
Arsenic (As)	0.68
Chromium (Hexavalent) (CrVI)	0.3
Zinc (Zn)	2,300
All Other Analyzed Metals	Varies
Cyanide	
Free Cyanide (CN)	NE
Total Cyanide (CN)	2.3

Abbreviations & Notes:
BRL = Below Laboratory Reporting Limits
RSLs = Regional Screening Levels
U.S. EPA = United States Environmental Protection Agency
All results and U.S. EPA Screening Levels are reported in milligrams per kilogram (mg/kg).
U.S. EPA RSLs are based on the Regional Screening Levels Generic Tables April 2024 Update.
RSLs are based on a 1E-6 target cancer risk and a 0.1 target hazard quotient (THQ)
The following denote the color of screening level exceedances:
* = At or Above U.S. EPA 2024 Resident Soil RSLs

Transect 0	North Bank		South Bank/ DUP-7	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/28/2024	10/28/2024	10/28/2024	10/28/2024
Parameters				
BaA	0.100	<0.053	<0.019	<0.048
BaP	0.130 *	<0.053	<0.049	<0.048
BbF	0.210	<0.053	<0.049	<0.048
DBA	0.033	<0.053	<0.049	<0.048
IP	0.095	<0.053	<0.049	<0.048
As	17.0 *	11.0 *	18.0 *	28.0 *
Cr IV	<0.610	0.910 *	1.8 *	<0.450
Zn	2,100	68.0	100	65.0
Total CN	230 *	1.1	49.0 *	1.6

Transect 250	North Bank / DUP-6		South Bank	
Depth (feet):	0.0-0.5	1.0-1.5	0.0-0.5	
Sample Date:	10/25/2024	10/25/2024	10/25/2024	
Parameters				
BaA	2.0 *	0.027	0.410	
BaP	2.8 *	0.034	0.460 *	
BbF	3.8 *	0.057	0.620	
DBA	0.400 *	<0.018	0.081	
IP	1.7 *	0.025	0.310	
As	13.0 *	15.0 *	12.0 *	
Cr IV	<0.240	<0.170	<0.150	
Zn	4,100 *	86.0	230	
Total CN	170 *	31.0 *	33.0 *	

Transect 500	North Bank		South Bank / DUP-5	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/24/2024	10/25/2024	10/24/2024	10/25/2024
Parameters				
BaA	0.062	<0.020	0.130	<0.020
BaP	0.072	<0.018	0.150 *	<0.018
BbF	0.100	<0.016	0.210	<0.016
DBA	<0.020	<0.020	0.030	<0.020
IP	0.053	<0.016	0.088	<0.016
As	11.0 *	8.0 *	15.0 *	15.0 *
Cr IV	<0.180	<0.150	<0.150	<0.150
Zn	260	61.0	680	60.0
Total CN	31.0 *	<0.720	57.0 *	<0.750

Transect 750	North Bank / DUP-4		South Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/24/2024	10/24/2024	10/24/2021	10/24/2024
Parameters				
BaA	1.5 *	<0.019	0.400	0.025
BaP	1.4 *	<0.018	0.460 *	0.028
BbF	2.0 *	<0.015	0.740	0.045
DBA	0.210 *	<0.019	0.084	<0.018
IP	0.880	<0.015	0.320	0.019
As	12.0 *	7.7 *	12.0 *	16.0 *
Cr IV	0.470 *	<0.170	<0.200	<0.170
Zn	220	74.0	470	80.0
Total CN	72.0 *	0.730	110 *	4.9 *

Transect 1000	North Bank		Center		South Bank / DUP-1	
Depth (feet):	0.0-0.5		2.0-2.5		0.0-0.5	2.0-2.5
Sample Date:	10/21/2024		10/21/2024		10/21/2024	10/21/2024
Parameters						
BaA	0.033		1.4 *	0.024	0.900	0.092
BaP	0.045		1.7 *	0.032	1.3 *	0.120 *
BbF	0.061		2.4 *	0.060	2.1 *	0.180
DBA	<0.020		0.280 *	<0.019	0.190 *	0.027
IP	0.028		1.1 *	0.020	0.780	0.070
As	13.0 *		27.0 *	12.0 *	10.0 *	11.0 *
Cr IV	<0.190		<0.170	<0.150	<0.150	<0.220
Zn	71.0		730	63.0	500	86.0
TotalCN	9.2 *		250 *	29.0 *	89.0 *	93.0 *

Transect 1250	North Bank		South Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/22/2024	10/22/2024	10/21/2024	10/22/2024
Parameters				
BaA	0.510	<0.019	0.690	0.170
BaP	0.620 *	<0.017	0.920 *	0.230 *
BbF	1.2 *	<0.015	1.6 *	0.310
DBA	0.100	<0.019	0.150 *	0.045
IP	0.510	<0.015	0.630	0.130
As	11.0 *	9.5 *	11.0 *	12.0 *
Cr IV	<0.210	<0.150	1.7 *	<0.150
Zn	1,400	71.0	4,300 *	130
Total CN	220 *	29.0 *	<47.0	43.0 *

Transect 1500	North Bank		South Bank	
Depth (feet):	0.0-0.5	2.0-2.5	0.0-0.5	2.0-2.5
Sample Date:	10/22/2024	10/22/2024	10/22/2024	10/22/2024
Parameters				
BaA	0.980	<0.018	<0.018	<0.019
BaP	1.1 *	<0.017	<0.017	<0.018
BbF	1.6 *	0.020	<0.014	<0.015
DBA	0.160 *	<0.018	<0.018	<0.019
IP	0.680	<0.014	<0.014	<0.015
As	8.7 *	13.0 *	11.0 *	13.0 *
Cr IV	<0.200	<0.170	<0.170	<0.170
Zn	1,100	66.0	80.0	61.0
Total CN	120 *	3.2 *	7.0 *	<0.530

Transect 1750	North Bank		South Bank	
Depth (feet):	0.0-0.5		0.0-0.5	
Sample Date:	10/23/2024		10/23/2024	
Parameters				
BaA	0.850		0.420	
BaP	1.2 *		0.530 *	
BbF	1.8 *		0.790	
DBA	0.190 *		0.096	
IP	0.850		0.350	
As	11.0 *		7.3 *	
Cr IV	0.460 *		0.490 *	
Zn	230		220	
Total CN	15.0 *		2.2	

Transect 1820	North Bank		Center		South Bank	
Depth (feet):	0.0-0.5		1.0-1.5		0.0-0.5	2.0-2.5
Sample Date:	10/23/2024		10/23/2024		10/23/2024	10/23/2024
Parameters						
BaA	4.9 *		0.610		0.570	0.190
BaP	5.5 *		0.530 *		0.710 *	0.170 *
BbF	7.7 *		0.740		1.0	0.250
DBA	0.930 *		0.077		0.100	0.036
IP	3.3		0.280		0.420	0.050
As	7.8 *		16.0 *		16.0 *	12.0 *
Cr IV	<0.220		<0.170		<0.170	<0.170
Zn	160		92.0		150	61.0
Total CN	11.0 *		1.5		1.4	<0.560

S Briarcliff Dr

Cardinal Dr

T2-0 T2-100 T2-250 T2-375 T2-500 T2-625 T2-750 T2-875 T2-1000 T2-1125 T2-1250 T2-1375 T2-1500 T2-1625 T2-1750 T2-1820

Subject Property
Sawmill Creek
Soil Sample

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation - Canfield

Sawmill Creek -
Soil Analytical Results Map

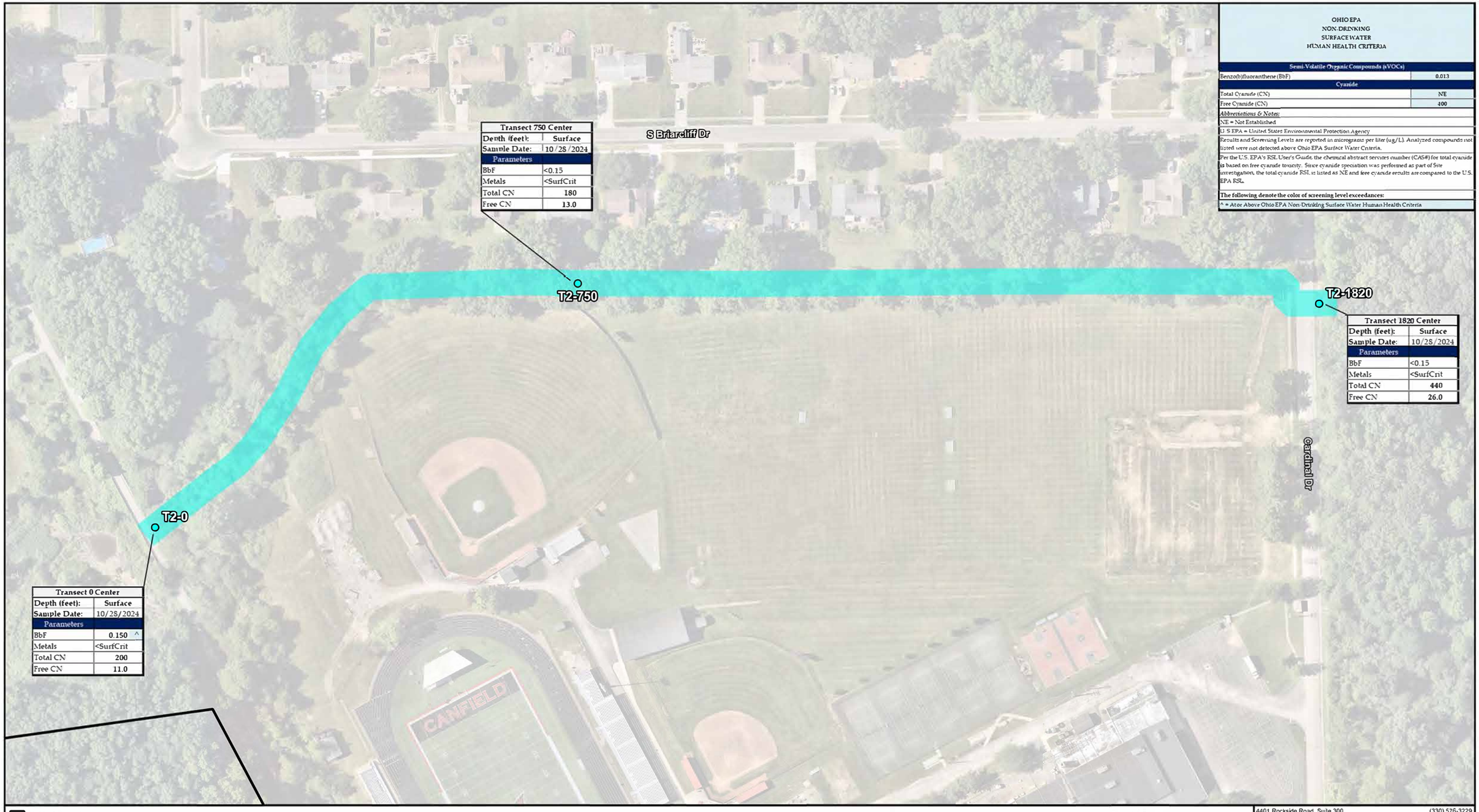
460 West Main Street
Canfield, Ohio 44406

N

0 75 150 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372
DATE: 12/12/2024
FIGURE: 7
SCALE: 1:1,500
CREATED BY: CC



Transect 750 Center	
Depth (feet):	Surface
Sample Date:	10/28/2024
Parameters	
BbF	<0.15
Metals	<SurfCrit
Total CN	180
Free CN	13.0

Transect 1820 Center	
Depth (feet):	Surface
Sample Date:	10/28/2024
Parameters	
BbF	<0.15
Metals	<SurfCrit
Total CN	440
Free CN	26.0

Transect 0 Center	
Depth (feet):	Surface
Sample Date:	10/28/2024
Parameters	
BbF	0.150 ^
Metals	<SurfCrit
Total CN	200
Free CN	11.0

OHIO EPA NON-DRINKING SURFACE WATER HUMAN HEALTH CRITERIA

Semi-Volatile Organic Compounds (sVOCs)	
Benzo(b)fluoranthene (BbF)	0.013
Cyanide	
Total Cyanide (CN)	NE
Free Cyanide (CN)	400

Abbreviations & Notes:

NE = Not Established

U S EPA = United States Environmental Protection Agency

Results and Screening Levels are reported in micrograms per liter (ug/L). Analyzed compounds not listed were not detected above Ohio EPA Surface Water Criteria.

Per the U.S. EPA's RSL User's Guide, the chemical abstract services number (CAS#) for total cyanide is based on free cyanide toxicity. Since cyanide speciation was performed as part of Site investigation, the total cyanide RSL is listed as NE and free cyanide results are compared to the U.S. EPA RSL.

The following denote the color of screening level exceedances:

^ = Ator Above Ohio EPA Non-Drinking Surface Water Human Health Criteria

Subject Property

Sawmill Creek

Neannap Aerial Imagery: June 15, 2024

Material Sciences Corporation - Canfield

Sawmill Creek - Surface Water Analytical Results Map

460 West Main Street
Canfield, Ohio 44406

N

0 75 150 ft

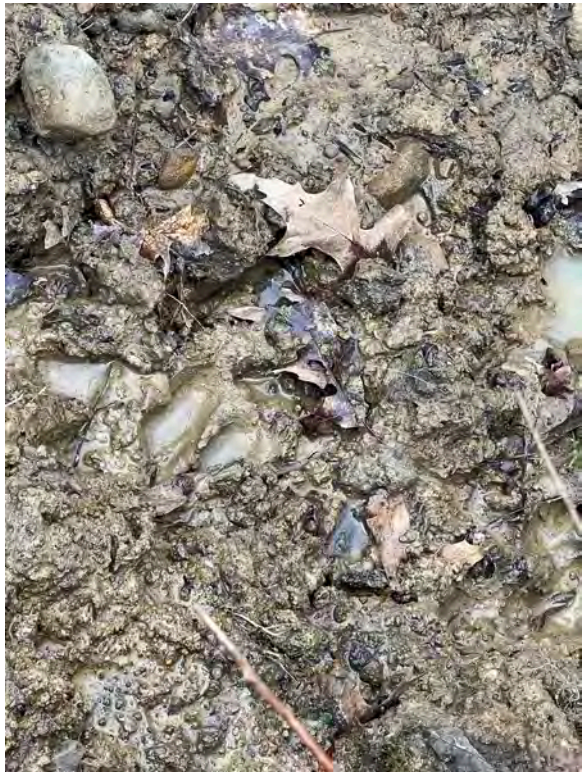
4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229
August Mack ENVIRONMENTAL

PROJECT NO.: JY2380.372	DATE: 12/12/2024
	SCALE: 1:1,500
FIGURE: 10	CREATED BY: CC

Attachment B

April 2025 Photo Log





File Name: IMG_1109
DateTime: 2025:04:01 10:37:15
Latitude: 41.03008611
Longitude: -80.77742778
Description: Floodplain soil including deer tracks and leaf litter.



File Name: IMG_1115
DateTime: 2025:04:01 10:40:57
Latitude: 41.0299
Longitude: -80.77776389
Description: Shallow creek that runs along the high school to the west of the trail.



File Name: IMG_1117
DateTime: 2025:04:01 10:44:34
Latitude: 41.03011389
Longitude: -80.77787778
Description: Dilapidated wooden footbridge that crosses over the high school creek. Facing the culvert under the trail.



File Name: IMG_1118
DateTime: 2025:04:01 10:44:43
Latitude: 41.02989444
Longitude: -80.77777222
Description: Debris and rocks at base of culvert beneath the bike trail.



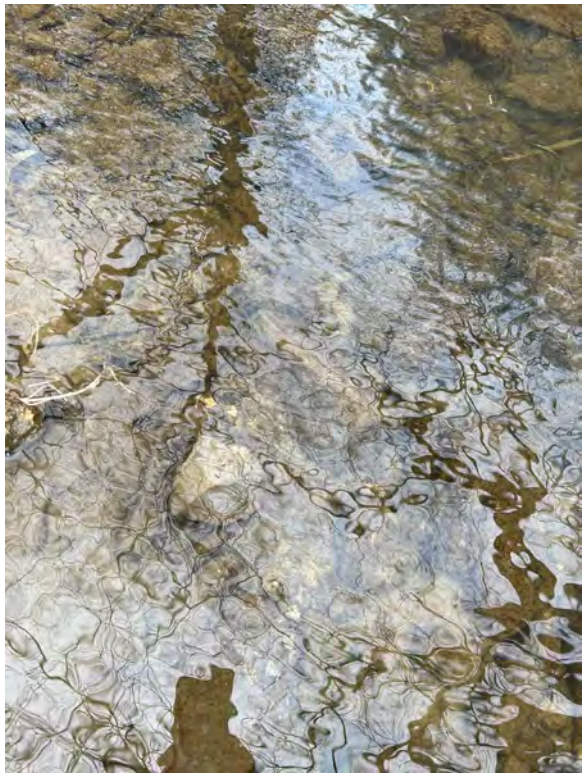
File Name: IMG_1119
DateTime: 2025:04:01 10:46:21
Latitude: 41.03001111
Longitude: -80.77769444
Description: Sawmill creek near culvert. Large rocks, small cobbles, miscellaneous debris, and floodplain characterized by erosion with exposed roots on southern bank.



File Name: IMG_1120
DateTime: 2025:04:01 10:46:31
Latitude: 41.02998333
Longitude: -80.77774722
Description: Sawmill Creek looking downstream.



File Name: IMG_1121
DateTime: 2025:04:01 10:46:32
Latitude: 41.02997222
Longitude: -80.77773333
Description: Sawmill Creek looking upstream.



File Name: IMG_1123
DateTime: 2025:04:01 10:47:05
Latitude: 41.029975
Longitude: -80.77771111
Description: Clear, shallow Sawmill Creek with visible rocky substrate.



File Name: IMG_1125
DateTime: 2025:04:01 10:49:33
Latitude: 41.03001111
Longitude: -80.77771667
Description: Sawmill Creek facing downstream.



File Name: IMG_1127
DateTime: 2025:04:01 10:49:38
Latitude: 41.02998611
Longitude: -80.77771111
Description: Sawmill Creek facing downstream, connected floodplain on northern bank, substantial erosion and undercutting on southern bank.



File Name: IMG_1128
DateTime: 2025:04:01 10:49:42
Latitude: 41.02998333
Longitude: -80.77771111
Description: Debris along southern eroded bank.



File Name: IMG_1135
DateTime: 2025:04:01 10:51:50
Latitude: 41.02995
Longitude: -80.77763333
Description: Dense thicket of leafless shrubs and trees with visible ground littered with dry leaves observed in a wooded area during late winter or early spring.



File Name: IMG_1136
DateTime: 2025:04:01 10:51:51
Latitude: 41.02995278
Longitude: -80.77759444
Description: Dense understory vegetation and leafless deciduous trees with scattered fallen branches are present in a woodland area during early spring.



File Name: IMG_1137
DateTime: 2025:04:01 10:52:32
Latitude: 41.030125
Longitude: -80.77733611
Description: Creek and floodplain facing north.



File Name: IMG_1139
DateTime: 2025:04:01 10:52:44
Latitude: 41.03012778
Longitude: -80.77738056
Description: Undercutting and exposed tree roots.



File Name: IMG_1140
DateTime: 2025:04:01 10:53:34
Latitude: 41.03019722
Longitude: -80.77731389
Description: Sawmill Creek and floodplain facing north.



File Name: IMG_1141
DateTime: 2025:04:01 10:53:40
Latitude: 41.03019722
Longitude: -80.77729722
Description: Overhanging vegetation along floodplain.



File Name: IMG_1143
DateTime: 2025:04:01 10:54:51
Latitude: 41.03026944
Longitude: -80.77705278
Description: Floodplain of Sawmill Creek (facing downstream).



File Name: IMG_1144
DateTime: 2025:04:01 10:54:54
Latitude: 41.03027778
Longitude: -80.77706944
Description: Floodplain of Sawmill Creek (facing upstream).



File Name: IMG_1156
DateTime: 2025:04:01 11:12:52
Latitude: 41.03080833
Longitude: -80.77648889
Description: Sawmill Creek floodplain and creek. Residential area in background.



File Name: IMG_1157
DateTime: 2025:04:01 11:12:55
Latitude: 41.03068611
Longitude: -80.77651944
Description: Riparian zone adjacent to Sawmill Creek.



File Name: IMG_1159
DateTime: 2025:04:01 11:13:28
Latitude: 41.03062778
Longitude: -80.77629722
Description: A wooden footbridge with rusted metal railings spanning Sawmill Creek.



File Name: IMG_1161
DateTime: 2025:04:01 11:13:40
Latitude: 41.03065556
Longitude: -80.77632778
Description: View of northern floodplain from footbridge.



File Name: IMG_1163
DateTime: 2025:04:01 11:13:50
Latitude: 41.03066389
Longitude: -80.77629722
Description: Looking upstream from footbridge. Pine needles scattered along floodplain.



File Name: IMG_1166
DateTime: 2025:04:01 11:14:32
Latitude: 41.03063889
Longitude: -80.77628333
Description: Base of footbridge with erosion.



File Name: IMG_1169
DateTime: 2025:04:01 11:14:37
Latitude: 41.03064722
Longitude: -80.77626667
Description: The ground surface in a forested area is covered with dry pine needles, numerous pinecones, small patches of grass, and a few scattered sticks.



File Name: IMG_1170
DateTime: 2025:04:01 11:15:06
Latitude: 41.03064444
Longitude: -80.77610833
Description: A burrow entrance surrounded by dry leaves and pine needles is observed on the forest floor.



File Name: IMG_1171
DateTime: 2025:04:01 11:15:09
Latitude: 41.03065556
Longitude: -80.77608611
Description: Sawmill Creek floodplain with exposed roots.



File Name: IMG_1172
DateTime: 2025:04:01 11:15:21
Latitude: 41.03063333
Longitude: -80.77604722
Description: Sawmill Creek and a residential area in the background.



File Name: IMG_1173
DateTime: 2025:04:01 11:17:07
Latitude: 41.03067778
Longitude: -80.77584167
Description: Sawmill Creek, looking upstream.



File Name: IMG_1174
DateTime: 2025:04:01 11:17:10
Latitude: 41.03068611
Longitude: -80.77581667
Description: Sawmill Creek, looking downstream near 452 Briarcliff.



File Name: IMG_1175
DateTime: 2025:04:01 11:17:14
Latitude: 41.03068056
Longitude: -80.77583333
Description: Sawmill Creek (looking upstream) and floodplain. Fencing near high school baseball field in background.



File Name: IMG_1176
DateTime: 2025:04:01 11:17:16
Latitude: 41.03067778
Longitude: -80.775825
Description: Sawmill Creek (looking downstream) and floodplain. Fencing near high school baseball field in background.



File Name: IMG_1178
DateTime: 2025:04:01 11:18:21
Latitude: 41.03068889
Longitude: -80.77576389
Description: Sawmill Creek and floodplain.



File Name: IMG_1179
DateTime: 2025:04:01 11:18:24
Latitude: 41.03068889
Longitude: -80.77566667
Description: Sawmill Creek and floodplain. Residential area in background.



File Name: IMG_1180
DateTime: 2025:04:01 11:19:23
Latitude: 41.03062778
Longitude: -80.77514722

Description: An exposed animal burrow.



File Name: IMG_1181
DateTime: 2025:04:01 11:19:34
Latitude: 41.03062778
Longitude: -80.77512222
Description: Potential burrow, exposed tree roots, scattered pine needles, fallen leaves, and several pinecones.



File Name: IMG_1182
DateTime: 2025:04:01 11:19:43
Latitude: 41.03064444
Longitude: -80.77510833
Description: A black culvert pipe is situated on the bank of a shallow, leaf-littered stream flowing through a residential area with sparsely vegetated ground and overhanging deciduous trees.



File Name: IMG_1183
DateTime: 2025:04:01 11:20:00
Latitude: 41.030625
Longitude: -80.77505556
Description: A small drainage pipe discharges into a shallow, leaf-strewn creek with overhanging trees and residential structures visible in the background.



File Name: IMG_1185
DateTime: 2025:04:01 11:20:21
Latitude: 41.030625
Longitude: -80.77499444
Description: A small animal burrow entrance surrounded by pine needles and pinecones is observed on the forest floor, with visible tree roots and minimal vegetation.



File Name: IMG_1186
DateTime: 2025:04:01 11:20:37
Latitude: 41.03063611
Longitude: -80.77485556
Description: Footbridge #2 (foreground) and Footbridge #3 (background).



File Name: IMG_1187
DateTime: 2025:04:01 11:21:52
Latitude: 41.03064444
Longitude: -80.77456667
Description: Shallow and narrow section of Sawmill Creek. Grass next to residential area.



File Name: IMG_1189
DateTime: 2025:04:01 11:22:18
Latitude: 41.03064722
Longitude: -80.77440556
Description: Sawmill Creek floodplain (looking downstream).



File Name: IMG_1190
DateTime: 2025:04:01 11:22:36
Latitude: 41.03063889
Longitude: -80.77427778
Description: Sawmill Creek.



File Name: IMG_1191
DateTime: 2025:04:01 11:23:04
Latitude: 41.03065556
Longitude: -80.77411667
Description: Sawmill Creek.



File Name: IMG_1192
DateTime: 2025:04:01 11:23:31
Latitude: 41.03071111
Longitude: -80.77406389
Description: Sawmill Creek (looking downstream)



File Name: IMG_1193
DateTime: 2025:04:01 11:24:28
Latitude: 41.03054444
Longitude: -80.77350556
Description: Sawmill Creek (looking upstream)



File Name: IMG_1194
DateTime: 2025:04:01 11:24:31
Latitude: 41.03060556
Longitude: -80.77349167
Description: Debris in Sawmill Creek.



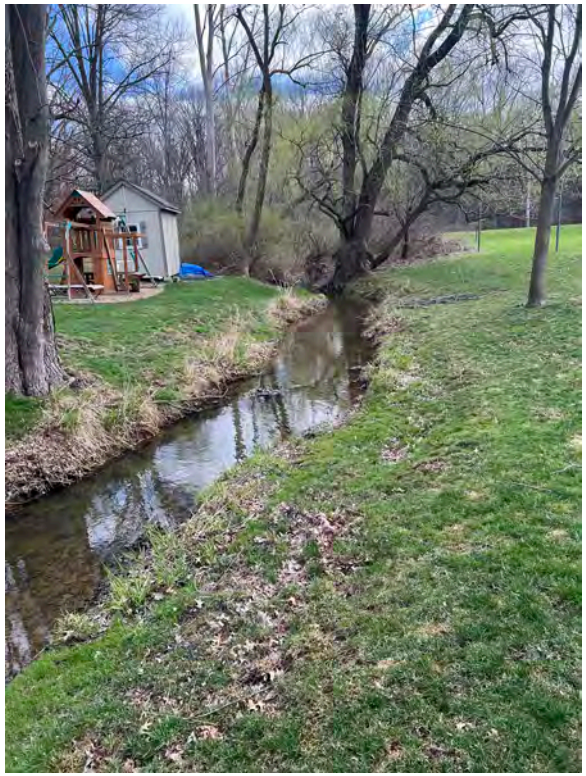
File Name: IMG_1195
DateTime: 2025:04:01 11:24:34
Latitude: 41.03063611
Longitude: -80.77348333
Description: Substrate in Sawmill Creek.



File Name: IMG_1196
DateTime: 2025:04:01 11:25:48
Latitude: 41.03069722
Longitude: -80.77281944
Description: Footbridge #4 (looking upstream).



File Name: IMG_1197
DateTime: 2025:04:01 11:25:50
Latitude: 41.03068889
Longitude: -80.77281944
Description: Northern stream bank and floodplain.



File Name: IMG_1198
DateTime: 2025:04:01 11:25:53
Latitude: 41.03068056
Longitude: -80.77281111
Description: Sawmill Creek (looking downstream).



File Name: IMG_1199
DateTime: 2025:04:01 11:26:29
Latitude: 41.03058889
Longitude: -80.77268333
Description: Sawmill Creek (looking downstream).



File Name: IMG_1200
DateTime: 2025:04:01 11:26:45
Latitude: 41.03059444
Longitude: -80.77253056
Description: Debris along floodplain.



File Name: IMG_1202
DateTime: 2025:04:01 11:28:26
Latitude: 41.03044167
Longitude: -80.77231667
Description: A black corrugated plastic drainage pipe discharges into Sawmill Creek.



File Name: IMG_1203
DateTime: 2025:04:01 11:28:28
Latitude: 41.03049444
Longitude: -80.772225
Description: Culvert under Cardinal Road.



File Name: IMG_1208
DateTime: 2025:04:01 11:32:46
Latitude: 41.03052222
Longitude: -80.77262222
Description: Floodplain (looking upstream) from high school soccer fields.

Attachment C

Ecological Scoping Checklist

Level I Attachment B
Ecological Scoping Checklist

Part 1			
SITE INFORMATION			
Site Name: Sawmill Creek		Date: 04/02/25	
Personnel: Jen Lyndall (Integral, lead) and Elisabeth Webber (August Mack) (Identify team leader)		Time Arrived: 10:27 Time Departed: 11:50	
Site Address: Canfield, OH 44406			
Site Location:	Latitude: 41.03069444	Longitude: -80.7745944	
Site Size (acres): Approx. 3.6 acres			
Weather Conditions (note any unusual conditions): Cloudy, scattered snow.			
Land uses at and adjacent to the site: (Circle all that apply and record at or adjacent)			
Residential Adjacent	Commercial	Recreational Adjacent	Industrial
Agricultural	Urban	Green-Space/ Undeveloped At/adjacent	Other:_____

Note: This checklist provides a suggested format. The format may be altered to fit the needs of the site; however, all pertinent information should be presented.

Part 2		
CONTAMINANTS OF INTEREST		
Contaminants of Interest and *Ecological Stressors* (Types, names including CASRN, classes, or specific *hazardous substances* and non-chemical stressors either known or suspected)	Onsite (O) or Adjacent (A) to the site	Media (soil, sediment, wetland, surface water, ground water (seeps/springs))
Benzo(a)pyrene	Onsite, adjacent	soil
Benzo(b)fluoranthene	Onsite, adjacent	soil, surface water
Arsenic	Onsite, adjacent	soil
Cyanide	Onsite, adjacent	soil
Benzo(a)anthrecene	Onsite, adjacent	soil
Dibenz(a,h)anthracene	Onsite, adjacent	soil
Indeno(1,2,3-cd)pyrene	Onsite, adjacent	soil
Chromium	Onsite, adjacent	soil
Zinc	Onsite adjacent	soil

Part 3

SPECIFIC EVALUATION OF ECOLOGICAL RECEPTORS/HABITAT a,

Terrestrial – Wooded _27___%of site

Dominant vegetation (circle one):
Coniferous (Deciduous) Mixed

Dominant tree diameter
diameter at breast height (*dbh*): ____ (inches)

Evidence/observation of wildlife*: squirrels, deer, birds

Terrestrial - Shrub/scrub/grasses __3__% of site

Dominant vegetation (circle one):
(shrub/scrub) grasses

vegetation density: (Dense) Patchy, Sparse
Prominent height of shrub/scrub (<2', (2' to 5', >5')
Prominent height of grasses/herbs (<2', 2' to 5', >5')
Evidence/observation of wildlife*:

Terrestrial - Ruderal/Engineered 68___% of site

Dominant vegetation/surfaces (circle one):
(Landscaped) Agricultural Bare ground
Parking lot Artificial surfaces
Dominant vegetation height (0', >0' - 2', 2' - 5', >5')
Vegetation Density: (Dense) Patchy Sparse
Evidence/observation of wildlife*:
Bird calls, squirrels

Aquatic - Non-Flowing (Lentic) ____% of site

Type: Lake Pond Vernal Pool Lagoon
Engineered** Impoundment Reservoir
Water source: Surface water Ground water
Industrial discharge Surface water runoff
Discharge Point: Surface water Ground water
Wetlands
Bottom Substrate***:
Vegetation: Submerged Emergent Floating
Wetland Present: (Yes/No)
Evidence/Observation of wildlife*:

Aquatic - Flowing (Lotic) _2___% of site

Aquatic Life Use Designation (if available) _____
Type: River (Stream) Intermittent Stream
Ditch
Water source: (Surface Water) Ground Water
Industrial discharge (seeps /springs)
Storm water runoff
Discharge Point: (Surface water) Ground water
Wetlands Impoundment
Bottom Substrate**:
Vegetation: Submerged Emergent Floating
Wetland Present: (Yes/No)
Evidence/Observation of Wildlife*:Bird calls, deer sign

Aquatic - Wetlands ____% of site

Size _____ (acres)
Obvious or designated wetland: (Yes / No)
Water source: Surface Water Ground Water
Industrial discharge Surface water runoff
Discharge Point: Surface water Ground water
Wetlands Impoundment
Bottom Substrate***:
Vegetation: Submerged Emergent Floating

Evidence/Observation of Wildlife*:

* Wildlife includes: macroinvertebrates, reptiles, amphibians, birds, mammals, and fish.
** Engineered can mean any surface water body that has been artificially created or significantly altered.
*** Bottom substrate types include but not limited to: cobble, gravel, sand, silt, clay, muck, artificial (*e.g.*, concrete).

Part 4
Ecologically Important Resources Observed

Attachment D

Letters to and from USFWS and ODNR, Responding to Queries about Threatened and Endangered Species

IPaC

U.S. Fish & Wildlife Service

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

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Location

Mahoning County, Ohio



Local office

Ohio Ecological Services Field Office

(614) 416-8993
(614) 416-8994

4625 Morse Road, Suite 104
Columbus, OH 43230-8355

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Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Indiana Bat Myotis sodalis Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5949	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

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Bald & Golden Eagles

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their nests, should follow appropriate regulations and implement required avoidance and minimization measures, as described in the various links on this page.

The data in this location indicates that no eagles have been observed in this area. This does

not mean eagles are not present in your project area, especially if the area is difficult to survey. Please review the 'Steps to Take When No Results Are Returned' section of the Supplemental Information on Migratory Birds and Eagles document to determine if your project is in a poorly surveyed area. If it is, you may need to rely on other resources to determine if eagles may be present (e.g. your local FWS field office, state surveys, your own surveys).

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Bald and Golden Eagle information is not available at this time

Bald & Golden Eagles FAQs

What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are an eagle (Bald and Golden Eagle Protection Act requirements may apply).

Proper interpretation and use of your eagle report

On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort line or no data line (red horizontal) means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide you in knowing when to implement avoidance and minimization measures to eliminate or reduce potential impacts from your project activities or get the appropriate permits should presence be confirmed.

How do I know if eagles are breeding, wintering, or migrating in my area?

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To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If an eagle on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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Migratory birds

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the

Department of Interior U.S. Fish and Wildlife Service (FWS). The incidental take of migratory birds is the injury or death of birds that results from, but is not the purpose, of an activity. The FWS interprets the MBTA to prohibit incidental take.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Migratory bird information is not available at this time

Migratory Bird FAQs

Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Avoidance & Minimization Measures for Birds describes measures that can help avoid and minimize impacts to all birds at any location year-round. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is one of the most effective ways to minimize impacts. To see when birds are most likely to occur and breed in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location, such as those listed under the Endangered Species Act or the Bald and Golden Eagle Protection Act and those species marked as “Vulnerable”. See the FAQ “What are the levels of concern for migratory birds?” for more information on the levels of concern covered in the IPaC migratory bird species list.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) with which your project intersects. These species have been identified as warranting special attention because they are BCC species in that area, an eagle (Bald and Golden Eagle Protection Act requirements

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may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, and to verify survey effort when no results present, please visit the Rapid Avian Information Locator (RAIL) Tool.

Why are subspecies showing up on my list?

Subspecies profiles are included on the list of species present in your project area because observations in the AKN for **the species** are being detected. If the species are present, that means that the subspecies may also be present. If a subspecies shows up on your list, you may need to rely on other resources to determine if that subspecies may be present (e.g. your local FWS field office, state surveys, your own surveys).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Bald and Golden Eagle Protection Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to avoid and minimize impacts to all birds, efforts should be made, in particular, to

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avoid and minimize impacts to the birds on this list, especially BCC species. For more information on avoidance and minimization measures you can implement to help avoid and minimize migratory bird impacts, please see the FAQ “Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds”.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Proper interpretation and use of your migratory bird report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list does not represent all birds present in your project area. It is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide implementation of avoidance and minimization measures to eliminate or reduce potential impacts from your project activities, should presence be confirmed. To learn more about avoidance and minimization measures, visit the FAQ "Tell me about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:

The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

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The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under

Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

RIVERINE
R4SBC

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

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Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe

wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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Ohio Department of Natural Resources
Divisions of Wildlife and Natural Areas & Preserves
Ohio Natural Heritage Program
2045 Morse Road Bldg. G-3 • Columbus, OH 43229-6693
Email: NHDRequest@dnr.ohio.gov • Voicemail: 614-265-6818

Ohio Natural Heritage Data Request

DNR 5203 (R0824)

Ohio Natural Heritage Database (ONHD) stand-alone data requests are processed for projects that meet one of these criteria:

- Academic research projects
- Other non-development or non-construction projects

Search results include records for state and federal listed plants and animals, high-quality plant communities, geologic features, and breeding animal concentrations.

If your project meets none of these criteria and you are requesting ONHD data for ORAM verification, please fill out and sign this form and submit it for ODNR Environmental Review as instructed at ohiodnr.gov/environmentalreview

Data within the project site will automatically be searched. Data within an additional 1-mile radius of the project site may be provided upon request. Because the ONHD contains sensitive information, it is our policy to provide only the data needed to complete your specific project.

Results are listed in a letter format and include a shapefile/map. Data requests will be completed within approximately 30 days. There is currently no charge to process requests.

INSTRUCTIONS

- Please complete all fields on this form.
- Submit a map detailing your project site boundaries. Please include at least one digital map (shapefile, .kmz, or .gdb) or allow extra time for processing.
- If you have questions, please visit ohiodnr.gov/onhd before submitting your request.
- Sign this form (required) and email with other attachments to NHDRequest@dnr.ohio.gov.

DATE:	12/13/2024	COMPANY NAME:	Integral Consulting Inc.
NAME OF PERSON RESPONSE LETTER SHOULD BE ADDRESSED TO:	Cristal Reagh		
STREET ADDRESS:	1903 7th Street		
CITY:	Berkeley	STATE: CA	ZIP: 94710
PHONE:	7075086105	E-MAIL ADDRESS:	creagh@integral-corp.com
PROJECT NAME:	C4272 Canfield Ohio Level I and II Report		
SITE ADDRESS:	460 West Main Street, Canfield, Ohio		
SITE COUNTY:	Mahoning	CITY/VILLAGE/TOWNSHIP:	Canfield
SITE LATITUDE:	41.025958384688074	SITE LONGITUDE:	-80.77619185992408

BRIEF DESCRIPTION OF WORK TO BE PERFORMED AT THE PROJECT SITE:

– Review environmental history and other publicly available data (e.g., state habitat monitoring, water quality)
– Conduct a site investigation
– Identify and delineate potential wetlands
– Evaluate quality of any wetlands identified during the site inspection
– Establish GIS project
– Prepare Level I report in accordance with OEPA (2018) including an Ecological Scoping Checklist and an

HOW DO YOU WANT YOUR DATA REPORTED? ***CHOOSE ONE:***

(●) **DIGITAL SHAPEFILE** ( ) **PDF MAP**

Both formats provide the same data. If you request a digital shapefile, we will send you a letter with a list of species/features found and a shapefile of record locations and details. The PDF Map is only recommended for those who cannot use digital map data. With the PDF option we will send you a letter with a list of species/features found and a map showing their location. It may take longer to fill your request if you choose the PDF Map.

The standard data we search includes state and federal listed plants and animals, high-quality plant communities, geologic features, and breeding animal concentrations within 1 mile of your project area boundaries (as specified on the map/shapefile you attach to this request). We provide a list of the above species and features found within 1 mile of your project area and may provide specific locations for these and other features that occur within or adjacent to your project area.

PLEASE LIST ANY INFORMATION *IN ADDITION TO THIS* THAT YOU REQUIRE:

A list of species and other resources such as critical habitat that are known or suspected to be on or near the project area. Thank you so much!

HOW WILL THIS INFORMATION BE USED?

This information will be used in accordance with the Ohio Environmental Protection Agency's Ecological Risk Assessment Guidance Document to complete a Level I and Level II Ecological Risk Assessment.

The chief of the Division of Wildlife has determined that the release of the ONHD data you have requested could be detrimental to the conservation of a species or unique natural feature. Pursuant to section 1531.04 of the Ohio Revised Code, this information is not subject to section 149.43 of the Revised Code. By signing below, you certify that the data provided will not be disclosed, published, or distributed beyond the scope of your project.

SIGNATURE: Cristal Reagh **DATE:** 12/13/2024

Integral Consulting Inc.
8742 E. Washington St.
Suite 115
Chagrin Falls, OH 44022

telephone: 303.404.2944
www.integral-corp.com

May 9, 2025

Project No. C4274

Office of Real Estate & Land Management
Ohio Department of Natural Resources
2045 Morse Road, E-2
Columbus, OH 43229
environmentalreviewrequest@dnr.ohio.gov

Submitted via email

Subject: **MSC Site, Canfield, Mahoning County, Ohio Environmental Review Request**

To Whom It May Concern:

Per your email request, Integral Consulting Inc. (Integral) is submitting this request for an environmental review of the Site located at and adjacent to 460 W. Main St, Canfield, Mahoning County, Ohio (approximately centered on 41.027837°, -80.777932° in WGS 84). The Site boundaries are provided in the attached shapefile. The subject area includes an on-site area (including Material Sciences Corporation parcel and portions of the Mill Creek Metroparks parcel) and an off-site area (including additional parcels along Sawmill Creek). This request includes both Material Sciences Corporation (MSC) parcel and wetland and portions of Sawmill Creek in order to consolidate requests for the environmental review. The on-site MSC parcel and wetland habitat includes approximately 4.9 acres of developed/industrial areas, 6.0 acres of upland forest, 1.6 acres of wetland, and 0.5 acres of a ditch.

The environmental review will be used to support the wetland delineation, ORAM form completion, and ecological risk assessment associated with the spill and response activities at the site.[1] Investigation and remedial actions led by August Mack (on behalf of Material Sciences Corporation) will be conducted in close coordination with Ohio EPA under the RCRA program.

This letter constitutes Integral's fulfillment of required information to complete ODNR's environmental review request. If there is additional information that would prove helpful, please do not hesitate to reach out.

[1] https://www.mscresponse.com/

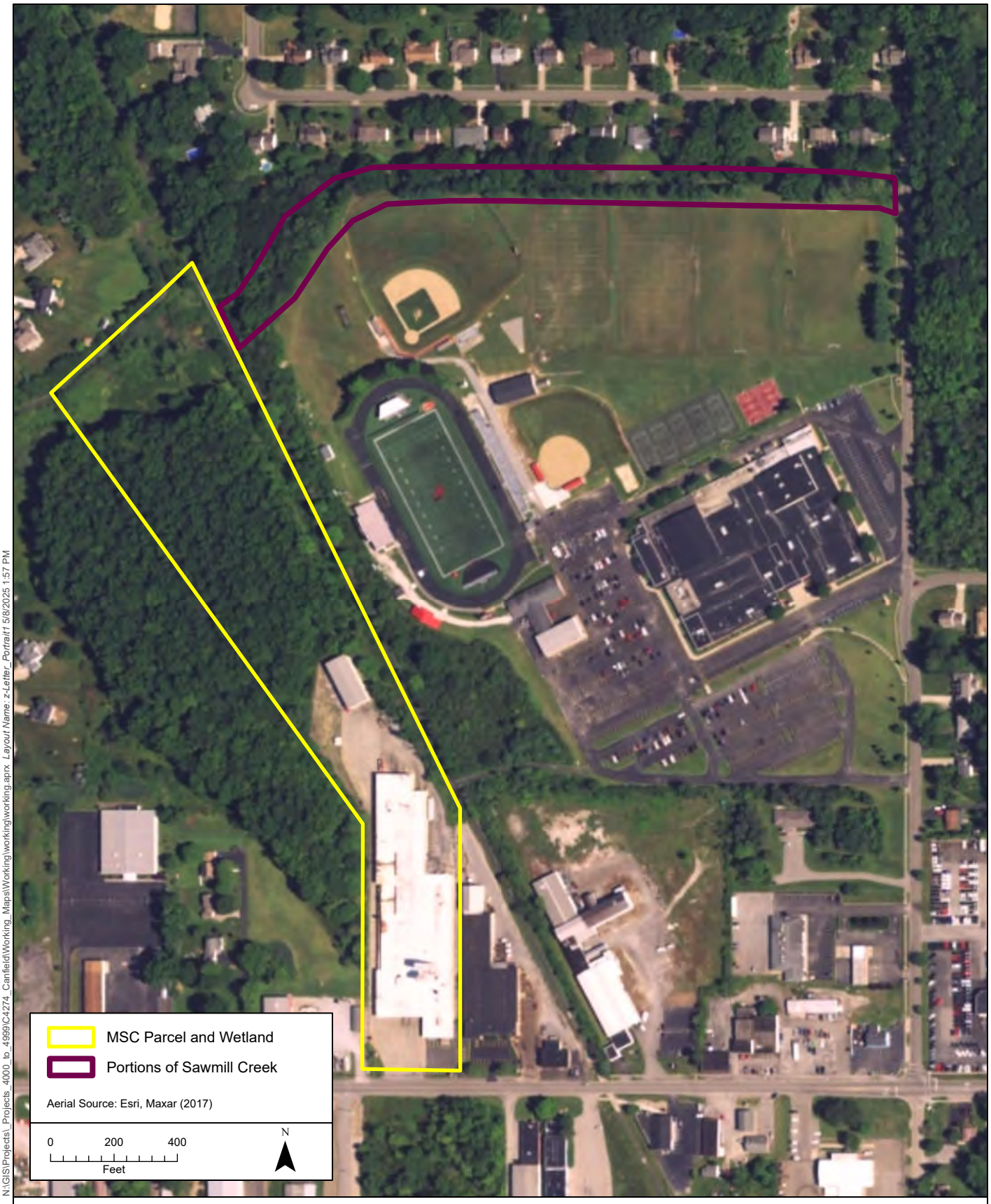
Thank you for your consideration of our request. We look forward to hearing from you.

Sincerely,

Cristal Reagh

Cristal Reagh
Scientist

Enclosure: Shapefile



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integral consulting inc.

Figure 1.
Site Boundaries
Material Science Corporation
Canfield OH

Outlook

Confirmation Receipt for ODNR Environmental Review Request Submission

From EnvironmentalReviewRequest@dnr.ohio.gov <EnvironmentalReviewRequest@dnr.ohio.gov>
Date Fri 5/9/2025 1:14 PM
To Cristal Reagh <creagh@integral-corp.com>

[CAUTION: External email. Think before you click links or open attachments.]

Thank you for contacting the Ohio Department of Natural Resources. This email is your receipt that we have received your message and/or project review request.
We aim to provide a completed Environmental Review comment letter within 45-60 calendar days, however, during periods of high volume or other extenuating circumstances, it may be longer. If you have any questions please contact Mike.Pettegrew@dnr.ohio.gov

ATTACHMENT E

INTEGRAL'S BIOLOGICAL SAMPLING SCOPE OF WORK

May 30, 2025

Ohio EPA, Division of Surface Water
c/o Kelsey Heyob, Credible Data Coordinator
50 W. Town Street, Suite 700
Columbus, Ohio 43215

Subject: Ohio EPA Qualified Data Collector Level 3 Study Plan for Sawmill Creek located within the watershed designated as Hydrologic Unit Code (HUC) number 050301030702 (Erie/Ontario Lake Hills & Plains) in the Mahoning River Basin (lower)

Dear Ms. Heyob,

Please find enclosed a Qualified Data Collector (QDC) Level 3 Project Study Plan (PSP) titled “2025 Sawmill Creek Fish, Macroinvertebrate, & Habitat Surveys” provided by MAD Scientist Associates (MAD). This PSP is being submitted to share the stream assessment data at the Level 3 standard with the Credible Data Program so that it can be utilized by the EPA and our client, Integral Solutions. The purpose of the work is to evaluate the current condition of this site related to a release of materials like zinc and hexavalent chromium upstream near the Material Sciences Corporation facility.

Sawmill Creek will be assessed using Index of Biotic Integrity (IBI), Invertebrate Community Index (ICI), and Qualitative Habitat Evaluation Index (QHEI) sampling methods and analyses. Results will be provided on the field forms and summarized in an excel table. They will also be shared with our client to assist the firm in assessing the current attainment status of Sawmill Creek.

If you have any questions regarding this plan, please call us at (614) 818-9156 (office). You can also e-mail questions or comments to Jenna@madscientistassociates.net. Thank you for your consideration of this plan. We hope to hear from you soon.

Best Regards,

Jenna Roller-Knapp
ESII, Aquatic Ecologist

Corbin Binkley
ESI, Ichthyologist

enclosures

Project Study Plan for 2025 Sawmill Creek Fish, Macroinvertebrate and Habitat Assessment

Sawmill Creek

Mahoning County, OH

prepared for

Ohio EPA, Division of Surface Water
Standards & Technical Support Section
50 West Town Street, Suite 700
P.O. Box 1049
Columbus, Ohio 43216-1049

prepared by

MAD SCIENTIST ASSOCIATES LLC

Specialists in
Ecological & Wetland Consulting

Level 3 Project Study Plan: 2025 Sawmill Creek Fish, Macroinvertebrate & Habitat Surveys Study

(1) Objectives: The objective of the proposed study is to evaluate the current health and condition of the fish and macroinvertebrate community and stream habitat in Sawmill Creek. The health of the fish and macroinvertebrate assemblages in Sawmill Creek will be assessed using Ohio EPA's Index of Biotic Integrity (IBI) for fish, Invertebrate Community Index (ICI) for macroinvertebrates, and Qualitative Habitat Evaluation Index (QHEI) for habitat. Results of this study will be utilized by August Mack, Integral Consulting, Inc., and EPA to document biological community health and stream attainment status, especially in comparison of any deviation from the full attainment status of this EPA reference site in 2013.

(2) Non-point/Point Sources: A 2024 release from the upstream Material Sciences Corporation facility resulted in the migration of material including zinc and hexavalent chromium, with cyanide as the marker, in the ground and surface water near the facility in Sawmill Creek. During a May 2025 site visit, EPA recommended this location in Sawmill Creek to characterize the potential impact downstream in Sawmill Creek. There is historical data here, therefore this survey serves as a current comparison to the historical data. Figures 1-2 display the HUC8 and HUC12 of the proposed survey location and the upstream release location.

The Ohio EPA's report (published 2018) titled "*Biological and Water Quality Study of the Lower Mahoning River Watershed, 2011 and 2013*" indicates the suggested aquatic life use (ALU) designation for Sawmill Creek at river mile 0.90 was warmwater habitat. When the site was sampled in 2013, the narrative evaluation for fish was "good" with an IBI score of 40 and total of 13 species present. The QHEI score was 67.0. The ICI score was not calculated, but there were 43 total taxa collected using the qualitative method with 10 Ephemeroptera, Plecoptera and Trichoptera (EPT), 12 sensitive taxa and 3 coldwater taxa. Overall full attainment was met.

According to the 2011 National Land Cover Database, approximately 3.4% of the local upstream watershed relative to the proposed sampling location is classified as row crop land use. Deciduous forest land cover comprises 26.6% of the upstream watershed area. Pasture/hay land use makes up 4.9% of the watershed area land use. Most notably, land classified as low, medium, and high intensity development represent a combined 38.3% of the watershed area land use. Lands classified as developed, open space represent 22.0% of the upstream watershed area. The remaining approximately 5 percent of the upstream watershed area is comprised of a multitude of other land use classifications in much smaller proportions (USEPA, 2019). Potential point and non-point sources (Mahoning County Auditor's office, 2025) can be seen in Figure 3.

Table 1. Potential Sources of Pollution

Potential Sources of Pollution	
Point Sources	**Nonpoint Sources**
MSC chemical release	Agricultural runoff
Combined sewer overflows	Highway runoff
Storm sewer outfalls	Sedimentation
Septic systems	Urban runoff
NPDES permitted facilities	Industrial runoff

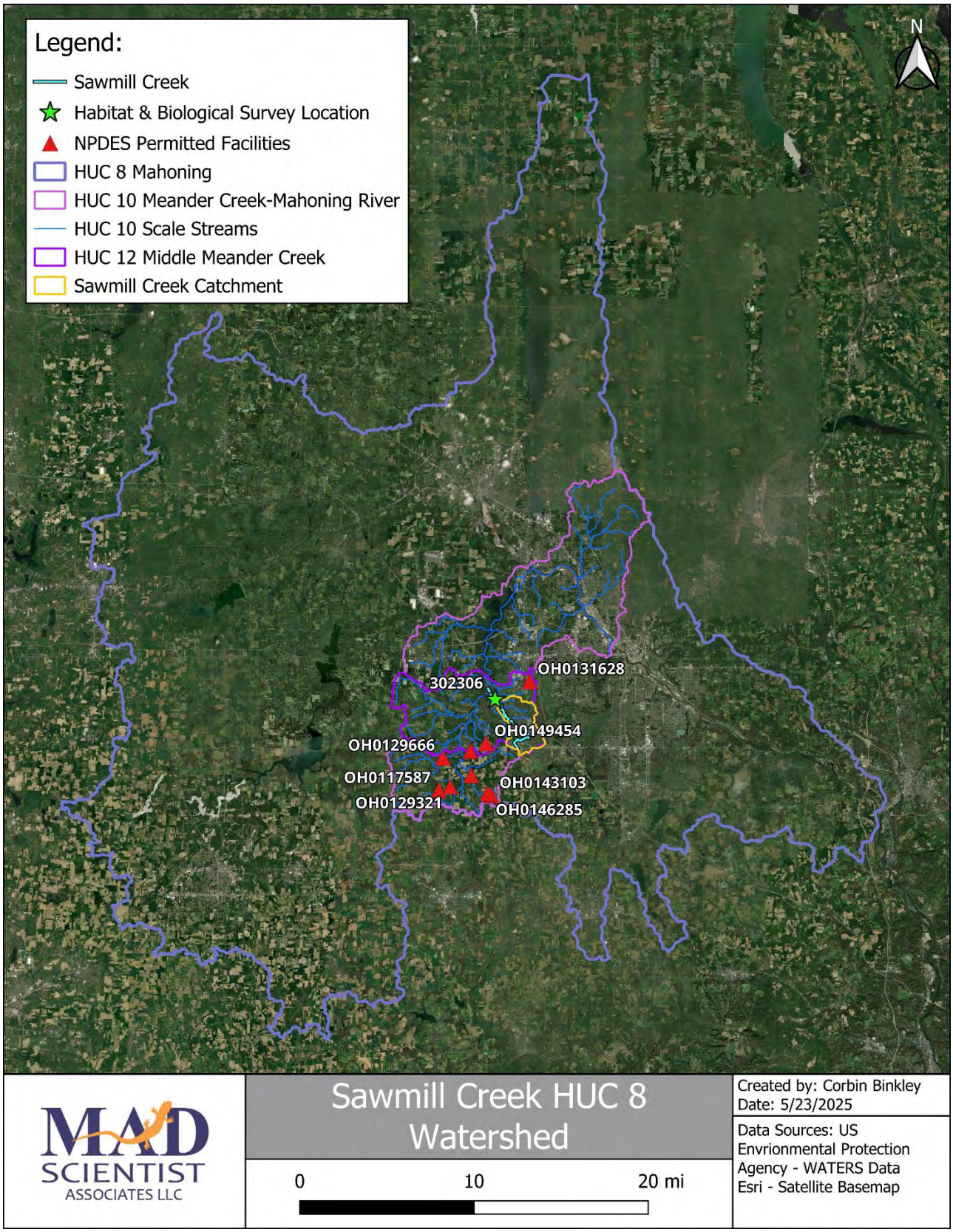


Figure 1. HUC8 of Sawmill Creek showing NPDES facilities and proposed survey area.

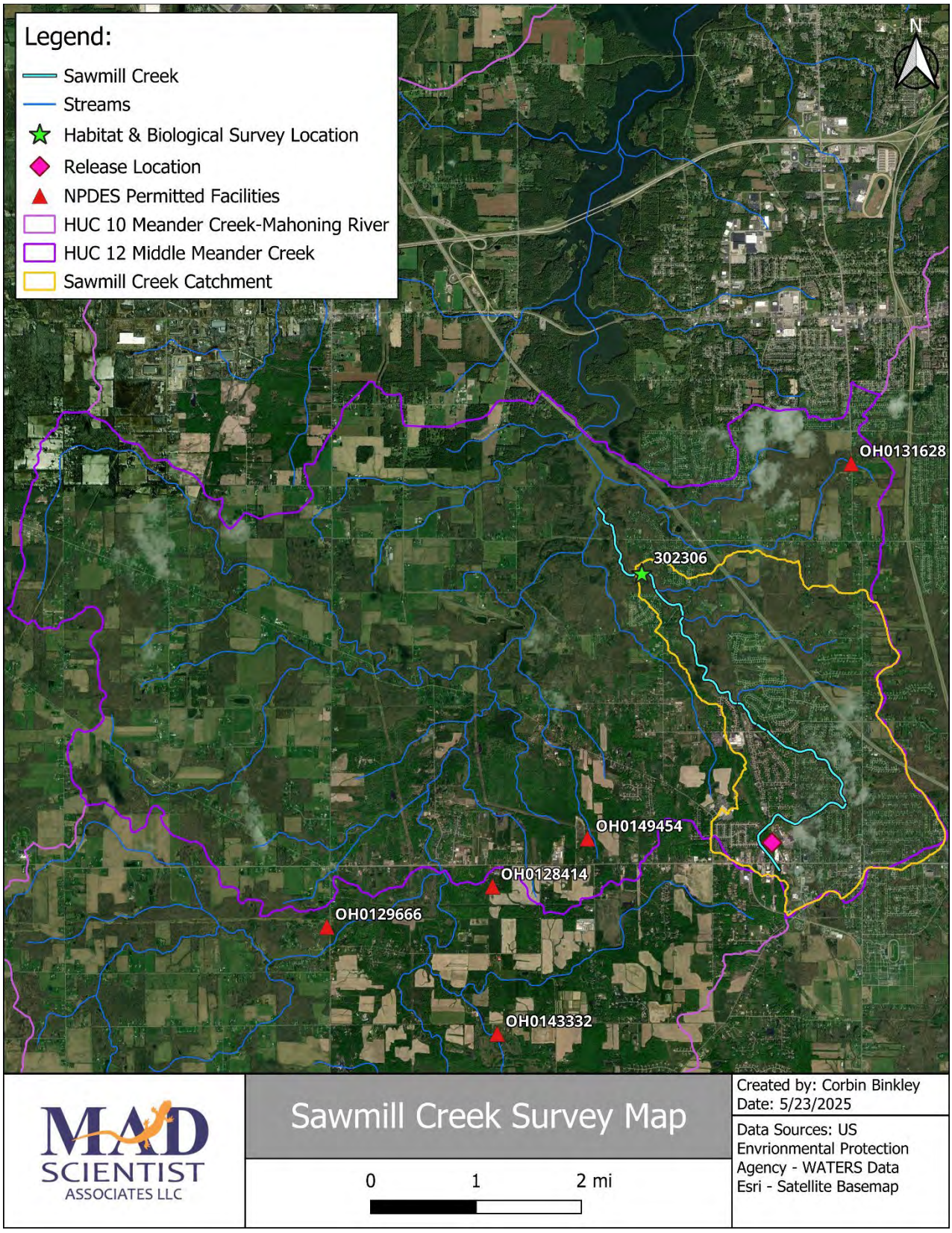


Figure 2. HUC12 of Sawmill Creek showing the NPDES facilities, 2024 release location and proposed survey location.

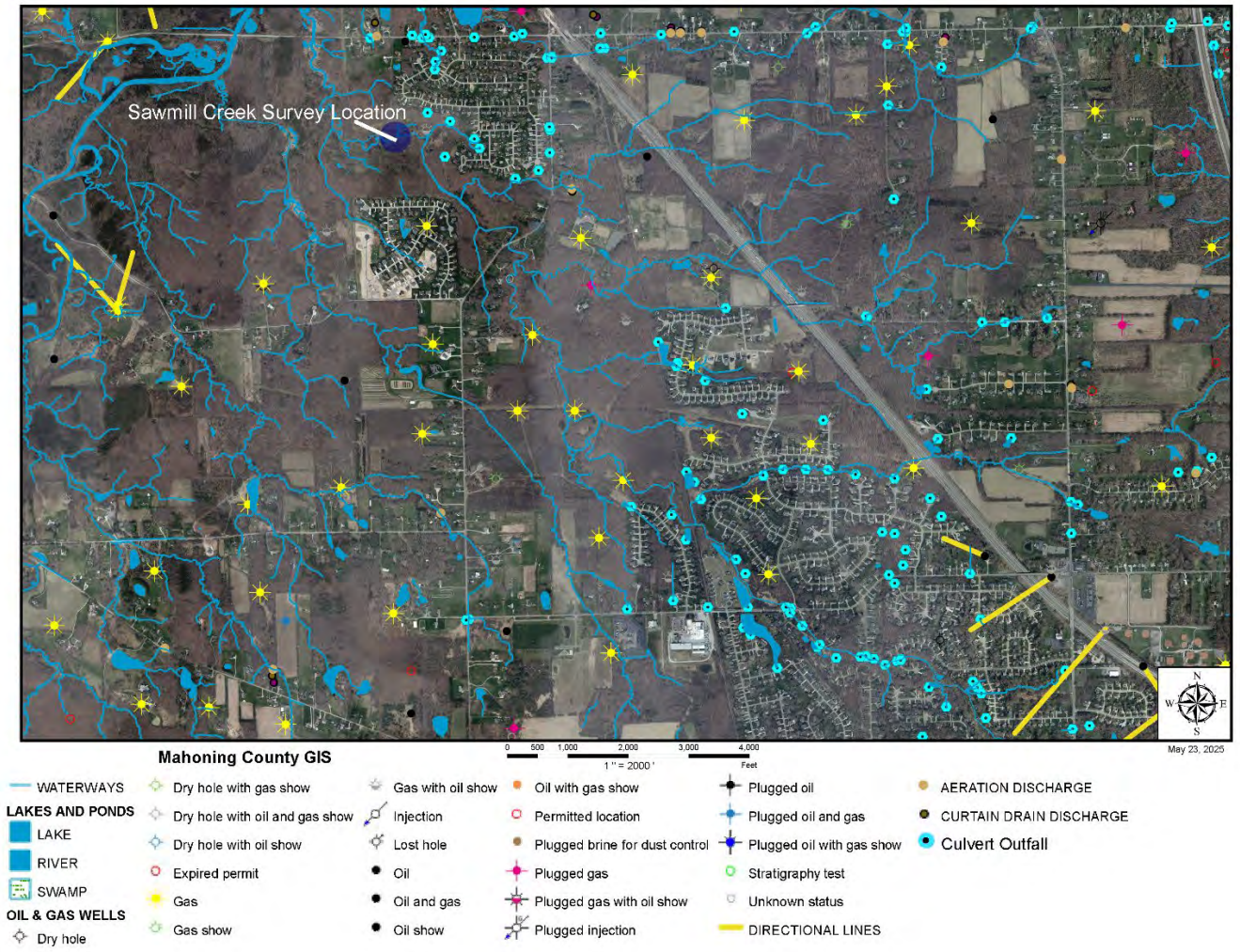


Figure 3. Potential Pollution Sources in Sawmill Creek near the Proposed survey (Mahoning County Auditor's office, 2025).

(3) Parameters Covered: Stream habitat quality will be evaluated using QHEI assessment in Sawmill Creek. This evaluation includes substrate, instream cover, channel morphology, riparian development, pool/glide features, and riffle/run features will be assessed along at least a 150-meter section of each stream.

Quantitative fish sampling will occur at the study location using wading methods. Fish collection using electrofishing will result in specimens identified to species level, weighed, counted, and examined for deformities, erosions, lesions, and tumors (DELT anomalies). Data will be recorded on Ohio EPA Fish Data Sheets or an equivalent form.

Macroinvertebrates quantitative and qualitative sampling will be conducted to collect the diversity of taxa present in Sawmill Creek. Vouchers will be collected and counted. Taxa will be noted as EPT, tolerant, sensitive, coldwater, etc. for the ICI metric.

(4) Methods: The Qualitative Headwater Evaluation Index (QHEI) will be used to assess both streams' habitat health. A 150-meter section or greater of stream that best represents the average stream conditions will be selected for the QHEI. To conduct the habitat assessment, MAD will walk the length of the stream reach and make note of their characteristics to complete the QHEI data forms in the field.

Fish sampling in Sawmill Creek will be conducted by electrofishing, using wading techniques described in *Ohio EPA's Biological Criteria for the Protection of Aquatic Life, Volume III* (1987a) and a long-line electrofishing unit. This long-line unit consists of 200 meters of cable connected to a 1750-watt generator, producing 125 or 250 volts of pulsed DC output. Starting from the downstream end of the sampling reach, MAD will work in the upstream direction using the anode net of the long-line electrofishing unit to thoroughly cover all habitat types and retrieve fish. Assist netters will follow closely behind to capture the stunned fish. Captured fish will be deposited into an aerated live well for containment until they can be sorted, counted, and subsequently released unless kept as physical vouchers for laboratory identification. Photos will be taken to record species present focused on identifiable features. Vouchers of species preserved in formalin will be returned to the lab. Data will be entered into excel spreadsheet to calculate an IBI score.

Macroinvertebrates will be collected following EPA Volume III: Standard Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities (Biological Criteria: Volume III; Ohio EPA 1987b). MAD will sample macroinvertebrates using quantitative Hester Dendy (HD) set out to be colonized for a six-week period. Two HD samplers are planned to be installed in case the initial one is lost due to vandalism, burial, washout, etc. Qualitative methods using a D-frame dip net will be used to sample all habitat types and handpicking rocks and vegetation when HD is retrieved. HD sampling is typically conducted at sites with greater than 20 square miles drainage areas, and Sawmill Creek is only approximately 5.56 sq. mi; however, EPA has expressed the desire to have quantitative ICI data at this stream as well. MAD will set the HDs in runs with water with flow of at least 0.3 feet/second. Flow will be recorded when the HDs are picked up, placed in plastic containers while still submersed and preserved with formalin. Midwest Biodiversity Institute (MBI) will identify macroinvertebrates to furthest taxonomic resolution and data will be used to calculate an ICI score and provide a narrative rating.

(5) Flow Methods: MAD will use a Global Water flow probe to record stream flow.

(6) Sampling Location: One stream segment of Sawmill Creek is to be sampled under this PSP. Specific location information is detailed in Table 2 and Figure 4.

Table 2. Sawmill Creek Stream Sampling Location Information for Sawmill Creek located at 0.90 river mile and EPA Station Code 302306.

Stream	Drainage Area (mi^2)	River Code	Stream Order	Latitude, Longitude	USGS HUC 8 Number	General location	USGS HUC 8 Name
Sawmill Creek	5.56	18-017-000	3	41.064400°, -80.800700°	5030103	North of Sawmill Creek Preserve	Mahoning

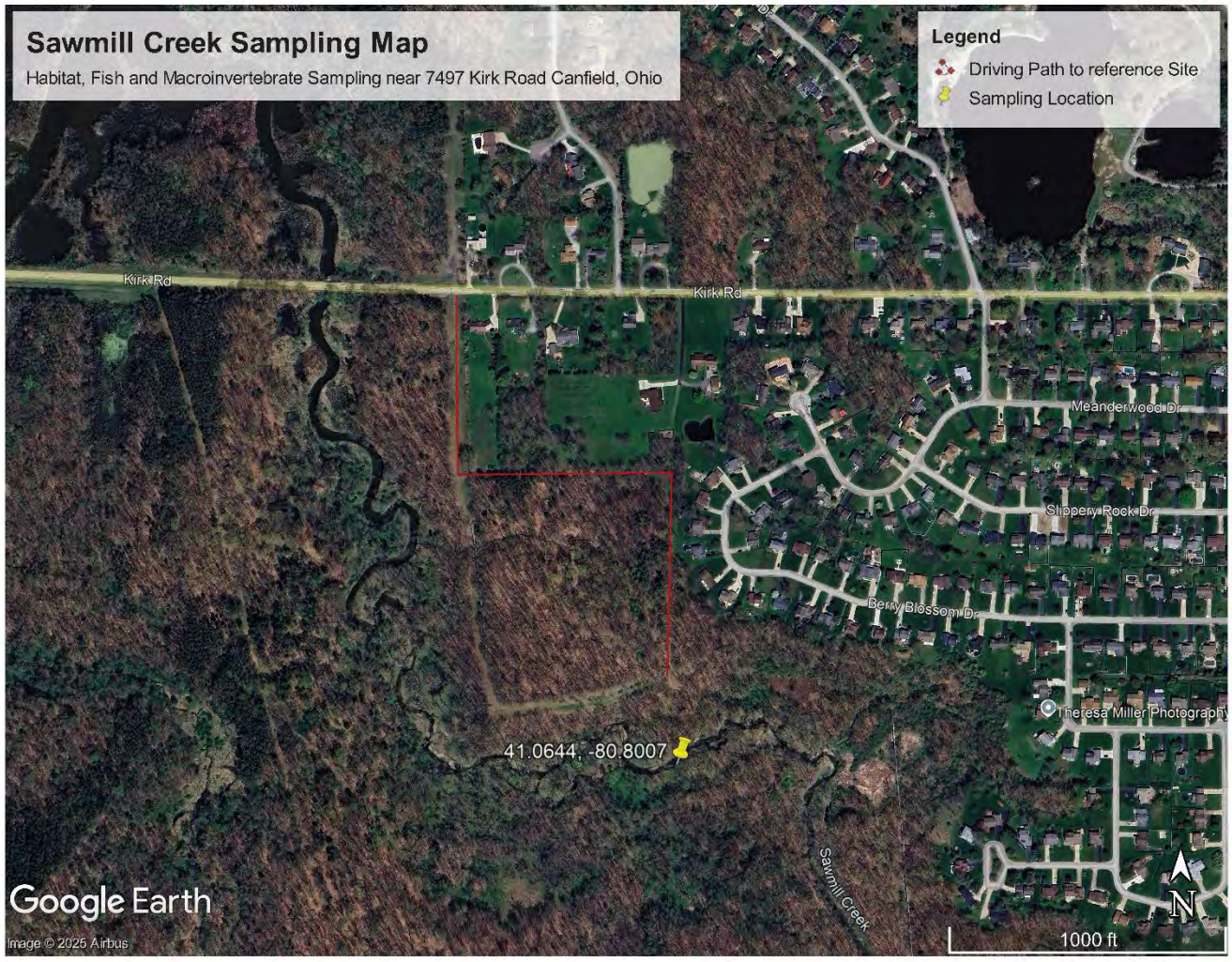


Figure 4. Sawmill Creek Map showing Proposed Habitat and Biological Sampling Locations

(7) Schedule: Sampling will be conducted during normal flow events, between June 15 and October 15, 2025 for fish and habitat data and June 15 to September 30, 2025 for macroinvertebrate data to provide an indication of the water quality conditions that are generally present in the stream. We tentatively are planning for sampling in July to replicate the sampling dates of the reference data collected in mid-July 2013. Normal

water conditions will be determined based on National Weather Service local rainfall data. Sampling dates will be avoided when it has rained within 24 hours. There are no nearby USGS stream gauges to provide data relevant to the water level in Sawmill Creek. After the report is reviewed by Integral Consulting, data will be submitted to EPA within one year of collection.

(8) QA/QC: Quality assurance and quality control of sampling and analysis methods for habitat and fish will follow *Ohio EPA's Biological Criteria for the Protection of Aquatic Life, Volume II* (1987, with updates) and *Volume III* (1987a) and the QHEI Manual (Ohio EPA, 2006). QA/QC of sampling and analysis methods for macroinvertebrate sampling will adhere to the general principles described in Ohio EPA's "Surface Water Field Sampling Manual for water quality parameters and flows" (Ohio EPA, 2009) and Biological Criteria: Vol III (Ohio EPA, 1987b).

Subsamples of difficult-to-identify fish species will be brought back to the laboratory for verification, and if necessary, sent to The Ohio State University Museum of Biological Diversity for verification by the Curator and/or Associate Curator of Fish. Voucher specimens will be collected as described in Section 14 and preserved following methods outlined in *Ohio EPA's Biological Criteria for the Protection of Aquatic Life* (1987a). Photographic vouchers will be taken to clearly show features that allow definitive identification of the species depicted.

(9) Work Products: By early 2026, MAD will digitally provide biological sampling results including stream habitat narrative and QHEI scores, fish IBI data, macroinvertebrate ICI data and an assessment of whether the sampled stream segment meets its ALU designation and attainment status. Attachments including maps and photos will be provided.

This data is also intended to be applied toward QDC renewal data for Corbin Binkley (QDC L3 Habitat and Fish) and Jenna Roller-Knapp (QDC L3 Macroinvertebrate).

(10) Qualified Data Collectors:

Jennifer Roller-Knapp, Lead Project Manager
QDC #01167 with Ohio EPA Level 3 in Benthic Macroinvertebrate Assessment-Collection and Data Evaluation only (Attachment A) **Note that certification is expired but recertification materials have been submitted, and the review is pending.*
MAD Scientist Associates
253 N. State Street, Suite 101
Westerville, OH 43081
Jenna@madscientistassociates.net
(614) 818-9156

Corbin Binkley
QDC #01608 with Ohio EPA Level 3 in Fish Community Biology - Headwater & Wading Only (Attachment A)
MAD Scientist Associates
253 N. State Street, Suite 101
Westerville, OH 43081
Corbin@madscientistassociates.net
(614) 818-9156

Jack Freda
QDC # 00838 Ohio EPA Level 3 in Benthic Macroinvertebrate Assessment- Collection identification and Data Evaluation (Attachment A)
Midwest Biodiversity Institute
4673 Northwest Pkwy
Hilliard, OH 43026
Jfreda@mwbinst.com
(614) 457-6000

Marty Knapp
QDC # 00300 Ohio EPA Level 3 in Benthic Macroinvertebrate Assessment- Collection identification and Data Evaluation (Attachment A)
Midwest Biodiversity Institute
4673 Northwest Pkwy
Hilliard, OH 43026
mknapp@mwbinst.com
(614) 457-6000

Corbin Binkley will be responsible for leading the fish and QHEI sampling in Sawmill Creek and identification of fish species. Jenna Roller-Knapp will be responsible for the macroinvertebrate collection and analysis. Identification of macroinvertebrates will be contracted to Midwest Biodiversity Institute located in Hilliard, Ohio. At least one intern and/or technician will assist with fish, macroinvertebrate, and habitat sampling.

(12) Contract Laboratories:

Macroinvertebrates will be identified by a Level 3 QDC in macroinvertebrate identification at Midwest Biodiversity Institute.

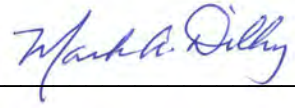
Midwest Biodiversity Institute
4673 Northwest Pkwy
Hilliard, OH 43026
Contact: Chris Yoder
Cyoder@mwbinst.com
(614) 457-6000

Any fish that cannot be positively identified in the field or MAD Scientist Associates laboratory will be sent to The Ohio State University Museum of Biological Diversity for verification by the Director, Associate Curator or Sampling Coordinator of Fish:

Dr. Marymegan Daly, Director/ Mr. Marc Kibbey, Associate Curator/ Brian Zimmerman, Sampling Coordinator
OSU Museum of Biological Diversity
1315 Kinnear Road
Columbus, OH 43212
(614) 292-7873

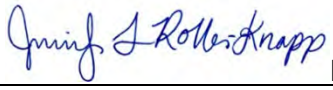
(12) Scientific Collector's Permit: Mark Dilley holds Scientific Collector's Permit (Permit No. SC220007) for collection of wildlife in Ohio. MAD Scientist Associates staff, Corbin Binkley and Jenna Roller-Knapp are listed as sub-permittees. A copy is provided as Attachment B.

(13) Digital Photograph Catalog: A digital photograph catalog of all sampling locations will be maintained for ten (10) years and will include photographs of the specific sampling locations.

Printed Name/Signature: Mark A. Dilley  Date: 05/30/2025

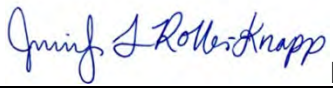
(14) Voucher Specimen Statement: MAD Scientist Associates will maintain a fish and macroinvertebrate voucher collection that includes two physical specimens or appropriate photo-vouchers of each fish species collected during the course of biological sampling from the specified study location.

Printed Name/Signature: Corbin Binkley  Date: 05/30/2025

Printed Name/Signature: Jenna Roller-Knapp  Date: 05/30/2025

(15) Sample Location Statement:

MAD will maintain and make available to the director, for each sampling location, the name of the water body sampled, the sampling location latitude and longitude, the sampling location river mile where possible or practicable, general location information, the USGS HUC 8 number and name, and the purpose for data collection at each sampling location.

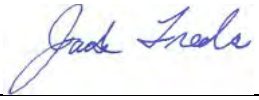
Printed Name/Signature: Jenna Roller-Knapp  Date: 05/30/2025

(16) Additional L3 Data Collector Statement:

MAD and MBI are aware of the qualified data collector's responsibilities for the data (including vouchers, photos, and site information).

Name	QDC Number	Attest	Date
Corbin Binkley	01608		5/30/25
Jack Freda	00838		5/30/25
Marty Knapp	00300		5/30/25
Jenna Roller-Knapp	01167		5/30/25

(17) I have not been convicted of or plead guilty to a violation of section 2911.21 of the Revised Code (Criminal Trespass) or a substantially similar municipal ordinance within the previous five years.

Name	QDC Number	Attest	Date
Corbin Binkley	01608		5/30/25
Jack Freda	00838		5/30/25
Marty Knapp	00300		5/30/25
Jenna Roller-Knapp	01167		5/30/25

References

Mahoning County Auditor's Office. 2025. GIS Public Viewer Version 2.9. https://gisapp.mahoningcountyoh.gov/mahgis/#

Ohio Environmental Protection Agency. 2018. Biological and Water Quality Study of the Lower Mahoning River Watershed, 2011 and 2013. Ohio EPA. Division of Surface Water.

Ohio Environmental Protection Agency (1987a). *Biological Criteria for the Protection of Aquatic Life: Volume II. User's Manual for Biological Field Assessment of Ohio Surface Waters* (Updated January 1988; September 1989; November 2006; August 2008). Columbus, OH: Division of Water Quality Monitoring and Assessment.

Ohio Environmental Protection Agency (1987b). *Biological Criteria for the Protection of Aquatic Life: Volume III. Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities* (Updated September 1989; March 2001; November 2006; and August 2008). Columbus, OH: Division of Water Quality Monitoring and Assessment.

United States Environmental Protection Agency. 2019. NHDPlus Watershed Report. National Land Cover Dataset. 2011. https://watersgeo.epa.gov/watershedreport/?reachcode=05030103000266&measure=

Attachment A: QDC Certificates

Environmental Protection Agency

Mike DeWine, *Governor* Jon Husted, *Lt. Governor* Anne M. Vogel, *Director*

I certify this to be a true and accurate copy of the official documents as filed in the records of the Ohio Environmental Protection Agency.
By: _____ Date: 05/15/2024

CERTIFIED MAIL

Effective Date: 5/15/2024
Expiration Date: 5/14/2026

Corbin Binkley
253 North State Street
Westerville, OH 43081

Re: Qualified Data Collector Approval, Surface Water Credible Data Program

Dear Corbin:

The Division of Surface Water Credible Data Program has reviewed your Qualified Data Collector (QDC) application. Pursuant to Ohio Revised Code (ORC) 6111.53 and Ohio Administrative Code (OAC) 3745-4-03, you are approved as a QDC for the following level and specialty:

Level:	**3**
Specialty:	**Fish Community Biology - Headwater & Wading Only**
QDC number:	**01608**

Please use this QDC number on all correspondence, study plans, etc. submitted to Ohio EPA.

As noted at the top of this letter, this status is effective as of the date of this letter and expires two years from that date. You may now submit study plans to the Credible Data Program.

A renewal application must be submitted in accordance with OAC 3745-4-03 (C). As provided in this rule, renewal of status is contingent upon active participation in the Credible Data Program at the designated level and specialty. Active participation means that the QDC has participated in activities under this program at the level and specialty of the applicant's QDC certification during the period the applicant's certification was valid, including the submission of data approved at the appropriate level, collected under an approved project study plan. Lack of such participation will prevent you from renewing your status, but you may re-apply for initial QDC status.

As a reminder, your status is contingent upon the absence of any trespassing violation (within the previous five years) by you or any person sampling under your supervision. Always obtain landowner permission prior to sampling.

Additionally, collection (and retention) of aquatic biological samples (this includes fish, macroinvertebrates, mollusks, and shells) requires a collector's permit from the Ohio Department of Natural Resources/Division of Wildlife. Obtain this permit prior to collection of any biological samples.

You are hereby notified that this action of the Director is final and may be appealed to the Environmental Review Appeals Commission pursuant to Section 3745.04 of the Ohio Revised Code. The appeal must be in writing and set forth the action complained of and the grounds upon which the appeal is based. The appeal must be filed with the Commission within thirty (30) days after notice of the Director's action. The appeal must be accompanied by a filing fee of $70.00, made payable to "Treasurer of the State of Ohio", which the Commission, in its discretion, may reduce if by affidavit you demonstrate that payment of the full amount of the fee would cause extreme hardship.

Notice of the filing of the appeal must be filed with the Director within three (3) days of filing with the Commission. Ohio EPA requests that a copy of the appeal be served upon the Ohio Attorney General's Office, Environmental Enforcement Section. An appeal may be filed with the Environmental Review Appeals Commission at the following address: 30 E. Broad Street, 4th Floor, Columbus, OH 43215.

Sincerely,



Anne M. Vogel

Ohio EPA 2/14/2022
Entered Directors Journal
I certify this to be a true and accurate copy of the official documents as filed in the records of the Ohio Environmental Protection Agency.
By: Date:

Ohio Environmental Protection Agency

Mike DeWine, Governor
Jon Husted, Lt. Governor
Laurie A. Stevenson, Director

2/14/2022

Effective Date: 2/8/2022
Expiration Date: 2/7/2025

Jennifer Roller-Knapp
609 Northridge Road
Columbus, OH 43214

Re: Qualified Data Collector Renewal, Surface Water Credible Data Program

Dear Jennifer:

The Division of Surface Water Credible Data Program has automatically renewed your Qualified Data Collector (QDC) status based on your recent data and project study plan submittals. Pursuant to Ohio Revised Code (ORC) 6111.53 and Ohio Administrative Code (OAC) 3745-4-03, your status as a QDC has been renewed for the following level and specialty:

Level:	**3**
Specialty:	**Benthic Macroinvertebrate Assessment - Collection and Data Evaluation Only**
QDC number:	**01167**

Please continue to use this QDC number on all correspondence, study plans, etc. submitted to Ohio EPA.

As noted at the top of this letter, this status was effective as of the date of your initial data submittal and expires three years from that date. You may continue to submit data and new study plans to the Program.

A renewal application must be submitted in accordance with OAC 3745-4-03 (C). As provided in this rule, renewal of status is contingent upon active participation in the Volunteer Monitoring Program at the designated level and specialty. Lack of such participation will prevent you from renewing your status, but you may re apply for initial QDC status.

As a reminder, your status is contingent upon the absence of any trespassing violation (within the previous five years) by you or any person sampling under your supervision. Always obtain land owner permission prior to sampling.

Additionally, collection (and retention) of aquatic biological samples (this includes fish,

macroinvertebrates, mollusks, and shells) requires a collector's permit from the Ohio Department of Natural Resources/Division of Wildlife. Obtain this permit prior to collection of any biological samples.

You are hereby notified that this action of the Director is final and may be appealed to the Environmental Review Appeals Commission pursuant to Section 3745.04 of the Ohio Revised Code. The appeal must be in writing and set forth the action complained of and the grounds upon which the appeal is based. The appeal must be filed with the Commission within thirty (30) days after notice of the Director's action. The appeal must be accompanied by a filing fee of $70.00, made payable to "Treasurer of the State of Ohio", which the Commission, in its discretion, may reduce if by affidavit you demonstrate that payment of the full amount of the fee would cause extreme hardship.

Notice of the filing of the appeal must be filed with the Director within three (3) days of filing with the Commission. Ohio EPA requests that a copy of the appeal be served upon the Ohio Attorney General's Office, Environmental Enforcement Section. An appeal may be filed with the Environmental Review Appeals Commission at the following address: 30 E. Broad Street, 4th Floor, Columbus, OH 43215.

Sincerely,



Laurie A.
Stevenson Director

Ohio EPA 11/01/2024

Entered Director's Journal

I certify this to be a true and accurate copy of the official documents as filed in the records of the Ohio Environmental Protection Agency.

By: _____ Date: 11/01/2024

Effective Date: 11/1/2024
Expiration Date: 10/31/2027

Martin J Knapp
4673 Northwest Parkway
Hilliard, OH 43026

Re: Qualified Data Collector Renewal, Surface Water Credible Data Program

Dear Martin:

The Division of Surface Water Credible Data Program has automatically renewed your Qualified Data Collector (QDC) status based on your recent data and project study plan submittals. Pursuant to Ohio Revised Code (ORC) 6111.53 and Ohio Administrative Code (OAC) 3745-4-03, your status as a QDC has been renewed for the following level and specialty:

Level:	**3**
Specialty:	**Benthic Macroinvertebrate Assessment - Sample Collection, Identification, and Data Evaluation**
QDC number:	**00300**

Please continue to use this QDC number on all correspondence, study plans, etc. submitted to Ohio EPA.

As noted at the top of this letter, this status was effective as of the date of your initial data submittal and expires three years from that date. You may continue to submit data and new study plans to the Program.

As provided in OAC 3745-4-03 (C)(3), renewal of status is contingent upon active participation in the Program at the designated level and specialty. Lack of such participation will prevent you from renewing your status, but you may re- apply for initial QDC status.

As a reminder, your status is contingent upon the absence of any trespassing violation (within the previous five years) by you or any person sampling under your supervision. Always obtain landowner permission prior to sampling.

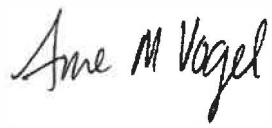
Additionally, collection (and retention) of aquatic biological samples (this includes fish,

macroinvertebrates, mollusks, and shells) requires a collector's permit from the Ohio Department of Natural Resources/Division of Wildlife. Obtain this permit prior to collection of

You are hereby notified that this action of the Director is final and may be appealed to the Environmental Review Appeals Commission pursuant to Section 3745.04 of the Ohio Revised Code. The appeal must be in writing and set forth the action complained of and the grounds upon which the appeal is based. The appeal must be filed with the Commission within thirty (30) days after notice of the Director's action. The appeal must be accompanied by a filing fee of $70.00, made payable to "Treasurer of the State of Ohio", which the Commission, in its discretion, may reduce if by affidavit you demonstrate that payment of the full amount of the fee would cause extreme hardship.

Notice of the filing of the appeal must be filed with the Director within three (3) days of filing with the Commission. Ohio EPA requests that a copy of the appeal be served upon the Ohio Attorney General's Office, Environmental Enforcement Section. An appeal may be filed with the Environmental Review Appeals Commission at the following address: 30 E. Broad Street, 4th Floor, Columbus, OH 43215.

Sincerely,



Anne M. Vogel

Ohio Environmental Protection Agency
EPA.Ohio.gov
Mike DeWine, *Governor* Jon Husted, *Lt. Governor* Anne M. Vogel, *Director*

CERTIFIED MAIL

Effective Date: 1/11/2024
Expiration Date: 1/10/2027

I certify this to be a true and accurate copy of the official documents as filed in the records of the Ohio Environmental Protection Agency.
By: _____ Date: 01/11/2024

Jack T Freda
4316 Stone Bridge Green
Hilliard, OH 43026

Re: Qualified Data Collector Renewal, Surface Water Credible Data Program

Dear Jack:

The Division of Surface Water Credible Data Program has automatically renewed your Qualified Data Collector (QDC) status based on your recent data and project study plan submittals. Pursuant to Ohio Revised Code (ORC) 6111.53 and Ohio Administrative Code (OAC) 3745-4-03, your status as a QDC has been renewed for the following level and specialty:

Level:	**3**
Specialty:	**Benthic Macroinvertebrate Assessment - Sample Collection, Identification, and Data Evaluation**
QDC number:	**00838**

Please continue to use this QDC number on all correspondence, study plans, etc. submitted to Ohio EPA.

As noted at the top of this letter, this status was effective as of the date of your initial data submittal and expires three years from that date. You may continue to submit data and new study plans to the Program.

As provided in OAC 3745-4-03 (C)(3), renewal of status is contingent upon active participation in the Program at the designated level and specialty. Lack of such participation will prevent you from renewing your status, but you may re- apply for initial QDC status.

As a reminder, your status is contingent upon the absence of any trespassing violation (within the previous five years) by you or any person sampling under your supervision. Always obtain landowner permission prior to sampling.

Additionally, collection (and retention) of aquatic biological samples (this includes fish, macroinvertebrates, mollusks, and shells) requires a collector's permit from the Ohio Department of Natural Resources/Division

of Wildlife. Obtain this permit prior to collection of any biological samples.

You are hereby notified that this action of the Director is final and may be appealed to the Environmental Review Appeals Commission pursuant to Section 3745.04 of the Ohio Revised Code. The appeal must be in writing and set forth the action complained of and the grounds upon which the appeal is based. The appeal must be filed with the Commission within thirty (30) days after notice of the Director's action. The appeal must be accompanied by a filing fee of $70.00, made payable to "Treasurer of the State of Ohio", which the Commission, in its discretion, may reduce if by affidavit you demonstrate that payment of the full amount of the fee would cause extreme hardship.

Notice of the filing of the appeal must be filed with the Director within three (3) days of filing with the Commission. Ohio EPA requests that a copy of the appeal be served upon the Ohio Attorney General's Office, Environmental Enforcement Section. An appeal may be filed with the Environmental Review Appeals Commission at the following address: 30 E. Broad Street, 4th Floor, Columbus, OH 43215.

Sincerely,



Anne M. Vogel

Attachment B: Scientific Data Collector Permit

DIVISION OF WILDLIFE
Ohio Department of Natural Resources

Division of Wildlife Headquarters
2045 Morse Road, Bldg. G
Columbus, Ohio 43229-6693
1-800-WILDLIFE

Chief: Kendra S. Wecker

Scientific Collection

License Number: SC220007

Effective Date: 03/16/2023
Expiration Date: 03/15/2026

Permit Holder:

MARK DILLEY
253 N. STATE ST., SUITE 101
WESTERVILLE, OH 43081

MAD SCIENTIST & ASSOCIATES, LLC
253 N. STATE ST., SUITE 101
WESTERVILLE, OH 43081
COUNTY: FRANKLIN

Others authorized on permit: YES (See below)

The permittee is hereby granted permission to take, possess, and transport at any time and in any manner specimens of wild animals, subject to the conditions and restrictions listed below or any documents accompanying this permit.

The Chief of the Division of Wildlife will not issue permit for Dangerous Wild Animal (DWA) species (ORC 935.01) except native DWA, required for specific projects. The permit issued by the Chief does not relieve the permittee of any responsibility to obtain a permit pursuant to R.C. Chapter 935 except as specified for the animals and purposes permitted herein. The permittee must adhere to all additional requirements under R.C. Chapter 935.

THIS PERMIT IS RESTRICTED AS FOLLOWS:

All native freshwater mussels are protected in the State of Ohio (Section 1533.324 of the Ohio Revised Code). In addition, federally listed species are protected by the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). Impacts to all freshwater mussels, including State and Federally protected mussels, and their habitats should be avoided and minimized to the maximum extent practicable. If impacts cannot be avoided, all streams which contain mussels or potential mussel habitat must be surveyed prior to any proposed stream disturbance following the Ohio Mussel Survey Protocol - April 2022 (link below).

https://ohiodnr.gov/static/documents/wildlife/permits/dow-protocol-ohio-mussel-survey.pdf

Mussel surveys are based on stream size and the potential presence of Federally Listed Species (FLS). Accordingly, for purposes of determining survey efforts, Ohio streams have been divided into the five categories listed below and are specifically named in Appendix A of the Ohio Mussel Survey Protocol:

-Unlisted: Streams not listed in the protocol with watersheds >5 mi2 with the potential for mussels.
-Group 1: Small to mid-sized streams, FLS not expected.
-Group 2: Small to mid-sized streams, FLS expected.
-Group 3: Large Rivers, FLS not expected.
-Group 4: Large Rivers, FLS expected.

This permit authorizes you and those working under your direct on-site supervision to work with freshwater mussels in Group 1 and 3 streams, including work with state-list designated endangered or threatened species (state-listed species). For work in Group 2 and 4 streams, a current federal permit for working with mussels is also required. All mussel surveyors in Ohio are required to be certified by the state of Ohio, and you may only work in the systems that you have been approved for (link below):

https://ohiodnr.gov/static/documents/wildlife/permits/dow-list-approved-mussel-surveyors.pdf

This permit allows you to collect specimens of freshwater mussels, including state-listed species for survey and inventory purposes, to add dead specimens of mussels salvaged during fieldwork to an approved repository, to continue to monitor mussel beds of mussels in Ohio, and to locate additional populations of mussel in Ohio. This permit does not authorize the use of lethal means.

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WESTERVILLE, OH 43081
COUNTY: FRANKLIN

This permit is conditioned on the following requirements:

1. At least 15 days prior to the initiation of a mussel survey in Group 1 & 3 systems, please provide John Navarro (john.navarro@dnr.ohio.gov) with a study plan specifying the objectives, location, dates, and all other details, for Division of Wildlife review and approval. For mussel surveys in Group 2 & 4 systems, contact the USFWS (Angela Boyer at angela_boyer@fws.gov).

2. May only work in the systems that you have been approved for (Reconnaissance, Groups 1 & 3, Groups 2 & 4).

3. If approved, may collect mussels, including listed species, for survey and inventory. May also collect non-endangered fish. Sportfish greater than six (>6) inches must be immediately released.

4. At least 24 hours prior to collection activities, the permittee must contact the local wildlife officer (attachment) to advise locations and sampling duration (messages are acceptable). Permission must be obtained from private landowners.

5. Any and all work conducted on federally listed mussels, as well as identification of mussels, must be conducted by federal permittees following restrictions of a current Federal permit. Assistants are only permitted to work under the direct, on-site supervision of federal permittees.

6. Specimens may be temporarily held per guidelines outlined in the mussel protocol and released within 3 hours to the collection location. Live specimens must be maintained at the Columbus Zoo's Freshwater Mussel Conservation and Research Center.

7. All voucher specimens collected are to be deposited at The Ohio State University Museum of Biological Diversity, Cleveland Museum of Natural History, or the Cincinnati Museum Center, unless otherwise specified in the permit.

8. Collection is prohibited on Division of Wildlife property without explicit written permission from the Division of Wildlife. Sampling is further restricted in streams that may have federally listed mussels. See Appendix A of the Ohio Mussel Survey Protocol for locations of federally listed mussels.

9. Please notify John Navarro by email or phone at 614-265-6346 within 24-hours if a new location for a state-listed species is found.

10. A report of your mussel survey findings for Group 1 and 3 systems should be sent to John Navarro (john.navarro@dnr.state.oh.us) and for Group 2 and 4 streams should be sent to Angela Boyer (angela_boyer@fws.gov).

11. An annual electronic report must be submitted in the Wildlife Diversity Database Excel spreadsheet format to the Permit Coordinator at wildlife.permits@dnr.ohio.gov by March 15th of each year. The file may be downloaded from wildohio.gov or obtained from the Permit Coordinator.

Note that a separate permit under Section 10 of the Endangered Species Act (ESA) is necessary in the case where you might hold live federally listed species longer than 45 days. Permit requests under Section 10 of the ESA should be directed to U.S. Fish and Wildlife Service (USFWS) at https://fwsepermits.servicenowservices.com/fws. If you have

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COUNTY: FRANKLIN

questions about whether any proposed activities are covered under this authority or need any other assistance, please contact Angela Boyer at the USFWS, at (614) 416-8993, ext. 122, or angela_boyer@fws.gov.

12. Permittee may collect fish, aquatic macroinvertebrates, insects and salamanders for research and survey purposes. All non-target specimens must be immediately released. Specimens must be immediately released after identification unless required as voucher specimens.

13. Biosecurity measures must be taken at all times to minimize the potential transmission of diseases. Permittee must follow the Division of Wildlife Aquatic Disinfection Protocol for all work with aquatic species.

14. Permittee must contact the Division of Wildlife if previously undocumented aquatic invasive species are discovered. Contact John Navarro at (614) 265-6346 or john.navarro@dnr.ohio.gov with information. If grass carp, silver carp, big head carp or black carp are captured, please retain and contact Eric Weimer at (419)625-8062 or at eric.weimer@dnr.ohio.gov.

15. All cages or enclosures must prevent ingress or egress of wild animals, have appropriate food and water, maintain appropriate temperature and provide protection from the weather. Enclosures must allow the animal to maintain species-specific and/or taxa specific seasonal and biological functions (e.g. bats hibernating). No part of collection may be held at a private residence.

16. All voucher specimens collected are to be deposited at The Ohio State University Museum of Biological Diversity, Cleveland Museum of Natural History, or the Cincinnati Museum Center, unless otherwise specified in the permit.

Locations of Collecting:

Statewide

Equipment and method used in collection:

Electrofishing and funnel trap

Name and number of each species to be collected:

Insects, crayfish, mussels, amphibians, invertebrates, and fish (Determined)

NO ENDANGERED SPECIES OR AQUATIC NUISANCE SPECIES MAY BE TAKEN WITHOUT WRITTEN PERMISSION FROM THE CHIEF

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COUNTY: FRANKLIN

SUB-PERMITTEES

Permit #SC220007 authorizes the following persons to conduct the activities listed on the permit, within the conditions and restrictions set forth. Each person must carry and exhibit upon request, a copy of the permit and this attachment when conducting any of the listed activities. The person named on the permit assumes full responsibility for the actions of the persons on this list and for completing and submitting all required reports.

- Adkins, Jenny
- Binkley, Corbin
- Coburn, Alan
- Duncan, Owen Julius
- Hanna, Lindsay
- Hribar, Daniel
- Nolan, Alexys
- Roller-Knapp, Jenna
- Smeenk, Nick
- Wright, Cody
- Zinsmeister, Ellie

ATTACHMENT F

STANDARD OPERATING PROCEDURES

APPENDIX F

STANDARD OPERATING PROCEDURES

SOP Number	Standard Operating Procedure Title	Latest Revision Date
111	**Subsurface Soil Sampling**	February 2022
122	**Groundwater Sample Collection from Monitoring Well**	October 2018
141	**Surface Water / Stormwater Sample Collection**	November 2024
151	**Indoor Air Sampling Using Canisters**	December 2019
152	**Ambient Air Sampling Using Canisters**	December 2018
154	**Sub-Slab Vapor Sampling Using Canisters**	February 2021
157	**Assembling & Testing Vapor Sampling Trains**	February 2021
158	**Vapor Sampling Building Surveys**	December 2019
211	**Monitoring Well Water Level Measurements**	January 2024
413	**Monitoring Well Installation**	September 2013
616	**Equipment Decontamination**	January 2020

STANDARD OPERATING PROCEDURE

SOP NUMBER: 111

SOP TITLE: SUBSURFACE SOIL SAMPLE COLLECTION METHODS

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202

DRAFT

REVISION DATE: February 2022

Revision Prepared By: _____

Mary Hile, CHMM
Project Scientist

Approved By: _____

James A. Berndt, LPG
Principal Hydrogeologist

1.0 PURPOSE AND SUMMARY

The following Standard Operating Procedure (SOP) describes general and specific procedures, methods and considerations to use when collecting subsurface soil samples for laboratory analysis. August Mack Environmental, Inc. (August Mack) personnel are to follow the procedures within this SOP when collecting subsurface soil samples. The procedures are subject to change if unusual or unanticipated field conditions are encountered. All deviations from this SOP must be pre-approved by the Project Manager or other designated project technical lead and documented in the field logbook, along with a description of the circumstances requiring the deviation.

Soil contamination typically occurs when human-made chemicals or other alterations in the natural soil environment are introduced. Soil contamination can occur from numerous causes including, but not limited to: industrial activity, manufacturing activity, agricultural activity, accidental spill and leaks, mining activity, or improper disposal of waste. Contaminants in subsurface soil can potentially leach to groundwater, result in vapor intrusion conditions in overlying structures, or affect individuals who come in direct contact if excavated and exposed. This SOP documents August Mack procedures for subsurface soil sample collection.

2.0 TABLE OF CONTENTS

1.0 Purpose and Summary
2.0 Table of Contents
3.0 Responsibilities
4.0 Definitions
5.0 Equipment and Supplies
6.0 Records and Forms
7.0 Health & Safety Considerations
8.0 Procedures
  8.1 Pre-Sampling Procedures
  8.2 Grab Soil Sampling Procedures
  8.3 Composite Soil Sampling Procedures
  8.4 Post-Sampling Procedures
9.0 Quality Assurance/Quality Control
10.0 Exceptions
11.0 Cross References/Sources
12.0 Attachments

3.0 RESPONSIBILITIES

It is the responsibility of the Project Manager to ensure that each project involving soil sampling is properly planned and executed. The Project Manager is also responsible for understanding specific requirements or regulations regarding soil sampling activities, and to ensure the procedures comply with all applicable local, State, and/or Federal requirements.

The Field Technician/Specialist is responsible for verifying and documenting that procedures and requirements contained in this SOP are followed. Any changes to the procedures outlined in the SOP should be approved by the Project Manager. The Field Technician/Specialist is responsible for ensuring that all work is conducted in a safe and professional manner. The Field Technician/Specialist implementing this SOP is encouraged to contact the Project Manager if there are any questions on the SOP or the task, as needed.

4.0 DEFINITIONS

Composite Sample- A technique that combines a number of subsamples collected from a body of material into a single homogenized sample for the purpose of analysis. The objective of composite soil sampling is to represent the average conditions in the sampled body of material. **Composite samples are not appropriate when analyzing volatile organic compounds (VOCs).**

Flame Ionization Detector (FID) – A scientific instrument that measures the concentration of organic vapors relative to a standard gas.

Grab Sample- Grab samples are collected at one location and at one point in time.

Hand auger – A hand-operated devise used for collecting shallow subsurface soil samples. Several types of hand augers are available – screw type augers, barrel augers, tube type augers, and hand-held power augers. The basic operation of a hand auger involves turning the auger repeatedly while applying pressure so that it goes down into the soil. Soil samples are collected either from the cuttings (screw-type) or the barrel (barrel or tube-type) of the auger.

Photoionization detector (PID) - A photoionization detector measures the concentration of volatile organic compounds and other gasses concentrations relative to a standard gas.

Shovel – A tool with a broad flat blade and typically upturned sided, used for moving materials, such as earth.

Smear Zone- The area within soil profile where the water table fluctuates between historic high and low elevations.

Subsample – A representative portion of a sample.

Trowel - Basic garden variety, which resembles a small shovel. Constructed of steel or polypropylene. The blade of a trowel is generally flat and 5 to 6 inches in length. A scoop with curved edges may be substituted if necessary.

5 Gram Terra Core™ Sampler (T-Sampler) - A disposable volumetric sampling device used for collecting, storing, and delivering an approximate 5 gram soil sample. A similar device may be used that meets the requirements of SW-846 Method 5035.

Water table- The water table is the upper surface of the zone of saturation. The zone of saturation is where the pores and fractures of the ground are saturated with water.

5.0 EQUIPMENT AND SUPPLIES

Equipment and supplies necessary to implement work described in this SOP include the following:

- Indelible black-ink pens and markers
- Personal Protective Equipment (PPE). Refer to SOP No. 624, *Personal Protective Equipment*
- Site control equipment. Refer to SOP No. 612, *Work Zone Setup and Site/Traffic Control*
- Decontamination equipment and supplies. Refer to SOP No. 616, *Equipment Decontamination*
- Tape measure or measuring wheel
- Field table and plastic sheeting or trash bags
- Laboratory supplied sample containers with labels, as required by the sampling plan
- Cooler chests with ice
- Photo Ionization Detector (PID) or Flame Ionization Detector (FID) and calibration supplies
- Appropriate containers for waste with labels
- Sampling equipment for the sampling method(s) [1] being utilized
- Zip-top plastic bags

[1] Possible Sampling Methods: Hand Trowel, Shovel, Hand Auger, Direct Push (Dual Tube and Macro Core), Rotosonic, and Split Spoon.

- Clean paper towel
- Spade / shovel / trowel
- Spatula
- Scoop
- Stainless steel spoon or other appropriate device (for composite sampling)
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl, or pan (for composite sampling)

6.0 RECORDS AND FORMS

The following records and forms used to implement work described in this SOP include the following:

- Site-specific Health and Safety Plan (HASP) (fully executed by the Project Manager, Field/Site Supervisor, and the Environmental Health and Safety Manager)
- Daily Tailgate/Toolbox Talk Form
- Field instructions (provided to field team before/during the kick-off meeting)
- Permit(s) and/or access agreement(s), if necessary
- Previous Site documentation
- Site map
- Field notebook and field binder
- Sample ID labels/tags
- Laboratory Chain of Custody (COC) Forms
- Shipping Forms (coolers, equipment, etc.)
- Drum inventory log
- Equipment calibration records
- Utility Locate Records
- Blank Soil Boring Logs (see Section 12 – Attachments)
- Sample Naming Convention
- AME Soil Classification (Cheat Sheet)

7.0 HEALTH AND SAFETY CONSIDERATIONS

All personnel conducting soil sampling activities should be qualified in proper safety procedures; have completed 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training; have necessary 8-hour HAZWOPER refresher training; and have current medical monitoring information. Refer to the Site-Specific HASP, task-specific Activity Hazard Analysis (AHA) for guidelines on safety precautions and proper PPE for implementation, and August Mack Health Standards of Practice for work-related activities.

Before drilling activity is initiated, underground utilities should be marked or cleared by the appropriate State or municipal utility protection organization. In addition, all drilling locations must be cleared using a private utility locating contractor who is equipped with electromagnetic (EM) and ground penetrating radar (GPR) utility locating equipment. Refer to SOP No. 614, *Underground and Overhead Utility Safety*. Once utilities have been located and prior to subsurface activities, a dig permit must be issued/authorized by the Project Manager or Senior Project Manager.

In addition, the following general Health and Safety requirements should be adhered to while performing soil sampling activities:

- **Take 5 and PIECE**
  - Participate
  - Require others to participate, and discuss safe ways to complete daily objectives
  - **Pause** and observe work area
  - **Identify** hazards
  - **Explain** hazards
  - **Control** hazards
  - **Execute** work safely
- Safety is everyone's job. Set high standards, hold people accountable, and make sure safety is the first consideration for every task.
- For more information refer to SOP No. 621, *Corporate Health and Safety Policy*

8.0 PROCEDURES

8.1 Pre-Sampling Procedures

The following activities should be performed prior to performing subsurface soil sampling.

1. Before leaving the office, check all sampling equipment, bottle orders, field books/logs to ensure everything is accounted for and ready.

2. When arriving onsite, conduct daily tailgate meeting and go over HASP.

3. Confirm that all field personnel are wearing the correct PPE. Refer to SOP 624 *Personal Protective Equipment*

4. Ensure all utilities have been marked and accounted for by public utility companies prior to work. If not, call the responsible utility company which is documented on the Public Utility Locate Form in the field binder. Refer to SOP No. 614, *Underground and Overhead Utility Safety*.

5. Locate all soil boring locations and determine if the area surrounding each boring is clear of utilities. A dig permit should be completed and confirmed by project manager prior to work in accordance with SOP No. 614, *Underground and Overhead Utility Safety*.

6. Check all equipment and calibrate PID/FID. Refer to the owner's manual for how to operate and calibrate PID/FID. Refer to SOP 241, *Headspace Analysis of Soil Samples* for additional information.

7. Set up work zone and traffic control for Site to ensure the safety of field crew. Refer to SOP 612 *Work Zone Setup and Site/ Traffic Control.*

8. Place plastic sheeting over a table (or tailgate if table is unavailable) for logging purposes and to ensure potential contamination is not spread. Be sure the plastic is securely fastened to the table.

9. Ask drillers if tooling for sampling method[2] have been decontaminated with a non-phosphatic detergent solution. If not, ask them to do so before beginning sampling activities. Tooling in direct contact with sample media should also be decontaminated between sample intervals. Refer to SOP 616 *Equipment Decontamination.*

8.2 Grab Soil Sampling Procedures

1. Once pre-sampling activities have been completed, begin soil sampling activities, as dictated by site specific project objectives and requirements. In general, sample collection activities should proceed progressively from the area of suspected least contamination to the area of suspected highest contamination.

2. Sampling depth intervals will be dependent upon the project specific requirements, but routinely will be one sample every two feet.

3. At no time should samples or the interior of sample containers be touched by unprotected (i.e., ungloved) hands. A fresh pair of gloves must be used for each sample (i.e. each 2-foot interval) to prevent cross contamination and provide protection from contaminant exposure. Gloves should be changed any time during sample collection when their cleanliness is compromised.

[2] Possible Sampling Methods: Hand Trowel, Shovel, Hand Auger, Direct Push (Dual Tube and Macro Core), Rotosonic, and Split Spoon.

4. Upon retrieval from the ground, ensure the driller cuts the plastic liner/bag while using cut-resistant gloves and places the sample interval on the table. If a soft digging technique is used, be sure to place soil on clean plastic sheeting. Note the time each sample interval is retrieved from the ground on the field boring log (Refer to SOP 321 *Classification of Unconsolidated Geologic Materials*).

5. If volatile organic analysis is to be performed, two options are available to meet protocols of Method 5035 and minimize losses of volatile compounds due to volatilization and biodegradation. To minimize loss of volatiles, soil samples are retrieved and jarred as quickly as possible, taking special care to limit exposure and disaggregation of the soil's physical structure[3].

    a. Option 1: Once a core barrel has been opened (or other sampling device), the collection of samples is the first activity performed (i.e., pre-empting the logging of the core sample and headspace analysis of the soil sample). Volatile sampling procedures are discussed in more detail in #12, below. Sampling personnel should be ready to jar samples immediately after the core is opened. The boring log should note the time the soil core is retrieved and the time the samples are collected. If there is a delay in opening the core liner, then that should be noted on the boring log as well. If a second core is obtained before the first core has been logged, the logging of the first core should be set aside until the second core has been sampled. Drill rig personnel should adjust their pace accordingly to allow proper collection of samples. This option requires samples for volatile analysis to be jarred at each interval. Headspace analysis will later determine which sample intervals to submit for laboratory analysis. Sample intervals that do not need sent to the laboratory for analysis may be appropriately disposed.

    b. Option 2: If the jarring of samples at each interval is not desired, a step-off boring for sample collection purposes only, may be completed as close as practical (preferably within one foot, but no more than three feet away) to the original boring. This option allows logging and headspace analysis (along with determination of the desired sample depth(s)) to be conducted first with the original boring, followed by sample collection from a step-off boring. The step-off boring will have the same name as the original boring and will be blank drilled to the desired sample depth(s), where

[3] The Indiana Department of Environmental Management (IDEM) Remediation Closure Guide (RCG) Section 3.2.4 Specifies "Collect subsamples soon after the soil core has been removed from the borehole. It is not appropriate to collect subsamples from previously iced material, or to wait five or more minutes for a standard headspace analysis before deciding whether or not to collect subsamples from soil left in the core barrel liner (or similar device) or soil screening container".

sample collected procedures (discussed above in Option 1 and below in #12) are then followed.

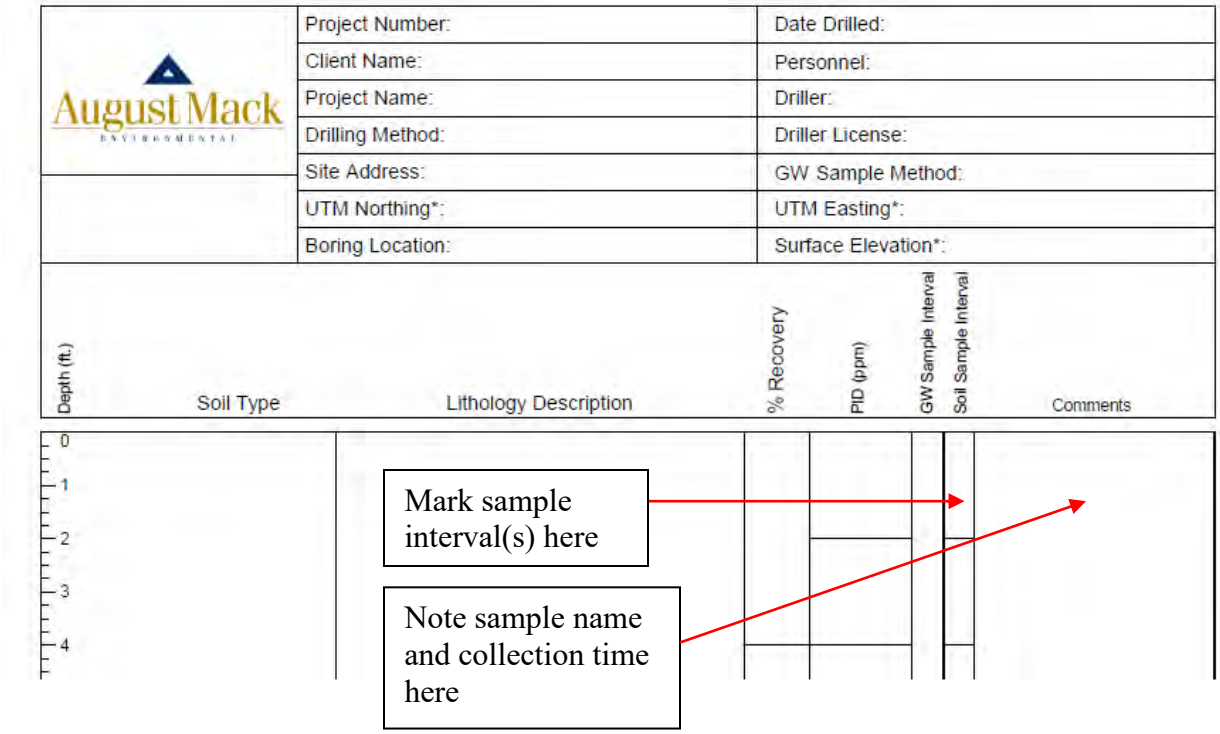
6. Document the lithology of the soil intervals according to SOP 321 *Classification of Unconsolidated Geologic Materials*. Note all soil descriptions on the field boring log**.**

7. Divide the sample interval length wise in half. Remove half the sample interval for field screening and place it in a clean zip-top bag and seal closed. Screen the soil in accordance with SOP 241 *Headspace Analysis of Soil Samples*. If non-volatile (TPH DRO, TPH ERO, SVOCs, PAHs, PCBs, metals, etc.) laboratory analysis is to be conducted, place the remaining portion of the two-foot section in another clean zip-top bag and place in the sample cooler until the entire boring has been logged and screened. Be sure the sample is representative of the entire interval with equal portion of the top, bottom and middle sections. **Samples for volatile analysis should never be placed in an intermediate storage container (e.g. plastic bags). See #5 above.** If you are following Option 2 above for volatile analysis, a second zip-top bag for temporary storage of sample media for non-volatile analysis is not necessary. Sample jarring for non-volatile analysis may also occur from the sample liners retrieved from the step-off boring discussed in Option 2.

8. Samples being submitted for laboratory analysis will be collected according to the Site-specific project objectives and requirements. Refer to field instructions for specific sampling intervals or sample selection protocols[4].

9. After determining which interval(s) will be laboratory analyzed, mark the sample interval with an "X" in the "Soil Sample Interval" column of the boring log and note the sample name (boring location and depth interval) and sample collection time in the "Comments" column on the boring log (example: SB-1-0-2 collected at 1045).

[4] If no specific sampling intervals are listed, the typical sample selection protocol is the interval with the highest PID hit above the water table and smear zone (see definitions). If multiple intervals have high PID hits, contact project team to discuss where to collect the sample(s). Note any contact with project team in field notebook. Refer to SOP 311 *Written Field Documentation*.



10. Soil sample containers and jarring procedures can vary, depending on the analyses and as dictated by site specific project objectives and requirements. If sampling for more than one analytical method type (i.e. VOCs, inorganics), obtain samples in a sequence of most to least volatile (i.e. VOCs, SVOCs, metals and PCBs).

11. For samples for volatile analysis, Terra Core™ Kits with T-Samplers (or equivalent) will be used to reduce the loss of volatiles associated with traditional sampling methods. Samples for volatile analysis will be collected directly from sample liners as discussed above in #5. Terra Core™ Kits vary depending on the laboratory employed, but typically consist of a foam block containing varying amounts of 40 ml vials (with and without preservatives and with or without magnetic stir bars) and a 2 oz. plastic jar (4 oz. glass jar can be substituted) in addition to the coring device. The vials are pre-weighted and pre-labeled by the laboratory. Be sure to complete the provided label, it is imperative that the weight is legible upon receipt at the laboratory. Do not affix a new label over the existing label since this will alter the weight of the vial. Preservatives[5] may include sodium bisulfate, methanol, and DI water. The 2 oz. jar[6] (used for percent moisture analysis) is unpreserved and should be filled/packed with soil until the

[5] Preservatives will vary depending on the laboratory employed.
[6] For some laboratories, the 2 oz. plastic jar may be substituted with a 4 oz. glass jar.

soil reaches the top of the jar[7]. The Terra Core™ Sampler will be used to deliver an approximate five gram plug of soil to each vial. Obtaining and transferring a sample should be done rapidly (<10 seconds) to reduce volatilization losses. A new Terra Core™ Sampler and new gloves should used for each sample interval. How to use the Terra Core™ Sampler:

a. Step 1 – Have the 40 ml glass vial ready for insertion of the soil plug. If the material has been exposed to the atmosphere for more than a couple minutes, create a fresh surface by scraping the soil surface using a clean spatula, scoop, knife, shovel, or equivalent. With the plunger seated in the handle, push the Terra Core™ into the soil sample until the sample chamber is filled. The sample should be collected from cohesive soil with the least amount of disruption (disaggregation) possible.
b. Step 2 – Wipe all soil or debris from the outside of the Terra Core™ Sampler. Ensure no soil extends past the end of the sampler barrel and is compacted, so equal amounts of soil are placed in each 40 ml container.
c. Step 3 – Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40 ml vial and extrude the sample by pushing the plunger down. Just before capping, a visual inspection of the lip and threads of the sample vessel should be made and any foreign debris should be removed with a clean towel, allowing an airtight seal to form. Quickly place the lid back on the 40 ml vial. The septum of VOA vial lids should be free of any punctures. Vials with a compromised septum should be discarded. Once sealed, vials should not be reopened to prevent compromising the integrity of the sample.

12. For all other analyses (i.e. non-volatile), remove the corresponding zip-top bag from the cooler or collect directly from the step-off boring sample liner. Fill/pack each 4 oz. jar until the soil reaches the top. Remove as much large aggregate from the sample media prior to placing in the sample container. Be sure the sample is representative of the entire interval with equal portion of the top, bottom and middle sections.

13. Wipe away any loose soil on the rim of the sample jars/vials and lids to guarantee a tight and complete seal. Place the lid on each jar and tighten.

14. Label the sample container, complete chain-of-custody form, and place the laboratory samples on ice in a cooler. Refer to SOP 171 *Sample Handling and Shipping.*

[7] Obtain the sample for the vials first, then fill the percent moisture sample jar.

15. Repeat the process for the next borehole. Plastic sheeting on the table that comes in direct contact with the sampled media should be discarded and replaced between each sample interval. Plastic sheeting on the table that is not in direct contact with the sample media should be changed at the field member's discretion. Tooling and equipment in direct contact with sample media should be decontaminated between sample intervals. Refer to SOP 616 *Equipment Decontamination*.

8.3 Composite Soil Sampling Procedures (if applicable to site)

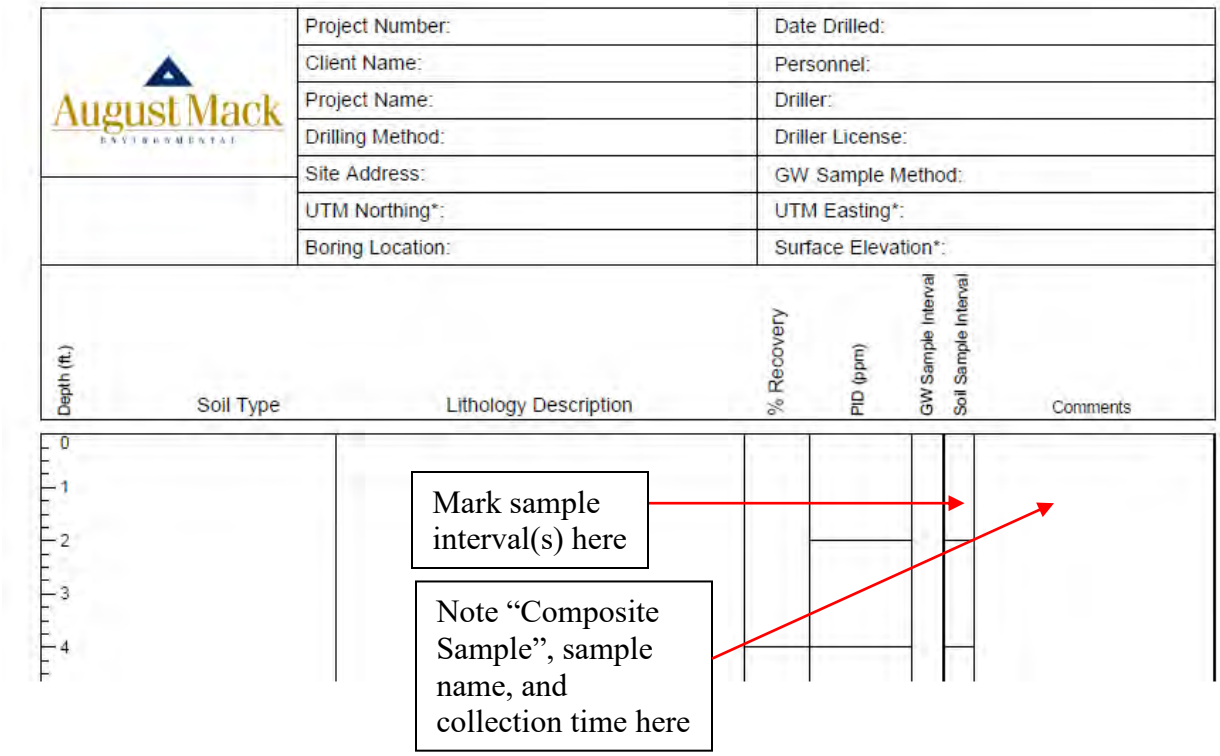
Composite soil samples are retrieved and classified in a similar manor as described above.

1. Once pre-sampling activities have been completed, initiate composite soil sampling activities, as dictated by site specific project objectives and requirements. **Composite samples are not appropriate when analyzing volatile compounds.**

2. Sampling depth intervals and placement will be dependent upon the project specific requirements. Composite samples can be taken from multiple locations (subsamples) in a grid system, or designated areas across a site. Field instructions from the project team should specify the amount of subsamples for each composite sample and their locations.

3. Samples being submitted for laboratory analysis must be of subsamples of equal size, from immediately adjacent sampling points, evenly spaced, and composited laterally (collected from similar depths). Refer to field instructions for specific sampling intervals and locations.

4. Place an equal amount of material from each subsample location in the stainless steel bowl or equivalent and homogenize by thoroughly mixing. Mark the sample interval with an "X" in the "Soil Sample Interval" column on the boring log and in the "Comments" column of the boring log, note that the sample is a composite sample and note the sample name and collection time.



5. Place the soil sample in an appropriate sample container(s) by using the alternate shoveling method. The alternate shoveling method involves placing a spoonful of soil in each sample container in sequence and repeating until the containers are full. Soil sample containers can vary, as dictated by site specific project objectives and requirements. **Samples for volatile analysis should not be homogenized**. Remove as much large aggregate from the sample media prior to placing in the sample container.

6. Unless stated otherwise, fill sample jars until the soil reaches the top of the jar. Again, be sure the composite sample is thoroughly mixed and representative of the sample media.

7. Wipe away any loose soil on the rim of the sample jars and lids to guarantee a tight and complete seal. Place the lid on each jar and tighten.

8. Label the sample container, complete chain-of-custody form, and place the laboratory samples on ice in a cooler. Refer to SOP 171 *Sample Handling and Shipping.*

9. Repeat process for next composite sample and be sure to change gloves for each boring location. Plastic sheeting on the table that comes in direct contact with

sample media should be discarded and replaced between each composite sample. Plastic sheeting on the table that is not in direct contact with sample media should be changed at the field member's discretion. Tooling and equipment in direct contact with the sample media should be decontaminated between samples. Refer to SOP 616 *Equipment Decontamination.*

8.4 Post-Sampling Procedures

1. Upon completion of the soil sampling activities abandon the borehole in accordance with SOP No. 411 *Geoprobe Soil and Groundwater Sampling and Site Restoration*.

2. All sample and utility locations should be documented on the site map. Use measuring tape or measuring wheel to measure the distance of each sample location to a minimum of two fixed objects identifiable on the site map. Note measurements on the site map. Refer to SOP No. 231, *Site Mapping*.

3. Containerize all investigation derived soil cores in approved and properly labeled 55-gallon capacity steel drums (or in approved containers specified by the sampling plan), label, and stage on-site (in an out of the way location) for later removal and disposal. Refer to SOP No. 511, *Containerized Waste Handling and Sampling.*

4. Once the investigation is complete, return to the office and prepare the samples for shipment to the laboratory. Volatile samples (Terra Core™ Kit vials) must be frozen within 48 hours of collection and all other sample containers must be lowered to at least six degrees Celsius (≤6°C). Refer to SOP 171 *Sample Handling and Shipping* and the below **Table 1.0 Sample Container Information.**

5. If samples are to be taken to the laboratory from the site, note on the chain of custody that the samples are coming straight from the site and the Terra Core™ Kits need to be frozen.

Table 1.0 Sample Container Information

Parameter	Method	Sample Jar(s)	Preservative	Sample Handling
Volatiles	8260	40 ml vials[8]	Varies No Preservative DI Water	Must be frozen within 48 hours

[8] Terra Core kits for volatile analysis will also come with an unpreserved 2-4 oz jar for percent moisture analysis.

			Methanol Sodium bisulfate	
SVOCs / PAH	8270 SIM	4 or 8 oz. Jar	None	≤6°C
Metals	6010/6020	4 or 8 oz. Jar	None	≤6°C
All Others	Varies	Varies	Varies	≤6°C
*Other parameters can be tested. Project team will discuss with field crew prior to sampling about various other methods and their requirements.				

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Various aspects of soil sampling procedures will depend on project-specific objectives and circumstances.

- Inspect equipment and supplies prior to use.
- Sample collection activities shall proceed progressively from the least suspected contaminated area to the most suspected contaminated area.
- If sampling for more than one analytical method type (i.e. VOCs, inorganics), obtain samples in a sequence of most to least volatile (i.e. VOCs, SVOCs, metals and PCBs).
- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample. Samples shall be custody sealed during long-term storage or shipment.
- Collected samples are in the custody of the sampler or sample custodian until the samples are relinquished to another party.
- If samples are transported by the sampler, they will remain under his/her custody or be secured until they are relinquished.
- Shipped samples shall conform to all U.S. Department of Transportation (DOT) rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179), and/or International Air Transportation Association (IATA) hazardous materials shipping requirements found in the current edition of IATA's Dangerous Goods Regulations.
- Documentation of field sampling is done in a bound logbook and/or sample collection forms, per August Mack SOP 311 – *Written Field Documentation*.
- Chain-of-custody documents shall be filled out and remain with the samples until custody is relinquished.
- All shipping documents, such as air bills, bills of lading, etc., shall be retained by the project leader and stored in a secure place.

- Quality Assurance/Quality Control (QA/QC) samples should be collected as specified by the Site-specific Quality Assurance Project Plan (QAPP) and/or sampling plan. QA/QC samples may include equipment blanks, duplicates, matrix spike/matrix spike duplicates, rinsate blanks, and/or trip blanks. Equipment blanks may be collected if equipment is field cleaned and re-used on-site or if necessary to document that low-level contaminants were not introduced by sampling tools.

10.0 EXCEPTIONS

- Review State regulations prior to implementation of this SOP to ensure procedures comply with local regulatory requirements.
- Depending on Site conditions, planned samples may or may not be taken due to what is encountered at the site.

11.0 CROSS-REFERENCES/SOURCES

- August Mack SOP No. 171 *Sample Handling and Shipping*
- August Mack SOP No. 231, *Site Mapping*
- August Mack SOP No. 241,
- *Headspace Analysis of Soil Samples*
- August Mack SOP No. 311, *Written Field Documentation*
- August Mack SOP No. 321, *Classification of Unconsolidated Geologic Materials*
- August Mack SOP No. 411, *Geoprobe Soil and Groundwater Sampling and Site Restoration*
- August Mack SOP No. 511, *Containerized Waste Handling and Sampling*
- August Mack SOP No. 612, *Work Zone Setup and Site/Traffic Control*
- August Mack SOP No. 614, *Underground and Overhead Utility Safety*
- August Mack SOP No. 616, *Equipment Decontamination*
- August Mack SOP No. 621, *Corporate Health and Safety Policy*
- August Mack SOP No. 624, *Personal Protective Equipment*
- August Mack SOPNo. 625, *General Health and Safety Rules and Responsibilities*
- August Mack Activity Hazard Analysis, *Logging & Screening Soil Samples*
- August Mack Activity Hazard Analysis, GeoProbe Operation and Well Installation
- IDEM. (March 22, 2012). *Remediation Closure Guide.*
- IDEM. (Revised October 13, 2016). *Sampling Soil and Waste for Volatile Organic Compounds (VOCs)*.
- U.S. EPA. (July 2002). *Appendix A of Method 5035A (SW-846): Closed -System Purge-And-Trap and Extraction for Volatile Organics in Soil and Waste Samples*, Draft Revision 1.

12.0 ATTACHMENTS

August Mack ENVIRONMENTAL	Project Number:	Date Drilled:
	Client Name:	Personnel:
	Project Name:	Driller:
	Drilling Method:	Driller License:
	Site Address:	GW Sample Method:
	UTM Northing*:	UTM Easting*:
	Boring Location:	Surface Elevation*:

Depth (ft.)	Soil Type	Lithology Description	% Recovery	PID (ppm)	GW Sample Interval	Soil Sample Interval	Comments
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

* = UTM Northing, Easting, and Surface Elevation are estimated, unless specified in the report to have been surveyed.

August Mack ENVIRONMENTAL	Project Number:	Date Drilled:
	Client Name:	Personnel:
	Project Name:	Driller:
	Drilling Method:	Driller License:
	Site Address:	GW Sample Method:
	UTM Northing*:	UTM Easting*:
	Boring Location:	Surface Elevation*:

Depth (ft.)	Soil Type	Lithology Description	% Recovery	PID (ppm)	GW Sample Interval	Soil Sample Interval	Comments
20							
21							
22							
23							
24							
25							
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37							
38							
39							
40							

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August Mack ENVIRONMENTAL	Project Number:	Date Drilled:
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	Project Name:	Driller:
	Drilling Method:	Driller License:
	Site Address:	GW Sample Method:
	UTM Northing*:	UTM Easting*:
	Boring Location:	Surface Elevation*:

Depth (ft.)	Soil Type	Lithology Description	% Recovery	PID (ppm)	GW Sample Interval	Soil Sample Interval	Comments
40							
41							
42							
43							
44							
45							
46							
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60							

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August Mack ENVIRONMENTAL	Project Number:	Date Drilled:
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	Drilling Method:	Driller License:
	Site Address:	GW Sample Method:
	UTM Northing*:	UTM Easting*:
	Boring Location:	Surface Elevation*:

Depth (ft.)	Soil Type	Lithology Description	% Recovery	PID (ppm)	GW Sample Interval	Soil Sample Interval	Comments
61							
62							
63							
64							
65							
66							
67							
68							
69							
70							
71							
72							
73							
74							
75							
76							
77							
78							
79							
80							

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August Mack ENVIRONMENTAL	Project Number:	Date Drilled:
	Client Name:	Personnel:
	Project Name:	Driller:
	Drilling Method:	Driller License:
	Site Address:	GW Sample Method:
	UTM Northing*:	UTM Easting*:
	Boring Location:	Surface Elevation*:

Depth (ft.)	Soil Type	Lithology Description	% Recovery	PID (ppm)	GW Sample Interval	Soil Sample Interval	Comments
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
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97							
98							
99							
100							

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August Mack ENVIRONMENTAL	Project Number:	Date Drilled:
	Client Name:	Personnel:
	Project Name:	Driller:
	Drilling Method:	Driller License:
	Site Address:	GW Sample Method:
	UTM Northing*:	UTM Easting*:
	Boring Location:	Surface Elevation*:

Depth (ft.)	Soil Type	Lithology Description	% Recovery	PID (ppm)	GW Sample Interval	Soil Sample Interval	Comments
101							
102							
103							
104							
105							
106							
107							
108							
109							
110							
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116							
117							
118							
119							
120							

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August Mack ENVIRONMENTAL	Project Number:	Date Drilled:
	Client Name:	Personnel:
	Project Name:	Driller:
	Drilling Method:	Driller License:
	Site Address:	GW Sample Method:
	UTM Northing*:	UTM Easting*:
	Boring Location:	Surface Elevation*:

Depth (ft.)	Soil Type	Lithology Description	% Recovery	PID (ppm)	GW Sample Interval	Soil Sample Interval	Comments
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							

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August Mack ENVIRONMENTAL	Project Number:	Date Drilled:
	Client Name:	Personnel:
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	Drilling Method:	Driller License:
	Site Address:	GW Sample Method:
	UTM Northing*:	UTM Easting*:
	Boring Location:	Surface Elevation*:

Depth (ft.)	Soil Type	Lithology Description	% Recovery	PID (ppm)	GW Sample Interval	Soil Sample Interval	Comments
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
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156							
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158							
159							
160							

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August Mack ENVIRONMENTAL	Project Number:	Date Drilled:
	Client Name:	Personnel:
	Project Name:	Driller:
	Drilling Method:	Driller License:
	Site Address:	GW Sample Method:
	UTM Northing*:	UTM Easting*:
	Boring Location:	Surface Elevation*:

Depth (ft.)	Soil Type	Lithology Description	% Recovery	PID (ppm)	GW Sample Interval	Soil Sample Interval	Comments
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							
172							
173							
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178							
179							
180							

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August Mack ENVIRONMENTAL	Project Number:	Date Drilled:
	Client Name:	Personnel:
	Project Name:	Driller:
	Drilling Method:	Driller License:
	Site Address:	GW Sample Method:
	UTM Northing*:	UTM Easting*:
	Boring Location:	Surface Elevation*:

Depth (ft.)	Soil Type	Lithology Description	% Recovery	PID (ppm)	GW Sample Interval	Soil Sample Interval	Comments
181							
182							
183							
184							
185							
186							
187							
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198							
199							
200							

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STANDARD OPERATING PROCEDURE

SOP NUMBER: 122

SOP TITLE: GROUNDWATER SAMPLE COLLECTION FROM MONITORING WELL

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202

REVISION DATE: October 2018

Revision Prepared By: Dawn L. Knipe

Dawn L. Knipe, LPG
Senior Geologist

Approved By: James A. Berndt

James A. Berndt, LPG
Principal Hydrogeologist

1. PURPOSE AND SUMMARY

The following Standard Operating Procedure (SOP) describes general and specific procedures, methods and considerations to use when collecting groundwater samples from monitoring wells for laboratory analysis. August Mack Environmental, Inc. (August Mack) field personnel are to follow the procedures within this SOP when collecting groundwater samples from monitoring wells. The procedures are subject to change if unusual or unanticipated field conditions are encountered. All deviations from this SOP must be pre-approved by the Project Manager or other designated project technical lead and documented in the field logbook, along with a description of the circumstances requiring the deviation.

Groundwater can become contaminated from surface spills, leaking tanks and pipes, and other sources. Contaminants in groundwater can potentially affect the drinking water wells and surface water (in groundwater discharge areas), and result in a vapor intrusion conditions in overlying structures. This SOP documents August Mack procedures for groundwater sample collection from monitoring wells, including: multi-volume purge and micro-purge sampling methods.

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3. RESPONSIBILITIES

It is the responsibility of the Project Manager to ensure that each project involving groundwater sampling is properly planned and executed. The Project Manager is also responsible for understanding specific requirements and/or regulations regarding groundwater sampling, and to ensure the procedures comply with all applicable local, State, and/or Federal requirements.

The Field Technician/Specialist is responsible for verifying and documenting that procedures and requirements contained in this SOP are followed. Any changes to the procedures outlined in this SOP should be approved by the Project Manager. The Field Technician/Specialist is responsible for ensuring that all work is conducted in a safe and professional manner. The Field Technician/Specialist implementing this SOP is encouraged to contact the Project Manager if there are any questions about the SOP or the task, as needed.

4. DEFINITIONS

Bonded Tubing – Two pieces of tubing continuously connected along the entire length of the tubes. Bonded tubing is typically used for the water and air supply lines when sampling with a bladder pump.

Decontamination – the neutralization or removal of contaminated substances from an area, object, or person.

Dissolved Oxygen (DO) – the amount of gaseous oxygen dissolved in water. DO measurements are typically reporting in milligrams per Liter (mg/L).

Filtration: The process of separating suspended solid matter from a liquid by causing the liquid to pass through the pores of a filter.

Flow Cell – a sealed container that attaches to a multi-parameter meter and allows the continuous measurement of physical and geochemical parameters in purge water (in-line) as it flows from a monitoring well.

Groundwater - fresh water derived from rain and/or melting ice and snow that percolates into the ground and is stored in the pore spaces and cracks between rocks and particles of soil.

Monitoring Well – wells designed to monitor and obtain groundwater quality samples and hydrogeological information from subsurface water in the saturated zone.

Oil/Water Interface Indicator - a polyethylene coated steel tape (marked in engineering or metric increments) equipped with a probe at the end, which emits a solid tone when in contact with separate-phase product and an intermittent tone when in contact with water.

Personal Protective Equipment - equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses.

Pump Controller/Compressor – a sealed case that attaches to a sampling pump, either through a pneumatic or electrical connection, and controls the rate of flow through adjustable dials.

Purging - the process of removing stagnant water from a well and surrounding filter pack, immediately prior to sampling, causing its replacement by groundwater from the adjacent formation that is representative of aquifer conditions.

Oxidation/Reduction Potential (ORP) - a numerical index of the intensity of the oxidizing or reducing conditions within an aqueous solution such as ground water. Oxidizing conditions are indicated by positive potentials and reducing conditions are indicated by negative potentials. ORP measurements are generally expressed in millivolts (mV).

Secondary Containment - a container, barrier, or other means of surrounding one or more primary storage containers to collect any contaminated material spillage in the event of loss of integrity or failure of the primary container.

Specific Conductivity - a measure of how well water can conduct an electrical current.

Submersible Pump – a device, which has a hermetically sealed motor close-coupled to the pump body, which can be submerged in fluid.

Turbidity - the cloudiness or haziness of a fluid

Water Level Indicator – a polyethylene coated steel tape (marked in engineering or metric increments) equipped with a probe at the end, which emits a solid tone when in contact with water.

5. EQUIPMENT AND SUPPLIES

Equipment and supplies necessary to implement work described in this SOP include the following:

- Personal Protective Equipment (PPE)
- Site control equipment

- Decontamination equipment
- Secondary containment equipment
- Teflon or Teflon lined LDPE tubing[1,2]
- Teflon or LDPE bailers
- Nylon mason line
- Field table and plastic sheeting or trash bags
- Socket wrench set and one 15/16-inch socket or 6-inch adjustable crescent wrench
- Well lock key(s)
- Water level indicator and/or an oil/water interface indicator
- Sampling pump and controller
- Multi-parameter meter[3] and flow cell
- Power Source
- Laboratory supplied sample containers and coolers

6. RECORDS AND FORMS

The following records and forms used to implement work described in this SOP include the following:

- Site-specific Health and Safety Plan (HASP) (fully executed by the Project Manager, Field/Site Supervisor, and the Environmental Health and Safety Manager)
- Field instructions (provided to field team before/during the kick-off meeting)
- Previous Site documentation (e.g., well location maps, well logs, tables with well depth/depth-to-water, etc.
- Access agreement, if necessary
- Field notebook
- Purge records
- Monitoring well inspection checklist
- Drum inventory record
- Sample ID tags and laboratory Chain of Custody
- Equipment calibration records

7. HEALTH AND SAFETY CONSIDERATIONS

All personnel conducting groundwater sampling activities should be qualified in proper safety procedures; have completed 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training; have necessary 8-hour HAZWOPER

[1] Inlet/outlet fittings vary by manufacturer and equipment type. Check with the vendor to ensure the size of tubing is compatible with the fittings of the equipment when placing orders.
[2] Teflon and similar PTFE components should not be used for some sampling parameters, such as PFAs and PFOAs.
[3] Multi-parameter meter sensors vary by manufacturer; check with the vendor to ensure the MPM is equipped with the appropriate sensors to meet project objectives and requirements when placing orders for rental equipment.

refresher training; and have current medical monitoring information. Refer to the Site-Specific HASP, task-specific Activity Hazard Analysis (AHA) for guidelines on safety precautions and proper PPE for implementation, and August Mack Health Standards of Practice for work-related activities.

8. PROCEDURES

Initial well purging methods were developed in the 1960's and 1970's for steel-cased water supply wells with screens set below the top of the water table. The procedures used for sampling wells called for purging multiple well volumes (usually three well volumes) of water before sampling, because all the water within the well casing was thought to be "stagnant", and not representative of water in the aquifer. The same multi-volume purge procedures were then carried over into the sampling of groundwater monitoring wells. Over the years, groundwater purging and sampling practices at many U.S. EPA sites, and sites in various state programs have shifted from traditional multi-volume purge (bailing) techniques to micro-purge (low-flow) sampling methods to eliminate problems associated with bailing (e.g., volatilization, preferential recharge from more porous layers, increased turbidity, and generation of large quantities of purge water).

The difference between methods is that a pre-determined volume of water is not removed from the well during micro-purge sampling; instead, the well is pumped at a low flow rate (100 ml/minute to 1.0 liter/minute) until groundwater physical and chemical parameters have stabilized, using an adjustable, down-hole pump. In some instances, groundwater recharge rates in monitoring wells may prevent micro-purge sampling techniques.

8.1 Pre-Sampling Activities

The following activities should be performed prior to performing groundwater sampling via micro-purge or multi-volume purge sampling techniques.

1. Inspect all pump and multi-parameter probes PRIOR TO mobilizing to job site to ensure that all of the necessary equipment is accounted for and in working condition. If you have not used a piece of equipment before, familiarize yourself with the equipment and review the manuals.
2. Don appropriate PPE and establish Site control near the monitoring well to be sampled in accordance with August Mack's Site Control Procedures (See **Figure 1** of **Attachment A**).
3. Set up and cover field table or ground surface around monitoring well with polyethylene plastic sheeting and setup secondary containment adjacent to monitoring well.

4. Place empty purge water containers inside secondary containment (See **Figure 2** of **Attachment A**).
5. Decontaminate non-dedicated, reusable equipment (i.e. flow-cell, sampling pump, and associated cables, water level) in accordance with approved Standard of Practice[4]
6. Open monitoring well. If Depth to Water (DTW) measurements were not collected the same day as sample collection, a DTW measurement should be collected at the well using a water level indicator (or equivalent)[5] prior to sampling. Do not collect a depth to bottom measurement at this time if sampling via micro-purge because that process will stir-up sediment in well and reduce effectiveness of low-flow sampling. *For detailed instructions on operation of water level, refer to owner's manual*.

8.2 Micro-Purge (Low-Flow)[6] Sampling

For groundwater sampling via micro-purge, a pre-determined purge volume is not required. Sampling is based on stabilization of field parameters and water level[7]. Refer to **Figure 3 through Figure 7** of **Attachment A** for low-flow sampling components. *For detailed instructions on operation of Multi-parameter meters (MPMs) and submersible sampling pumps, refer to the owner's manual for the specific MPM and pump being used*.

8.2.1 Pump & MPM Setup

1. Determine the pump intake depth within each well to be sampled. Unless otherwise specified by Project Manager, the pump intake should be placed at the depth of the approximate midpoint of the submerged portion of the well screen. To determine pump placement use the following:

    a. Refer to purge records from the most recent sampling event to determine the Depth to Bottom (DTB) and well construction diagrams to determine screen length and interval. If previous purge records are not available, refer to the monitoring well construction diagram to determine the DTB. *Do not gauge depth to bottom prior to sampling.*

    b. Subtract DTW from the DTB measurement to determine the thickness of the water column within each well to be sampled. If it is determined the well screen is completely submerged, the pump intake should be placed at the approximate midpoint of the well screen. If it is determined the well screen is not completely submerged, the pump intake should be placed at the approximate

[4] AME Standards of Practice: Decontamination
[5] SOP 211: Manual Water Level Measurement
[6] Indiana Department of Environmental Management, 2009) states the water table should be below the top of the well screen when using micro-purge sampling methods; however, the IDEM has not expressed concern when implementing Micro-Purge Sampling methods for wells with submerged screens.
[7] Purging and sampling of wells should be performed in the order of increasing chemical concentrations (known or anticipated).

midpoint of submerged portion of the well screen. *An effort should be made to set the pump intake at least two (2) feet above the bottom of the well.*

2. Measure a length of Teflon, Teflon-lined, or bonded LDPE tubing that is equivalent to the depth of the pump intake calculated above, and mark it with a piece of colored tape (or equivalent). Continue to measure an additional length of tubing beyond the marked intake depth, typically 8-10 feet and then cut the tubing.

3. Attach the end of the tubing furthest from the colored tape to the water outlet fitting on the sampling pump.

    a. If using bonded tubing, separate the ends of the tubing, typically 0.5-1 foot, and attach one end to the water outlet fitting and one end to the air inlet fitting on the sampling pump.

4. Secure a support line to the top of the sampling pump equal to the total depth of the well to be sampled plus additional length, typically 4-6 feet, to be tied off during sampling. The material used for the support line usually consists of a length of nylon mason line (or equivalent material), but in some cases (deep wells and heavier sampling equipment) it could be wire. Do not skip this step. The electrical/air and water lines should not be used to support the weight of the pump.

5. Lower the pump into the well VERY SLOWLY to avoid agitation when lowering the pump into the well, place the weight of the pump on the support line and not the tubing or electrical lead wires.

6. When the colored tape reaches the top of the well casing, secure the pump using the stopper attached to the hose reel and/or tie the support line around the handle of the hose reel or well casing.

7. Secure the tubing to the inside of a purge water container.

8. Confirm there is no electrical/air connection from the sampling pump to the pump controller/compressor.

9. Connect the pump controller/compressor to a power source and verify the controller is receiving power by checking the digital display readout.

10. Before connecting the sampling pump to the controller/compressor, setup the flow cell and MPM.

11. Assemble flow cell and place inside secondary containment. *Refer to the owner's manual for the specific flow cell assembly instructions*.

12. Measure a second length of tubing, typically 2-3 feet, to discharge water from the flow cell to the purge water container. Connect one (1) end of the flow cell discharge tubing to the water outlet fitting on the flow cell and secure the opposite end to the inside of a second purge water container.

13. Turn on the multi-parameter meter (MPM) and confirm the data logger is receiving power by checking the digital display readout.

14. Remove the protective cover from the sensor suite and thread the MPM into the flow cell until it is snug (be careful not to overtighten the MPM during installation).

15. Turn on the water level indicator and slowly insert into well until it begins to beep, then raise the indicator slightly, until it stops beeping and place the indicator tape reel on clean plastic sheeting or in secondary containment. The indicator will be used periodically to measure water level drawdown in the well. Keep the water level indicator in the well during the entire operation.

16. Connect the sampling pump to the controller/compressor and slowly adjust the frequency (speed) of the pump using the control dial(s) until water begins to flow from the pump discharge tubing inside the purge water container. *Be sure to confirm the output from the controller is at its lowest setting, typically 0.0 (use the control dials to adjust the flow rate if necessary) when starting the pump.*

17. Using a graduated cylinder (or equivalent measuring device), measure the flow rate from the pump discharge tubing in liters per minute (L/min), if necessary, use the control dial(s) to adjust the flow rate until it is within the acceptable range for low-flow sampling (0.1 to 0.3 L/min). *Flow rates may be up to 1.0 L/min in very transmissive formations.*

18. Visually evaluate the turbidity (clarity) of the water coming from the pump discharge tubing. If the water appears visually turbid, allow the well to purge for a brief period (no more than 10 minutes). Document the amount of time the well was allowed to purge due to turbidity and the depth to water in field notes.

19. Connect the pump discharge tubing to the water inlet fitting located at the bottom of the flow cell. This should be performed over the purge bucket to avoid water from flowing into the secondary containment while connecting to the flow cell.

20. Once water begins to flow from the discharge tubing into the flow cell, check the flow rate to confirm backpressure within the flow cell has not affected the flow rate and adjust as needed. Record the flow rate, water level, and MPM readings on the Field/Electronic Purge Record every 3-5 minutes[8].

21. Once the stabilization criteria has been achieved, disconnect the pump discharge tubing from the flow cell and secure the tubing inside the purge water bucket. (*Do not collect samples from the flow cell discharge tubing or the flow cell*). See Section 8.3.2 for sampling criteria.

8.2.2 Stabilization Criteria

The purpose of purging the monitoring wells prior to sampling is to obtain representative groundwater samples from the aquifer. Water level measurements are collected and field parameters are monitored throughout the purging process to ensure that there is no significant drawdown during purging and the water being purged is representative of formation water. Drawdown and parameter stabilization requirements may vary by state and/or project. Refer to specific state guidance and/or project requirements to determine appropriate sampling criteria. In the absence of specific state guidance and/or project requirements, the following criteria should be used:

8.2.2.1 Drawdown

Water level measurements should be collected every 3 to 5 minutes throughout the purging process to identify if significant drawdown (greater than 0.3 ft) is occurring. Drawdown may fluctuate within the first 15 minutes of purging as flow rates are adjusted; however, the water level should stabilize. If the water level drawdown is greater than 0.3 ft but stable, continue the low-flow purging process and record drawdown observation in field book. If drawdown is greater than 0.3 ft and the water level does not stabilize within the first 15 minutes, discontinue low-flow purging and proceed to the multi-volume purge method[9].

Alternative sampling procedures/methods should be discussed with regulator prior to the next sampling event if drawdown does not stabilize during purging in individual wells[10].

[8] At least one flow cell volume should be purged from the flow cell between measurements.
[9] If sampling in Indiana, refer to the IDEM Technical Guidance Document: Micro-Purge Sampling Option (Revised December 17, 2017) for sampling options if the recharge rate is lower than the lowest pumping rate and target drawdown cannot be met.
[10] This includes sites in Indiana.

8.2.2.2 Field Parameters

The following field parameters are typically monitored for stability during the purging process: pH, temperature, specific conductivity, oxygen-reduction potential (ORP), and turbidity. Field parameters should be collected every 3 to 5 minutes throughout the purging process until stabilization has been achieved. Stability will be achieved when three consecutive readings meet the specified stabilization criteria. In other words, when the last two parameter readings do not vary more than the allowable stabilization range from the third-to-last reading. Default stabilization criteria are specified in the table below[11]:

Parameter	Stabilization Range
pH	± 0.1 unit
Temperature	3%
Specific Conductance	3%
ORP	±10 millivolts
Dissolved Oxygen	10% for values greater than 0.5 mg/L, or 3 consecutive readings that are less than 0.5 mg/L
Turbidity	10% for values greater than 5 NTU; or three consecutive readings that are less than 5 NTU

Once the field indicator parameters have stabilized, proceed to **Section 8.4** for sample collection procedures. If parameters have not stabilized within 2 hours of initial purge time or three (3) well volumes have been purged: discontinue purging, collect samples and provide explanation of attempts to achieve stabilization in field book.

8.3 Multi-Volume Purge Sampling

For groundwater sampling via multi-volume purge technique, a predetermined volume of water is calculated and purged from the well.

1. Use one of the following equations, to calculate the volume of water within each monitoring well to be sampled.

$$V = 0.041\ d^2h \quad \text{or} \quad V = fh$$

Where:

V = volume of water in gallons
h = thickness of water column in feet
d = diameter of well in inches
f = Gallons per Foot of Depth (See Table Below)

[11] Default stabilization criteria should be followed unless site-specific stabilization criteria has been established.

Well Diameter (d)	Gallons per Foot of Depth (*f*)
1″	0.041
1.5″	0.092
2″	0.163
4″	0.653

*Table provides *f* for various casing diameters

2. If switching from low-flow sampling to multi-volume purge sampling:
    a. Lower the pump until it is 1 ft above the bottom of the well and remove three well volumes or until the well is pumped dry. Record total volume purged in field notebook. If the well was purged dry, do not collect a groundwater sample until there is sufficient recovery (commonly 90%) of the water column.
    b. Proceed to **Section 8.4** for sample collection procedures.
3. If using a bailer to sample:
    a. Secure a length of nylon mason line, or equivalent material, to the top of the dedicated bailer equal to the total depth of the well to be sampled plus additional length to prevent discomfort during sampling, typically 4-6 feet (Refer to **Figure 8** in **Attachment A** for bailer setup).
    b. Lower the bailer slowly into the well until the top of the bailer is submerged, or it reaches the bottom of the well, whichever comes first.
    c. Remove the bailer from the well and transfer the contents of the bailer to the purge water container, being careful not to allow the bailer or masons line/string to contact the ground or other surface during transfer.
    d. Repeat steps 2 and 3 until a minimum of three well volumes have been purged from the monitoring well or the well is purged dry. Record total volume purged in field notebook If the well was purged dry, do not sample until there is a sufficient recovery (commonly 90%) of the water column.
    e. Proceed to **Section 8.4** for sample collection procedures.

8.4 Groundwater Sample Collection

1. Prepare laboratory supplied sample containers for groundwater sample collection, including any blanks and duplicates.

a. Verify all sample containers have the appropriate preservative (if required) and the custody seals have not been broken[12].
b. Label the lid of each sample container with the Well ID Number
c. Complete and attach laboratory provided adhesive label to each sample container.

2. Don a pair of new disposable nitrile gloves (or equivalent). Gloves should not be exposed to the media being sampled and should be changed any time during sampling their cleanliness is compromised.
3. Open the appropriate sample container and place container lid on a clean surface within arm's reach.
4. Transfer groundwater sample from collection device (bailer or pump discharge tubing) directly into the appropriate sample container.
5. Sample container types, volumes, filtration and preservation methods will depend upon project specific analytical parameters; however, sample containers should typically be filled in the following order:

a. Glass Vial(s) – 40 ml with Teflon® septa

1) Fill container up to the neck (threaded portion) and then remove from flow path.
2) Fill the container lid with groundwater.
3) Transfer groundwater from the lid to the container until the neck of the container is full and a meniscus forms on top of the vial (do not overfill vials containing preservative). Refer to **Figure 9** of **Attachment A**.
4) Slowly place the lid on top of the container and close tightly.
5) Run a finger across the top of the lid, the Teflon septa should feel convex. If the membrane is concave, remove the lid and repeat steps 2 through 5.
6) Turn the container upside down and tap with finger to be certain there are no air bubbles in the sample. If bubbles are present, remove the lid and repeat steps 2 through 6.
7) If bubbles are still present after repeated attempts, a new vial should be obtained and the sample re-collected.

b. Glass Bottles - 100 ml to 1 L

1) Fill container to a point approximately half way up the neck and then remove from flow path.

[12] Refer to field instructions or bottle packing sheet provided by laboratory for details regarding preservative type required for each sample analysis.

2) Slowly place the lid on top of the container and close tightly.

c. Plastic Bottles – 100 ml to 1 L

1) Repeat steps 7 and 8.

6. Store the sample on ice in a cooler in accordance with Sample Handling and Shipping **SOP 161** and record the sample ID, sample time, preservative, number of containers, and requested analysis on a laboratory chain-of-custody (COC) form.

7. Note any changes from the standard sample container, preservative, or any specific comments or instructions for the laboratory regarding analysis (hold, Level IV, field filtered) in the comments section of the COC.

8.5 Post-Sampling Activities

1. Remove the WLI probe and associated length of tape from the monitoring well (*do not wind the WLI tape onto the tape reel*), decontaminate in accordance with approved Standard of Practice, and secure in the field vehicle for transport.
2. If not using a sampling pump to collect groundwater samples, proceed to step 10.
3. If using a pump controller, adjust the control dial until the output is at the lowest setting, and then disconnect the sampling pump from the pump controller.
4. Disconnect the pump controller cables from the power source. Remove the MPM from the flow cell and secure the MPM and handheld display in the field vehicle for transport.
5. Decontaminate the flow cell and secure in the field vehicle for transport.
6. Remove the pump, tubing, and associated lead wires from the monitoring well using the support line (*never use lead wires or tubing to support the weight of the pump*).
7. Remove the tubing, support line, and bladder (if using bladder pump) and set aside for disposal.
8. Decontaminate the sampling pump and associated lead wires, attach a new clean bladder[13] (if using a bladder pump), and secure in the field vehicle for transport.
9. Seal purge water and decontamination containers with tight-fitting lids and secure in the field vehicle for transport.
10. Secure field table and secondary containment containers in the field vehicle for transport.

[13] For detailed instructions on bladder replacement, refer to owner's manual.

11. Properly dispose of all material that has been exposed to groundwater (PPE, bailers, tubing, mason line, plastic sheeting). Disposal methods will depend upon specific project objectives and requirements.
12. Replace and tighten the J-plug in the monitoring well, close the monitoring well protective cover, and secure with either a lock or bolts (depending on cover type).
13. Check the ground near the monitoring well and remove any other equipment, tools, or trash in the area and secure in the field vehicle.
14. Review the Field/Electronic Purge Record and COC to confirm all necessary information has been recorded accurately.
15. Transfer contents of purge water containers to an appropriately labeled 55-gallon steel drum for temporary on-site storage and eventual characterization and disposal. (Refer to SOP 511).
16. Move to next sampling location and repeat sampling process as specified above.
17. Ship/deliver samples with completed chain-of-custody documentation to laboratory for analysis (Refer to SOP 161).

9. QUALITY ASSURANCE/QUALITY CONTROL

Based on project objectives and requirements, equipment blanks should be collected if equipment is field cleaned and re-used on-Site or if necessary to document that low-level contaminants were not introduced by pumps, bailers, or other sampling equipment.

Various aspects of groundwater sampling procedures will depend on project-specific objectives and circumstances.

- Inspect equipment and supplies prior to use;
- Multi-parameter meters should either be calibrated by the equipment supplier or the field technician/specialist prior to sampling activities;
- Samples and equipment should be stored in a secure location to prevent conditions, which could contaminate or alter the properties of the sample;
- Depending on project specific objectives and requirements, samples may be custody-sealed during long-term storage or shipment, and;
- If sampling devices are to be reused, sample collection activities shall proceed progressively from the least impacted well to the most impacted well.

10. EXCEPTIONS

- Review State/Federal regulations prior to implementation of this SOP to ensure procedures comply with appropriate regulatory guidance or project-specific requirements;
- If non-aqueous phase liquids are identified within a monitoring well, discuss with the Project Manager or other designated project technical lead prior to sample collection.

11. CROSS-REFERENCES/SOURCES

- August Mack Sample Handling and Shipping SOP No. 161
- August Mack Manual Water level Measurement SOP No. 211
- August Mack Containerized Waste Handling and Sampling SOP No. 511
- August Mack Standards of Practice: Decontamination
- August Mack Activity Hazard Analysis, Groundwater Monitoring/Sampling
- IDEM. (March 22, 2012). *Remediation Closure Guide.*
- IDEM. (December 2017) Technical Guidance Document: *The Micro-Purge Sampling Option*.
- US EPA Region 1 (September 2017) Low Stress (low flow) Purging and Sampling Procedure For the Collection of Groundwater Samples From Monitoring Wells
- US EPA (May 2002) Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers
- US EPA Region 4 Science and Ecosystem Support Division (March 2013) Groundwater Sampling Operating Procedure
- US EPA Ground Water Issue (April 1996) Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures

12. ATTACHMENTS

- Field Sampling Equipment Calibration (if Electronic Record is not applicable)
- Groundwater Sampling Field Purge Record (if Electronic Record is not applicable)
- Monitoring Well Inspection Checklist
- Groundwater SOP Photo Log

ATTACHMENT A

Field Sampling Equipment Calibration

FIELD SAMPLING EQUIPMENT
CALIBRATION AND INSPECTION FIELD FORM

FACILITY: _____ DATE:_____

PURPOSE OF SAMPLING: _____

SAMPLERS: _____

MULTI-PARAMETER METER:

Manufacturer:_____ Serial Number:_____

Overall Condition: Good Fair Poor Comments:_____
Battery Charged: Yes No Comments:_____
Decon Prior to Use: Yes No Comments:_____

STANDARDS

	Manufacturer	Lot No.	Expiration Date
PH			
4.0			
7.0			
Conductivity			
7980 uS			
Turbidity			
Factory			

Before Calibration				
Time	Temperature	pH	Conductivity	Turbidity

After Calibration				
Time	Temperature	pH	Conductivity	Turbidity

WATER LEVEL INDICATOR:

Manufacturer:_____ Serial Number:_____

Overall Condition: Good Fair Poor Comments:_____
Battery Charged: Yes No Comments:_____
Decon Prior to Use: Yes No Comments:_____

INTERFACE PROBE:

Manufacturer:_____ Serial Number:_____

Overall Condition: Good Fair Poor Comments:_____
Battery Charged: Yes No Comments:_____
Decon Prior to Use: Yes No Comments:_____

ATTACHMENT B

Groundwater Sampling Field Purge Record

August Mack
ENVIRONMENTAL

GROUNDWATER SAMPLING/PURGE RECORD

Well/Sample Number: _____ Date: _____

Project Name/Number: _____/_____

Project Location: _____

Depth to Water: (ft) _____ Total Depth: (ft)_____ Well Diameter: (inch)_____

Type of Pump/Sampler: Proactive Mega-Monsoon/Horiba U-22

Weather: _____ Temp: _____

Comments: _____ Pump Depth: _____

				0.1 - 0.4		+/- 0.1	+/- 3 %	+/- 10%	+/- 10%	+/- 3 %	+/- 10 mV
Time	Water Level	Pump On	Pump Off	Pump Rate	Volume Pumped	pH	Specific Cond.	Turbidity	DO	Temp (C)	ORP

Sampled/Purged By: _____

Sample ID: _____ Sample Time: _____

Samples Delivered To: _____ MS/MSD: ___ DUP: ___ EB:____

Well/Sample Number: _____ Date: _____

Project Name/Number: _____/_____

				0.1 - 0.4		+/- 0.1	+/- 3 %	+/- 10%	+/- 10%	+/- 3 %	+/- 10 mV
Time	Water Level	Pump On	Pump Off	Pump Rate	Volume Pumped	pH	Specific Cond.	Turbidity	DO	Temp (C)	ORP

Modified from U.S. EPA Document EPA/600/2-85/104/Sept.198

ATTACHMENT C

Monitoring Well Inspection Checklist

August Mack
ENVIRONMENTAL

GROUNDWATER MONITORING WELL INSPECTION CHECKLIST

Project Name/Number: _____ Date: _____

Project Location: _____

Well ID#	Well Pad Visible	Well Lock Present	CONDITION OF:							Well # Visible
			Well Pad	Well Lock	Vault/ Cover	Bolts	Seal	Cap	Casing	

Y = Yes N = No M = Missing G = Good F = Fair D = Damaged

Inspected By: _____

ATTACHMENT D

Groundwater SOP Photo Log

Figure 1:
Site control near the monitoring well with cones and caution tape.



Figure 2.
Low-Flow Sampling Equipment with Secondary Containment.



Figure 3.
Bladder pump components.

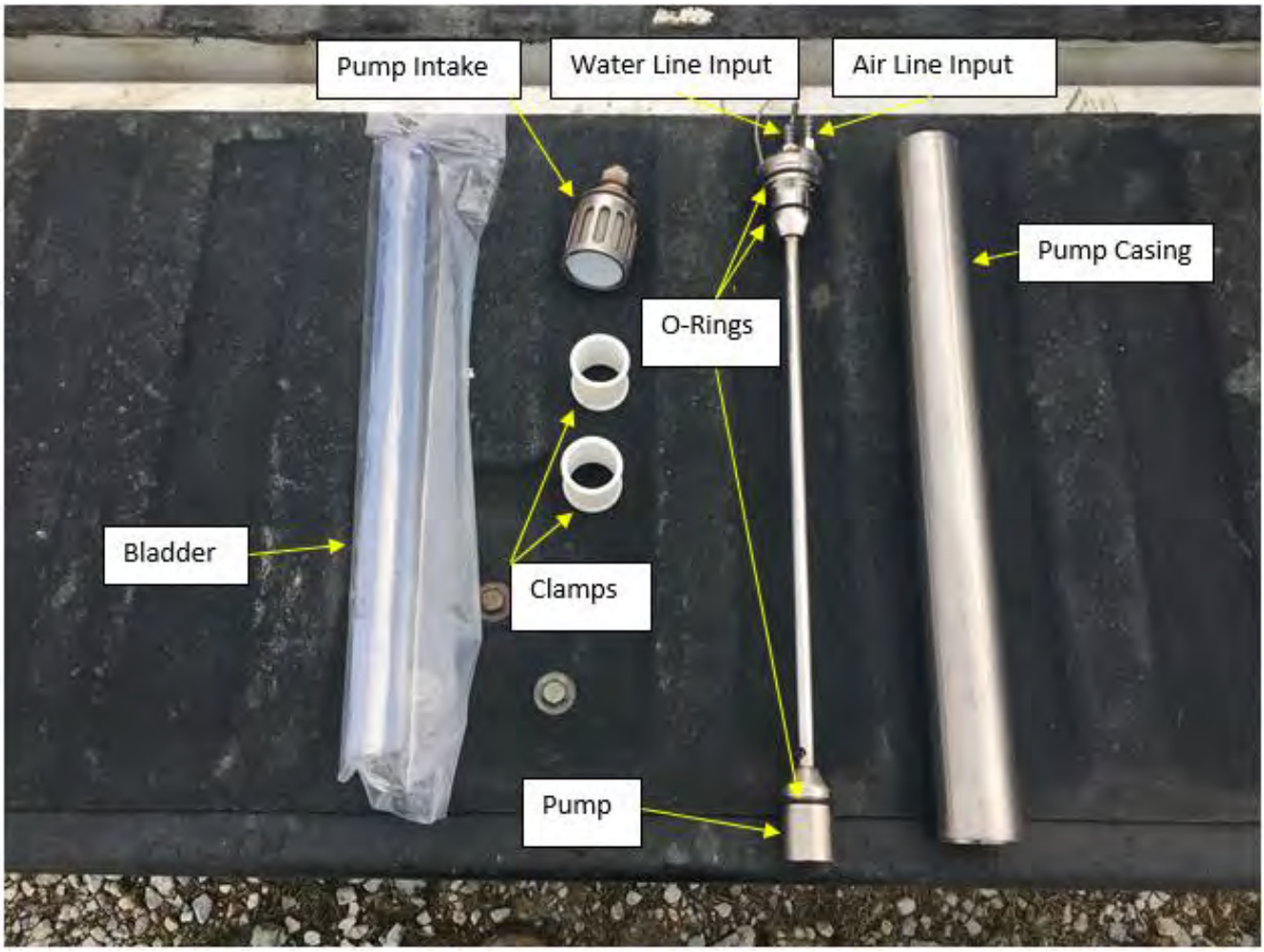


Figure 4.
Air compressor and components.

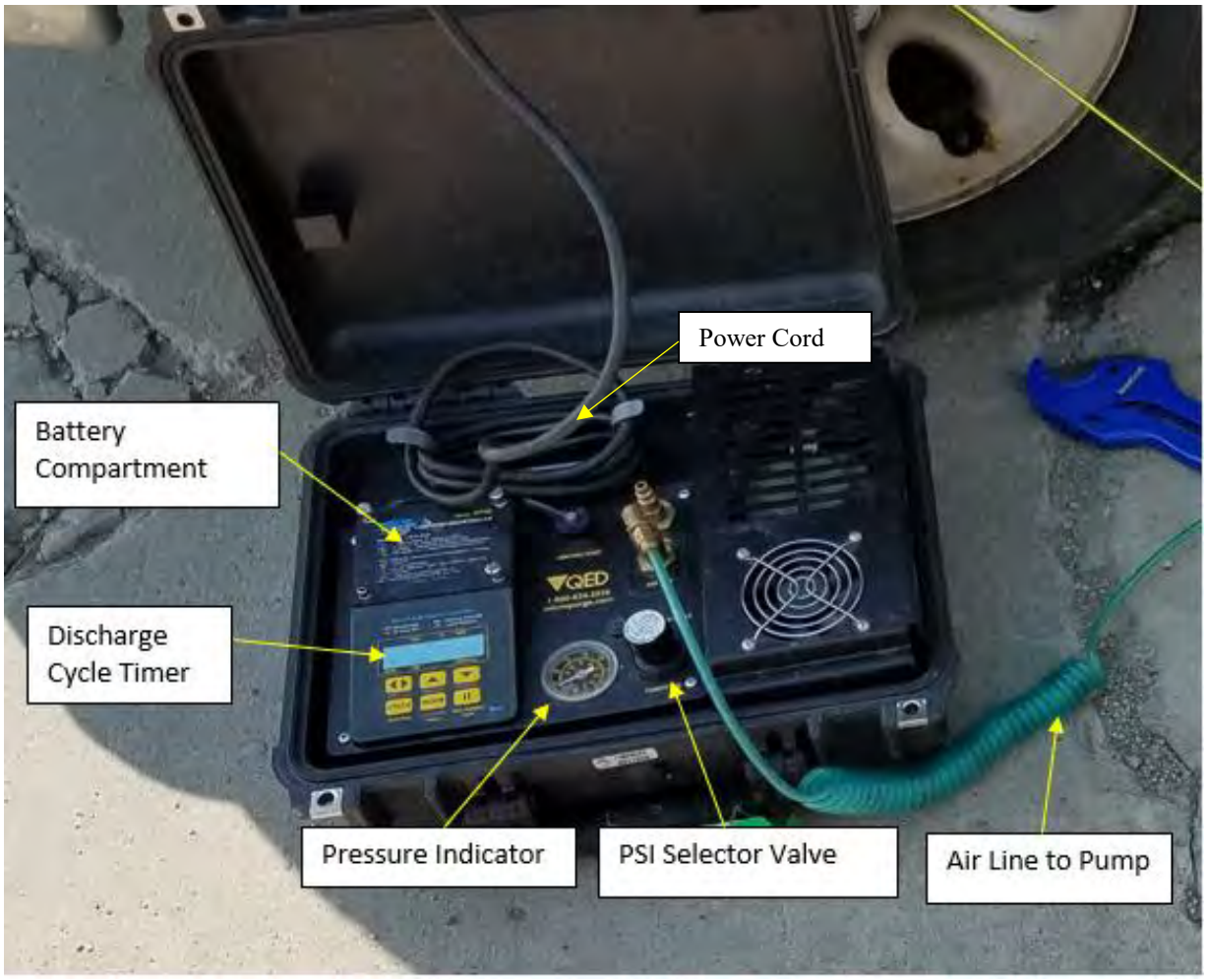


Figure 5.
Multi-Parameter Meter (MPM) Components

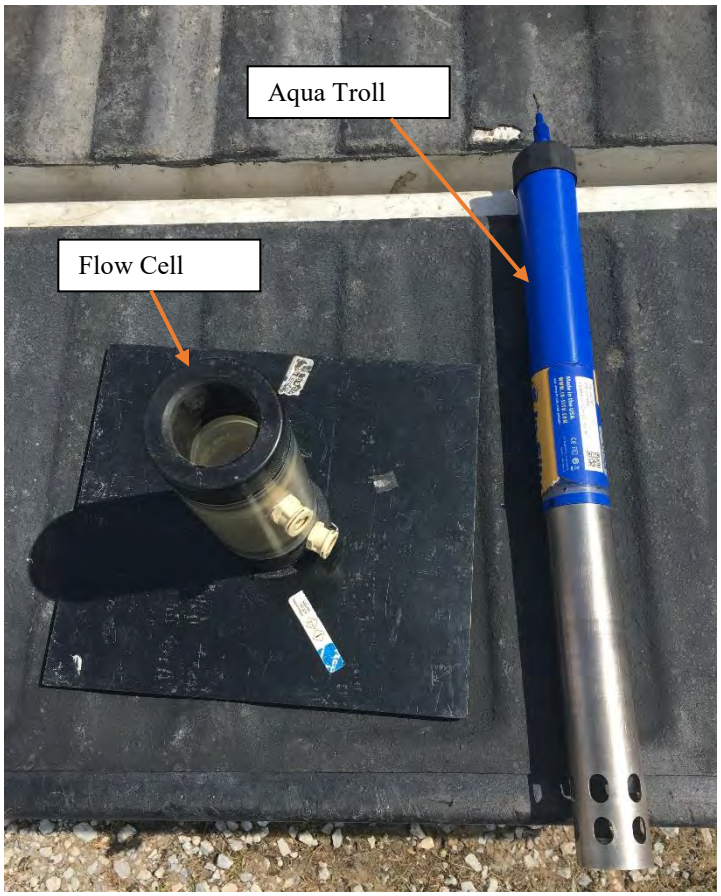
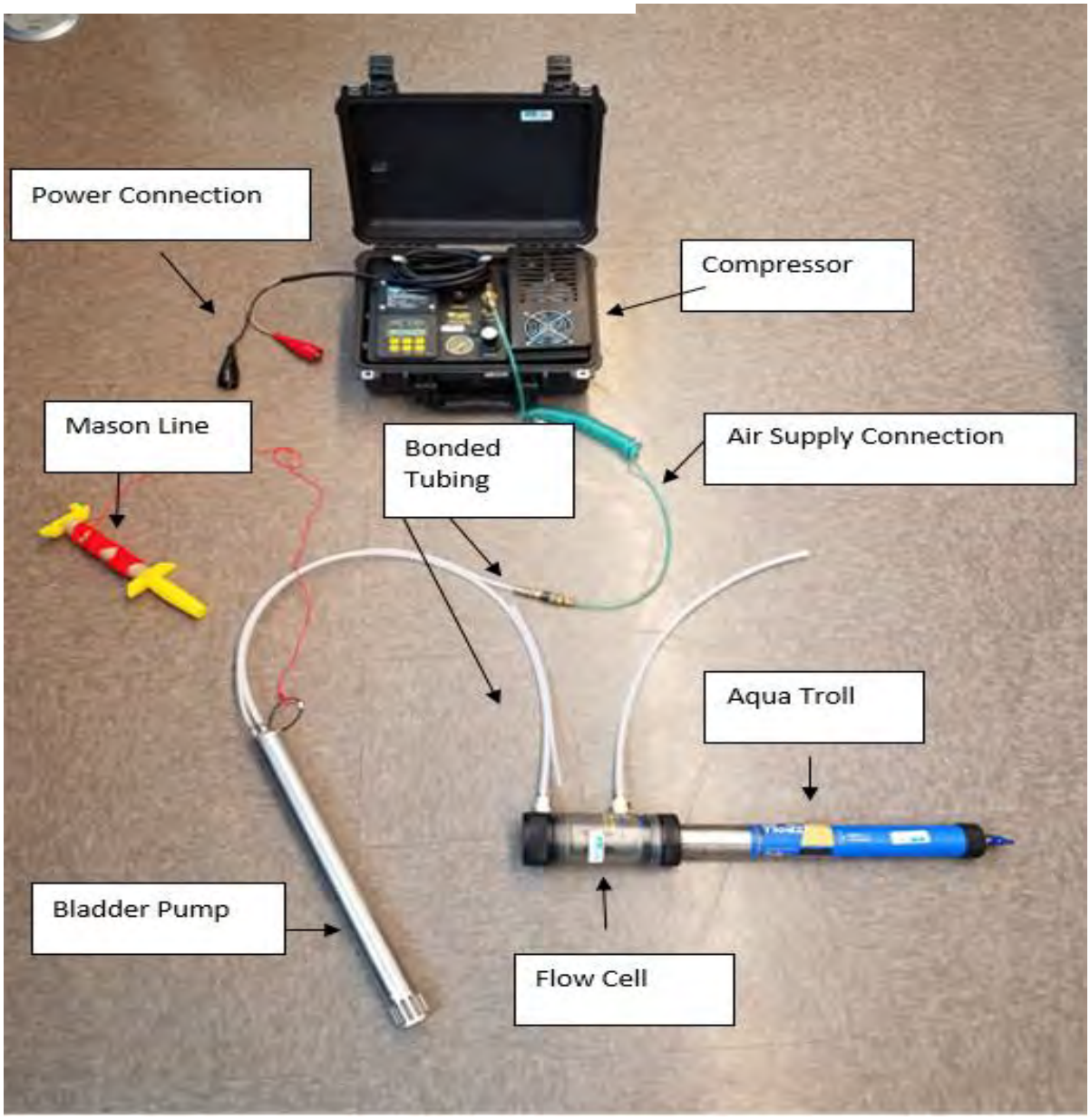


Figure 6.
MPM Setup



Figure 7.
Low-Flow Sampling Equipment Setup



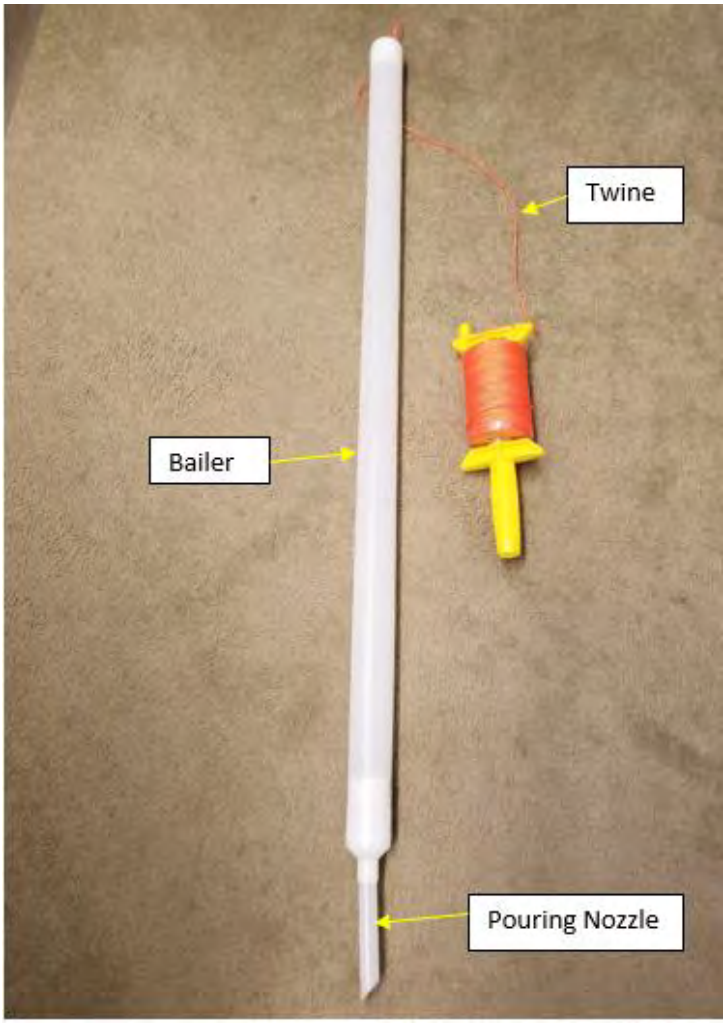


Figure 8.
Groundwater sampling set-up with a bailer.



Figure 9.
Meniscus on top of a 40 ml Vial

STANDARD OPERATING PROCEDURE

SOP NUMBER: 141

SOP TITLE: SURFACE WATER/STORM WATER SAMPLE COLLECTION

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202

REVISION DATE: November 2024

Revision Prepared By: _____

Andrew R. Tennyson, CHMM
Senior Analyst

Approved By: _____

James Berndt, LPG
Vice-President of Corporate Technical Services

1.0 PURPOSE AND SUMMARY

The following Standard Operating Procedure (SOP) has been developed for surface water/storm water sample collection during August Mack Environmental, Inc. (August Mack) field investigation projects. This SOP will be followed by August Mack technical personnel when collecting surface water/storm water samples for laboratory analysis. The procedures are subject to change if unusual or unanticipated field conditions are encountered. Deviations from this SOP must be approved by the Project Manager or other designated project technical lead.

Water quality parameters are measured prior to sampling using a multi-parameter portable meter. The sampler should refer to the Project-Specific Field Sampling Plan for project specific requirements and objectives.

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1.0 Purpose and Summary
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3.0 RESPONSIBILITIES

It is the responsibility of the Project Manager to ensure that each project involving surface water/storm water sampling is properly planned and executed. The Project Manager is also responsible for understanding specific requirements or regulations regarding surface water/storm water sampling activities, and to ensure the procedures comply with applicable locate, State, and/or Federal requirements.

The Field Geologist/Scientist is responsible for verifying and documenting that procedures and requirements contained in this SOP are followed. The Field Geologist/Scientist is responsible for ensuring that work is conducted in a safe and professional manner. The Field Geologist/Scientist implementing this SOP is encouraged to contact the Project Manager if there are any questions on the SOP or the task, as needed.

4.0 DEFINITIONS

Surface Water – Water that flows over or rests on the land and is open to the atmosphere; it includes ditches, streams, rivers, lakes, pools, ponds, basins, or any other water source that fits the definition of surface water.

Grab Samples – Discrete aliquots representing a specific location at a given point in time. The sample is collected all at once and at only one particular point in the sample medium. Grab samples are not mixed or composited with other samples.

Composite Samples – Non-discrete samples composed of more than one specific aliquot collected at various locations or at different points in time. Analytical results from this type of sample represents an average value for the locations or time periods incorporated into the sample. Composite samples can be collected where investigative goals indicate that it is appropriate; otherwise, grab samples should be collected.

5.0 EQUIPMENT AND SUPPLIES

The list of potential sampling equipment and supplies needed for collection of surface water/storm water samples includes, but is not limited to, the items listed below. The specific requirements for each sampling project should be identified from the results of the pre-sampling field reconnaissance and the HASP.

- Life preservers
- Polyethylene safety line (floatable)
- Cellular phone or radio
- Site maps (if not included in the HASP)
- Appropriately sized pond sampler or extended dipper, clamp, and telescoping heavy-duty pole

- Sample collection vessels (bucket, bailer, beakers) composed of Teflon®, glass, stainless steel, or other inert material
- Weighted bottle sampler, Wheaton bottle, or Kemmerer sampler
- Peristaltic pump (or equivalent) with tubing and power supply
- Syringe sampler device
- Water quality meter (for measurement of pH, specific conductivity, temperature, dissolved oxygen, oxygen-reduction potential, and turbidity)
- Sample bottles with preservative
- Sample coolers with ice
- Sample labels and tape
- Black pens
- Permanent marker pens
- Sample Collection Sheets
- pH paper
- Paper towels
- Plastic trash bags
- Folding ruler or yardstick
- 100-meter measuring tape
- Stopwatch
- Camera
- Wooden stakes
- Flagging tape
- Sledge hammer
- Boat or canoe, if needed
- Waders and/or Mudders.

6.0 RECORDS AND FORMS

The following records and forms (hard copy or digital) used to implement work described in this SOP include, but is not limited to, the following:

- Site-specific Health and Safety Plan (HASP) (fully executed by the Project Manager, Field/Site Supervisor, and the Environmental Health and Safety Manager)
- Field instructions (provided to field team during the kick-off meeting)
- Previous Site documentation
- Field notebook
- Sample collection sheets
- Sample labels/tags
- Chain-of-Custody (COC) Forms
- Shipping Forms (coolers, equipment, etc.)

7.0 HEALTH AND SAFTEY CONSIDERATIONS

Personnel conducting surface water sampling activities should be qualified in proper safety procedures; have completed 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training; have necessary 8-hour HAZWOPER refresher training; and have current medical monitoring information. Refer to the Site-Specific Health and Safety Plan (HASP), task-specific Activity Hazard Analysis (AHA) for guidelines on safety precautions and proper Personal Protective Equipment (PPE) for implementation, and August Mack Health Standards of Practice for work-related activities.

Before surface water sampling activity is initiated, a logistical assessment of the study area should be performed to understand what level of access is available (i.e. is a boat necessary, what are the ingress and egress points).

8.0 PROCEDURES

The following is a list of general procedures for the collection of all surface water/storm water samples:

1. If surface water is extremely silty or muddy, postpone sampling until better conditions prevail.
2. Plan to collect samples first from those areas suspected of being the least contaminated, so areas of suspected contamination are collected last, thus minimizing the risk of cross-contamination.
3. If sediment samples are to be collected at the same location as surface water samples, collect the surface water samples first. In general, surface water samples should be collected from near the base of the water column, as near to the sediment/surface water interface as possible. The exception would be when sampling to assess a floating layer or sheen.
4. Coordinate surface water sampling from flowing bodies so as to reflect base-flow conditions and not conditions during or immediately after a rainfall event.
5. To determine sample locations when sampling in flowing water, evaluate the flow conditions and channel geometry relative to the location of the suspected release. Avoid stagnant pools unless they are adjacent to a suspected discharge point. Collect samples from the active flow channel (thalweg) within the stream. If the channel is linear, collect the sample the same side of the stream as the source or suspected discharge point. When sampling for VOCs, avoid sampling below riffles, or in shallow water in direct sunlight where volatility effects could impact sample integrity.
6. Where possible, take field measurements (pH, temperature, conductivity, etc.) directly from the surface water body (not the sample) in the location from which the sample was collected.
7. Whenever possible, collect surface water samples directly into the sample container. Always collect samples for oil and grease, total petroleum

hydrocarbons (TPH), etc., directly into the sample container. This procedure reduces any loss of volatiles, cross-contamination, or other alteration that could occur during transfer from a collection vessel into the sample container.

8. Do not composite samples collected for analysis of VOCs and some semi-volatile organic compounds (SVOC).
9. For any given stream, begin sampling with the sampling point located farthest downstream and proceed upstream to prevent cross-contamination of downstream samples by upstream activities. For lakes and ponds, begin sampling with the sampling point located closest to the discharge point and proceed around the lake or pond in an orderly fashion.
10. If wading is required, approach the sample site from downstream, being careful not to disturb any bottom sediment. Position the mouth of the sample container so it faces upstream while the sampling personnel are standing downstream. In water bodies with little or no current, the sampling personnel should not enter the actual sample area. A pond sampler with an extendable handle should be used to reach the sample site.
11. Unless required otherwise, samples should be collected from below the water surface. The sample container should be submerged and then opened underwater to expel air.
12. Conduct sample packaging, handling, and shipping conducted in accordance with DOT regulations.
13. The collection of surface water samples should be documented on the appropriate Sample Collection Sheet or digital form and/or field logbook.

8.1 DIP SAMPLING

A sample may be collected directly into the sample container when the surface water source is accessible by wading or other means. The sampler should face upstream if there is a current and collect the sample without disturbing the bottom sediment. The surface water sample should always be collected prior to the collection of a sediment sample at the same location. The sampler should be careful not to displace the preservative from a pre-preserved sample container, such as the 40-ml VOC vial.

8.2 SCOOPS

Stainless steel scoops provide a means of collecting surface water samples from surface water bodies that are too deep to access by wading. They have a limited reach of about eight feet and, if samples from distances too far to access using this method are needed, a mobile platform, such as a boat, may be required.

Stainless steel scoops are useful for reaching out into a body of water to collect a surface water sample. The scoop may be used directly to collect and transfer a

surface water sample to the sample container, or it may be attached to an extension in order to access the selected sampling location.

8.3 PERISTALTIC PUMPS

Another device that can be effectively used to sample a water column, such as a shallow pond or stream, is the peristaltic pump/vacuum jug system. The peristaltic pump can be used to collect a water sample from any depth if the pump is located at or near the surface water elevation. There is no suction limit for these applications. The use of a metal conduit to which the tubing is attached, allows for the collection of a vertical sample (to about a 25-foot depth) which is representative of the water column. The tubing intake is positioned in the water column at the desired depth by means of the conduit. Using this method, discrete samples may be collected by positioning the tubing intake at one depth or a vertical composite may be collected by moving the tubing intake at a constant rate vertically up and down the water column over the interval to be composited.

Samples for VOC analysis cannot be collected directly from the peristaltic pump discharge or from the vacuum jug. If a peristaltic pump is used for sample collection and VOC analysis is required, the VOC sample must be collected using one of the "soda straw" variations. Ideally, the tubing intake will be placed at the depth from which the sample is to be collected and the pump will be run for several minutes to fill the tubing with water representative of that interval. After several minutes, the pump is turned off and the tubing string is retrieved. The pump speed is then reduced to a slow pumping rate and the pump direction is reversed. After turning the pump back on, the sample stream is collected into the VOC vials as it is pushed from the tubing by the pump. Care must be taken to prevent any water that was in contact with the peristaltic pump head tubing from being incorporated into the sample.

8.4 BAILERS

Bailers may also be used for surface water sampling if the study objectives do not necessitate a sample from a discrete interval in the water column. A closed-top bailer with a bottom check-valve is sufficient for many studies. As the bailer is lowered through the water column, water is continually displaced through the bailer until the desired depth is reached, at which point the bailer is retrieved. This technique may not be successful where strong currents are found.

8.5 BUCKETS

A plastic bucket can be used to collect samples for measurement of water quality parameters such as pH, temperature, and conductivity. Samples collected for

analysis of classical water quality parameters including but not limited to ammonia, nitrate-nitrite, phosphorus, and total organic carbon may also be collected with a bucket. Typically, a bucket is used to collect a sample when the water depth is too great for wading, it is not possible to deploy a boat, or access is not possible (excessive vegetation or steep embankments) and the water column is well mixed. The water body is usually accessed from a bridge. The bucket is normally lowered by rope over the side of the bridge. Upon retrieval, the water is poured into the appropriate sample containers.

Caution should be exercised whenever working from a bridge. Appropriate measures should be taken to ensure the safety of sampling personnel from traffic hazards.

8.6 DISCRETE DEPTH SAMPLERS

When discrete samples are desired from a specific depth, and the parameters to be measured do not require a Teflon®-coated sampler, a standard Kemmerer or Van Dorn sampler may be used. The Kemmerer sampler is a brass cylinder with rubber stoppers that leave the ends of the sampler open while being lowered in a vertical position, thus allowing free passage of water through the cylinder. The Van Dorn sampler is plastic and is lowered in a horizontal position. In each case, a messenger is sent down a rope when the sampler is at the designated depth, to cause the stoppers to close the cylinder, which is then raised. Water is removed through a valve to fill respective sample containers. With a rubber tube attached to the valve, dissolved oxygen sample bottles can be properly filled by allowing an overflow of the water being collected. With multiple depth samples, care should be taken not to disturb the bottom sediment, thus biasing the sample.

When metals and organic compounds parameters are of concern, then a double-check valve, stainless steel bailer or Kemmerer sampler should be used to collect the sample.

8.7 SUBMERSIBLE PUMPS

Submersible pumps can be used to collect surface water samples directly into a sample container. The constituents of interest should be taken into consideration when choosing the type of submersible pump and tubing to be used. If trace contaminant sampling of extractable organic compounds and/or inorganic analytes will be conducted, the submersible pump and all of its components should be constructed of inert materials such as stainless steel and Teflon®. The tubing should also be constructed of Teflon®. Note that Teflon materials should not be used if sampling for PFAS or related compounds. If reusing the same pump between sample locations, the pump should be decontaminated using SOP

for Field Equipment Cleaning and Decontamination. New tubing should be used at each sample location.

If the samples will be analyzed for classical parameters such as ammonia, nitrate-nitrite, phosphorus, or total organic carbon, the pump and tubing may be constructed of components other than stainless steel and Teflon®. The same pump and tubing may be re-used at each sampling station after rinsing with deionized water and then purging several volumes of sample water through the pump and tubing prior to filling the sample containers.

Either a grab or composite sample can be collected using a submersible pump. A composite sample can be collected by raising and lowering the pump throughout the water column. If a composite sample is collected, it may be necessary to pump the sample into a compositing vessel for mixing prior to dispensing into the sample containers. If a compositing vessel is required, it should be constructed of materials compatible with the constituents of concern and decontaminated between sample stations according to appropriate procedures, again depending on the constituents of concern.

8.8 AUTOMATIC SAMPLERS

Where unattended sampling is required (e.g., storm-event sampling, time-of-travel studies) an automatic sampler may be used. The automatic sampling device may be used to collect grab samples based on time, in-stream flow or water level or used to collect composite samples as dictated by the study data needs. The automatic sampling device should be calibrated prior to deployment to insure the proper volume is collected. The manufacturer's instruction manual should be consulted for automatic sampler operation. Insure that the materials of the automatic sampler are appropriate for the target analytes.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Various aspects of surface water/storm water sample collection procedures will depend on project-specific objectives and circumstances. The following procedures and precautions should be considered when collecting surface water/storm water samples.

- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample.
- Collected samples are in the custody of the sampler or sample custodian until the samples are relinquished to another party.
- If samples are transported by the sampler, they will remain under his/her custody or be secured until they are relinquished.

- Shipped samples shall conform to all U.S. Department of Transportation (DOT) rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179), and/or International Air Transportation Association (IATA) hazardous materials shipping requirements found in the current edition of IATA's Dangerous Goods Regulations.
- Documentation of field sampling is done in a bound logbook.
- Chain-of-custody documents shall be filled out and remain with the samples until custody is relinquished.
- Shipping documents, such as air bills, bills of lading, etc., shall be retained by the project leader and stored in a secure place.
- If possible, a control sample should be collected from a location not affected by the possible contaminants of concern and submitted with the other samples. In streams or other bodies of moving water, the control sample should be collected upstream of the sampled area. For impounded bodies of water, particularly small lakes or ponds, it may be difficult or inappropriate to obtain an unbiased control from the same body of water from which the samples are collected. In these cases, it may be appropriate to collect a background sample from a similar impoundment located near the sampled body of water if there is a reasonable certainty that the background location has not been impacted. Equipment blanks should be collected if equipment is field cleaned and re- used on-site or if necessary to document that low-level contaminants were not introduced by pumps, bailers or other sampling equipment.

10.0 EXCEPTIONS

- Review State regulations prior to implementation of this SOP to ensure procedures comply with local regulatory requirements.

11.0 CROSS REFERENCES/SOURCES

This SOP will be used in conjunction with the following cross references where applicable.

- August Mack SOP No. 311: Field Documentation
- August Mack SOP No. 616: Field Equipment Documentation

12.0 ATTACHMENTS

- Surface Water Sampling Worksheet

FIELD SAMPLING FORM
SURFACE WATER SAMPLING

Sample ID	Latitude	Longitude	Sample Date	Sample Time	QA/QC?	Sampling Location Condition						Water Quality Parameters					
						Sheen	Odor?	Water Depth	Water Clarity	Water Color	Notes?	Temp	pH	Specific Conductivity	ORP	DO	Turbidity

STANDARD OPERATING PROCEDURE

SOP NUMBER: 151

SOP TITLE: INDOOR AIR SAMPLING USING CANISTERS

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202

REVISION DATE: December 2019

Revision Prepared By: _____

Andrew R. Tennyson, CHMM
Senior Chemistry Manager

Approved By: _____

Enter Name (add Credentials)
Enter Title

1.0 PURPOSE AND SUMMARY

The following Standard Operating Procedure (SOP) has been developed for indoor air (IA) sample collection during August Mack Environmental, Inc. (August Mack) vapor investigation projects. This SOP will be followed by August Mack technical personnel when collecting IA canister samples for laboratory analysis. The procedures are subject to change if unusual or unanticipated field conditions are encountered. Deviations from this SOP must be pre-approved by the Project Manager or other designated project technical lead.

This SOP documents August Mack procedures for IA sample collection. Procedures associated with other canister sampling techniques (i.e. ambient air samples, crawl space air samples, exterior soil gas samples, and sub-slab vapor samples) can be found under separate covers.

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3.0 RESPONSIBILITIES

It is the responsibility of the Project Manager to ensure that each project involving IA sampling is properly planned and executed. The Project Manager is also responsible for understanding specific requirements or regulations regarding indoor air sampling activities, and to ensure the procedures comply with all applicable local, State, and/or Federal requirements.

Field personnel are responsible for verifying and documenting that procedures and requirements contained in this SOP are followed. Field personnel are responsible for ensuring that all work is conducted in a safe and professional manner. Field personnel implementing this SOP are encouraged to contact the Project Manager if there are any questions on the SOP or the task, as needed.

4.0 DEFINITIONS

Ambient Air (AA) – The outdoor air surrounding a building or site.

Indoor Air (IA) – The air within a building or structure.

HVAC – Heating, Ventilation, and Air Conditioning. Typically refers to the systems used to control indoor temperature and humidity.

Passivated Sample Canisters ("Canisters") – Stainless steel canisters with specially treated interior surfaces, such as electro-polishing processes or fused silica coatings.

Swagelok® or equivalent stainless steel fittings – Includes tube fittings, valves, tubing, and gauges, specifically the compression tube fitting, a commonly used family of connectors for high and low pressure stainless steel tubing.

Vapor – A substance in the gaseous state as distinguished from the liquid or solid state.

Vapor Intrusion (VI) – The migration of potentially hazardous vapors from any subsurface contaminant source, such as contaminated soil or groundwater, through the vadose zone and into a building or structure.

5.0 EQUIPMENT AND SUPPLIES

Equipment and supplies necessary to implement work described in this SOP include the following:

- Laboratory supplied Canisters with flow regulators
- Personal Protective Equipment (PPE)
- Flashlight
- Two (2), 6-inch adjustable crescent wrenches
- Teflon plumbing tape
- Large plastic tote(s) with lid(s)
- Steel chain
- Padlock and key
- Duct tape

- Camera
- Field notebook
- Appropriate AME records and forms

6.0 RECORDS AND FORMS

The following records and forms used to implement work described in this SOP include the following:

- Site-specific Health and Safety Plan (HASP) (fully executed by the Project Manager, Field/Site Supervisor, and the Environmental Health and Safety Manager)
- Field instructions (provided to field team during the kick-off meeting)
- Access agreement, if necessary
- Previous site documentation
- Field notebook
- Vapor Sampling Building Survey
- Common Sources of Indoor Air Background Contamination (field reference guide)
- Recommended Instructions for Homeowners
- Vapor Intrusion Sampling Data Sheet
- Shut-in Testing Data Sheet
- Sample ID tags and laboratory Chain of Custody

7.0 HEALTH AND SAFETY CONSIDERATIONS

Personnel conducting indoor air sampling activities should be qualified in proper safety procedures. Refer to the Site-Specific Health and Safety Plan (HASP); task-specific Activity Hazard Analysis (AHA) for guidelines on safety precautions and proper Personal Protective Equipment (PPE) for implementation; and August Mack Health Standards of Practice for work-related activities. Typically, August Mack indoor air sampling projects require OSHA Modified Level D PPE (i.e. hard hat, steel-toed shoes, high-visibility vest, and eye protection).

8.0 PROCEDURES

IA samples should be collected during periods that maximize the potential for VI (i.e. worst case scenario). When collecting samples during the winter worst-case conditions, the indoor temperature should be at least 10 degrees warmer than the outdoor temperature. When collecting samples during the summer worst-case conditions, the building cooling system should be in operation.

Two types of samples can be collected with canisters: grab or time-integrated. During grab sampling, the canister is opened and allowed to fill rapidly. During time-integrated sampling, the canister is filled at a specific rate set within the flow controller. Know your sample timeframe prior to deploying sample canisters. With either type of sample collection, the following general procedures should be followed.

8.1 Pre-Sampling Activities

1. Perform a detailed survey of the building being investigated and document observations in accordance with *SOP 158 – Vapor Sampling Building Surveys*.
2. If the building will be occupied during the sampling event, review the *Recommended Instructions for Homeowners* with the occupant, stressing the importance of following instructions on the potential sample results. If logistically necessary, provide the instructions in advance.
3. If requested in the field instructions, remove potential indoor air background sources of contamination by placing chemicals in container(s) and store outside of building, if possible. Ideally, background sources should be removed at least 24 to 48-hours prior to sampling.



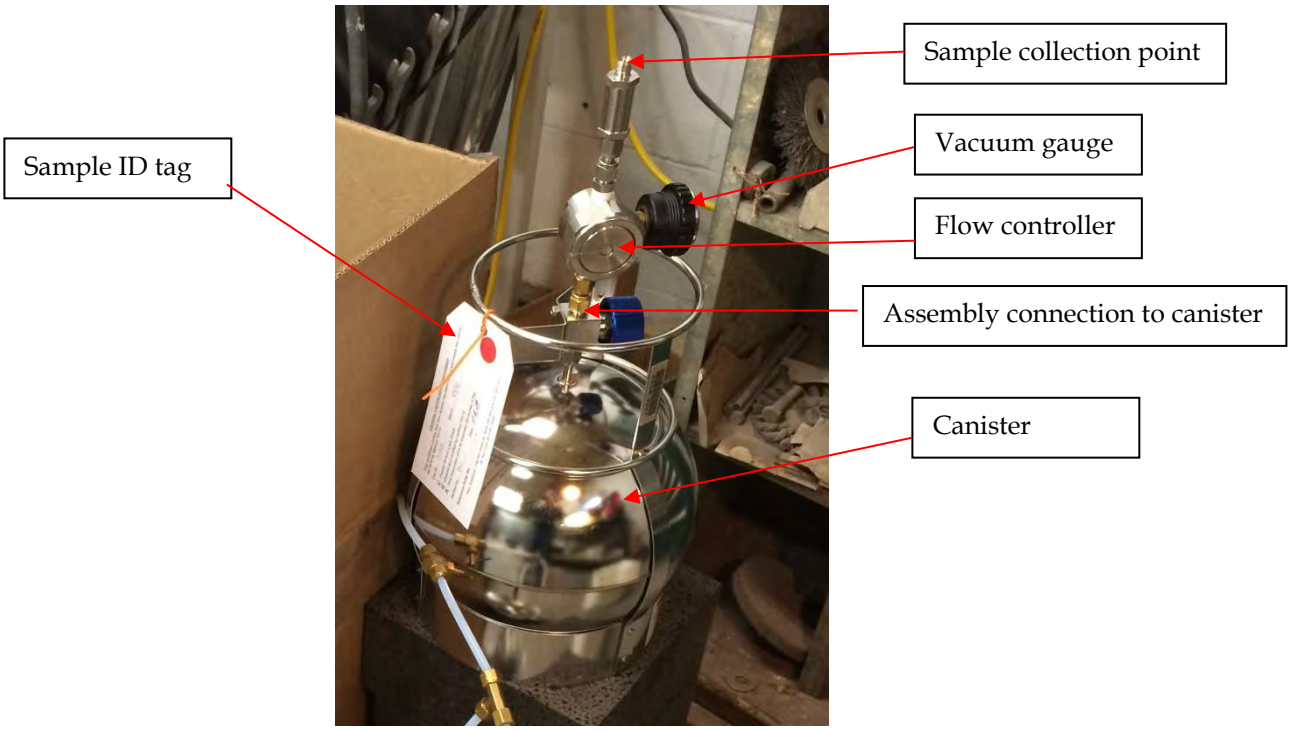


4. Ensure and document that doors and windows are closed and that the mechanical heating, ventilation or cooling system is operational during the sampling event. Ideally, any HVAC system should be operational at least 24 to 48-hours prior to and during sample collection.

8.2 Canister Setup and Placement

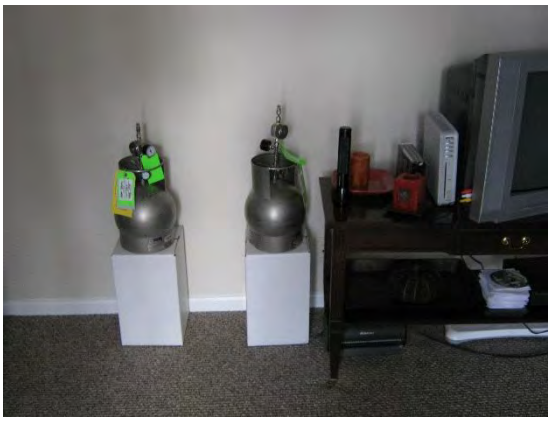
The canister may come preassembled with a vacuum gauge and flow controller ("assembly"). If not, connect the canister to the assembly by securing the stainless steel nut to the top of the canister using the adjustable crescent wrenches. Do not overtighten the connection.

Create at least one extra fully connected canister assembly. This will allow for quick substitution if any canisters fail quality control checks.

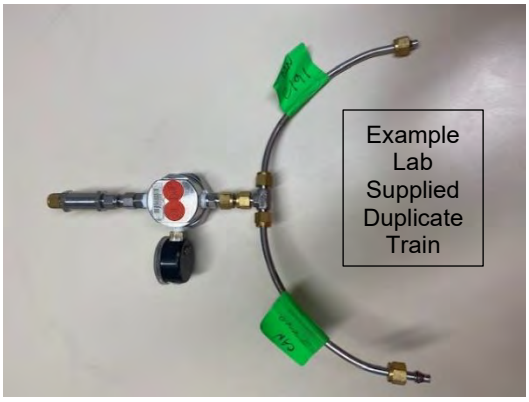


Place the canister assembly in a predetermined location at a height that will simulate breathing space (approximately three to five feet above surface).

If duplicate IA samples are being collected, follow the same procedures listed below and place the duplicate canister next to the parent canister and connect them using a separate sampling train in a "T" configuration (see SOP 157 *Assembling & Testing Vapor Sampling Trains* for more info regarding sample train creation and testing). The analyzing laboratory may send a premade duplicate train or it may need created by the field team prior to the sampling event.



Duplicate Setup (before connecting duplicate sampling train)



8.3 Initiating Sample Collection

1. Perform a final review of the sampling assembly. Verify the regulator on the canister is set for the appropriate sampling period. Verify DUP regulators either have double exposure or have two separate regulators on the sample train. Take precautions as necessary to ensure the canister is not knocked over or otherwise disrupted during the collection period.
2. Open the valve on the canister to initiate sample collection.
   a. Note, if you hear any distinguishable continuous sound (i.e. hissing) after the canister is turned on, there is a potential leak in the canister-assembly connection.
      i. Turn the canister off before additional troubleshooting.
      ii. Unscrew the connection and re-connect, ensuring the threads of the stainless steel nut and canister are aligned.
      iii. You may need to wrap threads with Teflon plumbing tape prior to canister-assembly connection.
      iv. Discuss this issue with your Project Manager or other project technical lead and note any corrective action taken in your field notebook.

b. When the sample canister is turned on, the vacuum gauge should read between -25 and -30 inches of mercury (in. Hg). If the vacuum gauge is greater than -25 in. Hg (i.e. between 0 and -25 in. Hg), contact the Project Manager or other project technical lead. A new canister may be substitued for sample collection. Document initial canister vacuum on VI sampling data sheet.

3. Document sample start date and time as well as set-up activities in the field notebook and the Vapor Intrusion Sampling Data Sheet per SOP 311 *Written Field Documentation*.
4. Photograph the canister, vacuum gauge, and sample location per SOP 312 *Field Photography* following the start of sample collection to document field conditions.
5. Periodically check the vacuum gauges throughout the sample duration and document the time and vacuum in the field notebook.
6. Be prepared to arrive at the site at least one hour prior to end of the predetermined sample collection time period (i.e. 23 hours after a 24-hour sample collection period began or seven hours after an eight hour sample collection period began). The canister must be turned to the off position before the vacuum gauge reaches 0 in. Hg. Document this end vacuum on the VI Sampling Data Sheet.
7. Following sample collection, ensure the sample ID tag is attached to the canister and is completely filled in with pertinent information. Do not use a marker to complete the sample ID tag.
8. Document date and time of the end of sampling activities in the field notebook and the Vapor Intrusion Sampling Data Sheet per SOP 311 Written Field Documentation.
9. Submit sample canisters to the laboratory with the sampling Chain of Custody.
10. Submit field data sheets and copies of field notes to the Project Manager in accordance with SOP 311 Written Field Documentation.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

Various aspects of IA sampling procedures will depend on project-specific objectives and circumstances; however, general quality assurance/quality control measures should include the following at a minimum.

9.1 Pre-Mobilization:

- Inspect equipment and supplies prior to use.
- Sampling canisters should either be batch certified clean or 100% clean by the laboratory prior to sampling activities. Document the cleaning method specific to the sampling event on the Vapor Intrusion Sampling Data Sheet per SOP 311 *Written Field Documentation*.
- Stainless steel connectors (e.g. Swagelok®) parts should not appear damaged prior to use.

- Equipment and supplies should be stored in an appropriate manner away from potential contaminants, including fuel canisters, exhaust fumes, or other confounding vapor sources, to prevent cross-contamination.

9.2 Transportation:

- Secure equipment and supplies in vehicle prior to transport to minimize shifting loads and potential damage.
- Avoid exposure to exhaust fumes or other vapor sources during transport.

9.3 Sampling Precision via Duplicate Collection

Collection of a duplicate sample is often a requirement for a VI sampling program. In order to eliminate potential precision errors, original/duplicate sample pairs are collected simultaneously from the same sample collection port. Refer to *SOP 157 Creating and Testing Vapor Sampling Trains* for details on duplicate sample train setup.

9.5 Shut-in Testing

If sampling trains will be employed, such as in duplicate sample collection, shut-in testing will be performed and documented prior to sample collection. Shut-in testing creates a sealed system, applies a vacuum within the sampling lines, and verifies that no unacceptable vacuum loss occurs. Refer to *SOP 157 Creating and Testing Vapor Sampling Trains* for details on shut-in testing.

8.0 DOCUMENTATION SUMMARY

The following data must be obtained and documented over the course of the sampling event. A chronology of site activities beginning at arrival and ending at departure, noting with timestamps any visitors, communications with project team, sampling issues, or other noteworthy events should be maintained throughout the sampling event in the field notebook. The individual datum and final location of documentation are presented below:

Category	Data	Location
Project Metadata:	Project Name, Project Number, Project Location	VI Sampling Data Sheet
Sampler Information	Sampler Name, Affiliation, Receiving Laboratory	
Sample Information	Sample ID, Sample Location, UTM Coordinates, Sample Source, Sample Duration, Parent/Duplicate Associations	

Canister Information	Canister Size, Canister Number, Flow Regulator Number, Batch Clean or 100% Certified Clean	
Sample Duration	Sample Start/End Date & Time	
Vacuum Information	Initial Vacuum & Final Vacuum	
Sample Train Testing	Train type, test date/time, test results	Shut-in Test Data Sheet
Building Information	Building construction information, HVAC info, demographics, potential vapor concerns	IA Building Survey Checklist
Background Sources	Potential background sources of contamination; removal status	
Photos of Sample Locations		Electronic Project File – Field/VI/Event Date/Photos
Sketch of Sample Location		Field Notebook
Chronology of Site Events / Communication Log		Field Notebook
Ambient Conditions		VI Sampling Data Sheet

9.0 EXCEPTIONS & INTERFERENCES

- Review State regulations prior to implementation of this SOP to ensure procedures comply with local regulatory requirements.
- Precipitation may influence the results of VI sampling. If precipitation occurs within 24-hours prior to sampling or is predicted during the sampling event, discuss sampling options with the Project Manager or other designated project technical lead.
- If potential background sources of contamination are observed and/or unavoidable, discuss canister placement options with your Project Manager or other designated project technical lead.
- Occupants may refuse to remove potential background sources of contamination. If so, document discussions with occupant and items remaining inside of the building. Discuss findings with the Project Manager or other technical project lead.
- A mechanical heating/cooling system may not be in working condition during sample collection. If so, document and discuss with the Project Manager or other technical project lead.
- According to ASTM D5466-15, the volume of air within the sample train should be less than 2% of the volume of the sampling canister. Therefore, for a six (6)-liter

canister using ¼″ inner diameter tubing, 150 linear feet of tubing should be considered the upper limit of tubing length employed in sampling.

10.0 CROSS-REFERENCES/SOURCES

- ASTM, 2015. *Standard Test Method for Determination of Volatile Organic Compounds in Atmospheres (Canister Sampling Methodology) D5466-15*. American Society of Testing and Materials, 2015.
- August Mack SOP No. 158: *Vapor Sampling Building Surveys*
- August Mack SOP No. 157: *Assembling & Testing Vapor Sampling Trains*
- August Mack SOP No. 311 *Written Field Documentation*
- August Mack SOP No. 312 *Field Photography*
- Indiana Department of Environmental Management (IDEM). (March 22, 2012). *Remediation Closure Guide.*
- U.S. EPA. (June 2015). *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air.*

11.0 ATTACHMENTS

A. Recommended Instructions for Homeowners
B. Vapor Intrusion Field Sampling Data Sheet

12.0 FIGURES

Figure 1: Duplicate Sample Collection Apparatus

ATTACHMENTS

Recommended Instructions for Building Occupants/Owners

The following is a suggested list for building occupants/owners to follow (to the extent practical) in order to reduce interference in obtaining representative samples. IDEM suggests that these items be followed starting at least 48 hours prior to and during the sampling event.

- Do not open windows, fireplace opening or vents.
- Do not keep doors open.
- Do not operate ventilation fans.
- Do not use air fresheners or odor eliminators.
- Do not smoke in the house/structure to the extent practical.
- Do not use wood stoves, fireplace or auxiliary heating equipment (ie. kerosene heater).
- Do not use paint or varnishes.
- Do not use cosmetics, including hair spray, nail polish, nail polish remover, perfume, etc.
- Do not partake in indoor hobbies that use solvents.
- Do not apply pesticides.
- Do not store containers of gasoline, oil or petroleum-based or other solvents within the house/structure or attached garage (except for fuel oil tanks).
- Do not operate or store automobiles in an attached garage.

Give copy of this table to building occupant and/or owner of structure.

August Mack ENVIRONMENTAL

VAPOR INTRUSION SAMPLING DATA SHEET (TO-15)

Project Name:		Field Team:	
Project Number:		Company:	*August Mack Environmental, Inc.*
Sampling Address (es):		Laboratory:	
Weather:	Temp:	Canister Clean Certification:	Batch [x] 100% [ ]

Sample I.D.	Pre-Sampling Information						Post-Sampling Information		
	Sample Location	Canister Size	Canister #	Flow Regulator Serial #	Sample Start Date /Time	Initial Vacuum ("Hg)	Sample Stop Date/Time	Final Vacuum ("Hg)	NOTES

Additional Questions:

Were "*Instructions for Occupants*" provided to tenant? ☐ Yes ☐ No ☐ NA

NOTES:

Windows open during sampling period? ☐ Yes ☐ No ☐ NA

Active construction in sampling period? ☐ Yes ☐ No ☐ NA

Precipitation during sampling period? ☐ Yes ☐ No

Were "*Instructions for Occupant*" followed? ☐ Yes ☐ No ☐ NA

Notes & Abbreviations

Canister Sizes: 400 mL / 1.0L Canister / 6.0L Canister

The VI Sampling Data form should be completed at the beginning and end of the sampling time frame.

Any periodic checks of canister vacuums should be noted in personnel's field books.

"Hg = vacuum in inches of mercury; NA = Not applicable

Any deviations from expected conditions should be noted in the "*Additional Questions: Notes*" section.

STANDARD OPERATING PROCEDURE

SOP NUMBER: 152

SOP TITLE: AMBIENT AIR SAMPLING USING CANISTERS

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202

REVISION DATE: December 2018

Revision Prepared By: _____

Andrew R. Tennyson, CHMM
Senior Chemistry Manager

Approved By: _____

Dave Zbieszkowski, LPG
Principal Closure Geologist

1.0 PURPOSE AND SUMMARY

The following Standard Operating Procedure (SOP) has been developed for ambient air (AA) sample collection during August Mack Environmental, Inc. (August Mack) field Vapor Intrusion (VI) investigation projects. This SOP will be followed by all August Mack technical personnel when collecting AA samples for laboratory analysis. The procedures are subject to change if unusual or unanticipated field conditions are encountered. All deviations from this SOP must be pre-approved by the Project Manager or other designated project technical lead.

VI occurs when contamination volatilizes and migrates from groundwater, soil, or non-aqueous phase liquids through the soil or some preferential pathway and into nearby buildings. VI can be a significant source of exposure in indoor air. Evaluation of potential risk to vapor receptors is appropriate whenever volatile contaminants are present and the preliminary screening process indicates a need for further evaluations. This SOP documents August Mack procedures for AA sample collection. Procedures associated with indoor air samples, crawl space air samples, exterior soil gas samples, and sub-slab vapor samples are provided in SOP 151, SOP 153, SOP SOP 155, and SOP 154, respectively.

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3.0 RESPONSIBILITIES

It is the responsibility of the Project Manager to ensure that each project involving AA sampling is properly planned and executed. The Project Manager is also responsible for understanding specific requirements or regulations regarding AA sampling activities,

and to ensure the procedures comply with all applicable local, State, and/or Federal requirements.

Field personnel are responsible for verifying and documenting that procedures and requirements contained in this SOP are followed. Field personnel are responsible for ensuring that all work is conducted in a safe and professional manner. Field personnel implementing this SOP are encouraged to contact the Project Manager or other project technical lead if there are any questions on the SOP or the task, as needed.

4.0 DEFINITIONS

Ambient Air (AA) – The outdoor air surrounding a building or site.

Background – Refers to a vapor-forming chemical(s) or location(s) that is (are) not influenced by the releases from a site, and is usually described as naturally occurring or anthropogenic (EPA 1989, 1995c, 2002e).

Background vapor source – The origin(s) and location(s) of a vapor-forming chemical(s), other than vapor intrusion, and not associated with or emanating from a site-related release(s) to the environment. Background vapor sources may include indoor or outdoor sources.

Passivated Sample Canisters ("Canisters") – Stainless steel canisters with specially treated interior surfaces, such as electro-polishing processes or fused silica coatings.

Subsurface vapor source – Refers to a vapor-forming chemical(s) present in the subsurface environment arising from a release(s) to the environment.

Swagelok® or equivalent stainless steel fittings – Includes tube fittings, valves, tubing, and gauges, specifically the compression tube fitting, a commonly used family of connectors for high and low pressure stainless steel tubing.

Vapor – A substance in the gaseous state as distinguished from the liquid or solid state.

Vapor Intrusion – The migration of potentially hazardous vapors from any subsurface contaminant source, such as contaminated soil or groundwater, through the vadose zone and into a building or structure.

5.0 EQUIPMENT AND SUPPLIES

Equipment and supplies necessary to implement work described in this SOP include the following:

- Laboratory supplied Canisters with flow regulators
- Personal Protective Equipment (PPE)
- Flashlight
- Two (2), 6-inch adjustable crescent wrenches
- Teflon plumbing tape
- Shepherd hook (for hanging sample canister)
- Steel chain
- Padlock and key
- Umbrella
- Duct tape
- Camera
- Field notebook
- Appropriate AME records and forms

6.0 RECORDS AND FORMS

The following records and forms used to implement work described in this SOP include the following:

- Site-specific Health and Safety Plan (HASP) (fully executed by the Project Manager, Field/Site Supervisor, and the Environmental Health and Safety Manager)
- Field instructions (provided to project team during the kick-off meeting)
- Access agreement, if necessary
- Previous site documentation
- Field notebook
- Vapor Intrusion Sampling Data Sheet
- Sample ID tags and laboratory Chain of Custody

7.0 HEALTH AND SAFETY CONSIDERATIONS

All personnel conducting AA sampling activities should be qualified in proper safety procedures. Refer to the Site-Specific Health and Safety Plan (HASP), task-specific Activity Hazard Analysis (AHA) for guidelines on safety precautions and proper Personal Protective Equipment (PPE) for implementation, and August Mack Health Standards of Practice for work-related activities.

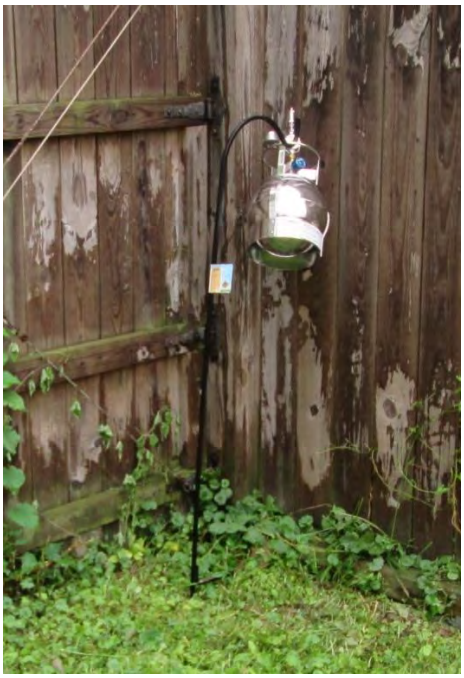
8.0 PROCEDURES

AA samples are typically collected in conjunction with indoor air samples, paired indoor air and sub-slab vapor samples, or soil gas exterior samples to evaluate the potential impact of outdoor air on other VI samples. The AA sample can serve as a reference for

background conditions. AA sample collection typically begins *at least one hour prior* to the initiation of indoor air, paired indoor air and sub-slab vapor, or soil gas exterior sample collection.

Two types of samples can be collected with canisters: grab or time-integrated. During grab sampling, the canister is opened and allowed to fill rapidly. During time-integrated sampling, the canister is filled at a specific rate set within the flow controller supplied by the laboratory. Know and document your sample timeframe prior to deploying sample canisters. With either type of sample collection, the following general procedures should be followed.

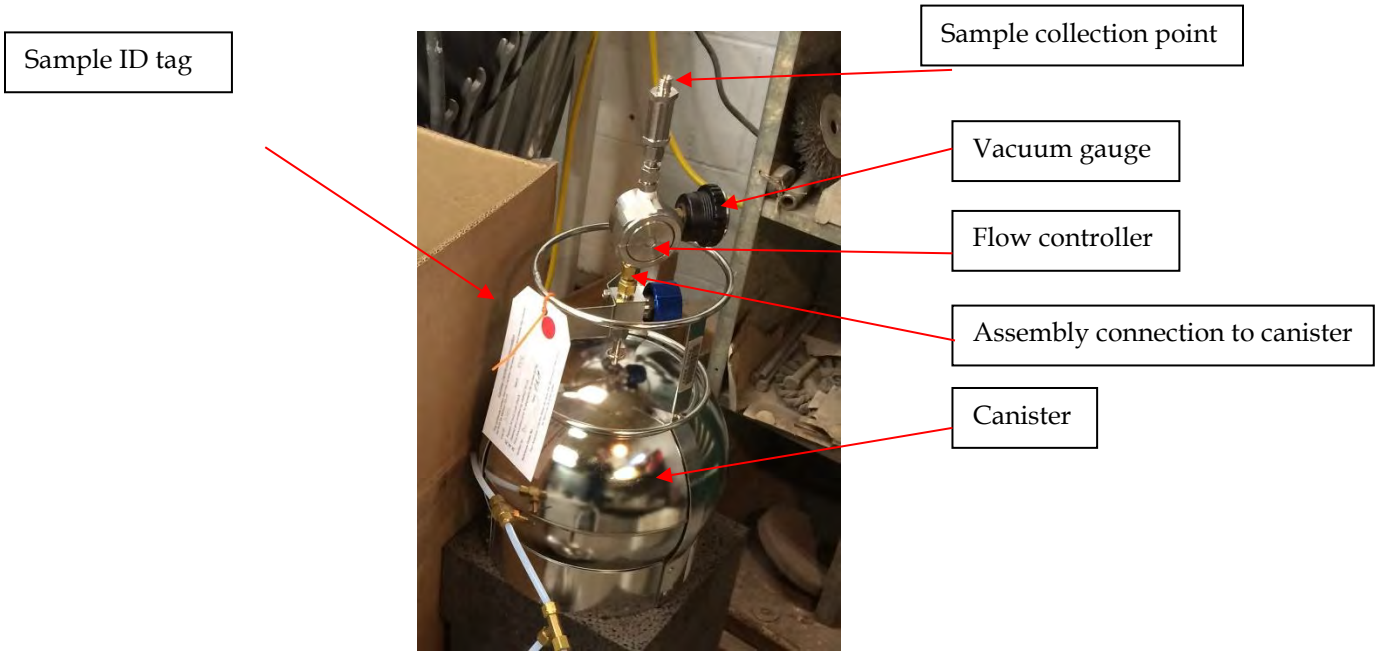
1. Determine an appropriate location to collect the AA sample. The sample location should be upwind of the site building being investigated for VI. Potential background sources (i.e. running vehicles, exhausts) should be avoided when collecting AA samples.
2. Depending upon surface conditions/site features located in the upwind direction of the building under investigation, set the ambient canister using one of the following methods:
    a. Install a Shepherd's hook in soil/grass/landscaping in order to hang the AA sample canister.



    b. Prepare to secure the AA sample canister to a permanent site fixture using a steel chain, padlock, and key.



3. The canister may come preassembled with a vacuum gauge and flow controller ("assembly"). If not, connect the canister to the assembly by securing the stainless steel nut to the top of the canister using the adjustable crescent wrenches. Do not overtighten the connection.



4. Place the canister assembly in a predetermined location at a height that will simulate breathing space (approximately 3 to 5 feet above surface) and open the

valve to collect the AA sample for the predetermined amount of time. If duplicate AA samples are collected, follow the same procedures listed below and place the duplicate canister next to the parent canister and connect them using a sampling train "T" configuration (see SOP 157 *Vapor Intrusion Sample Train Assembly & Tightness Testing*).

5. When the sample canister is turned on, the vacuum gauge should read between -25 and -30 inches of Mercury (in. Hg). Document this initial vacuum. If the vacuum gauge is greater than -25 in. Hg (between 0 and -25 in. Hg), contact the Project Manager or other project technical lead. A new canister may be needed for sample collection. Document initial canister vacuum on VI sampling data sheet.
6. Note, if you hear any distinguishable continuous sound (e.g. hissing) after the canister is turned on, there is a potential leak in the canister-assembly connection. You will need to troubleshoot by first turning off the canister. Unscrew the connection and re-connect being sure the threads of the stainless steel nut and canister are aligned. You may need to wrap threads with Teflon plumbing tape prior to canister-assembly connection. Discuss this issue with your Project Manager or other project technical lead.
7. Document sample start date and time as well as set-up activities in the field notebook and the Vapor Intrusion Sampling Data Sheet per SOP 311 *Written Field Documentation*.
8. Document the environmental conditions (e.g. any potential outdoor VOC sources) of the AA sample in the field logbook.
9. Photograph the canister, vacuum gauge, and sample location per SOP 312 *Field Photography* following the start of sample collection to document field conditions.
10. Periodically check the vacuum gauges throughout the sample duration and record the time and vacuum in the field notebook.
11. Be prepared to arrive at the site at least one (1) hour prior to end of the predetermined sample collection time period (i.e. 23 hours after a 24-hour sample collection period began or 7 hours after an 8-hour sample collection period began). The goal is to turn the canister to the off position **before** the vacuum gauge reaches 0 in. Hg. Document this end vacuum on the VI Sampling Data Sheet.
12. Following sample collection, ensure the sample ID tag is attached to the canister and is completely filled in with pertinent information. Do not use a marker to complete the sample ID tag.
13. Document date and time of the end of sampling activities in the field notebook and the Vapor Intrusion Sampling Data Sheet per SOP 311 *Written Field Documentation*.
14. Submit sample canisters to the laboratory with the sampling Chain of Custody.
15. Submit field data sheets and copies of field notes to the Project Manager in accordance with SOP 311 *Written Field Documentation.*

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Various aspects of AA sampling procedures will depend on project-specific objectives and circumstances; however, general quality assurance/quality control measures should include the following at a minimum.

9.1 Pre-Mobilization:

- Inspect equipment and supplies prior to use.
- Sampling canisters should either be batch certified clean or 100% clean by the laboratory prior to sampling activities. Document the cleaning method specific to the sampling event on the Vapor Intrusion Sampling Data Sheet per SOP 311 *Written Field Documentation*.
- Stainless steel connections should not appear damaged prior to use.
- Equipment and supplies should be stored in an appropriate manner to ensure no cross-contamination occurs.
- Equipment and supplies should be stored in an appropriate manner away from potential contaminants, including fuel canisters, exhaust fumes, or other confounding vapor sources, to prevent cross-contamination.

9.2 Transportation:

- Secure equipment and supplies in vehicle prior to transport to minimize shifting loads and potential damage.
- Avoid exposure to exhaust fumes or other vapor sources during transport.

10.0 DOCUMENTATION SUMMARY

The following data must be obtained and documented over the course of the sampling event. A chronology of site activities beginning at arrival and ending at departure, noting with timestamps any visitors, communications with project team, sampling issues, or other noteworthy events should be maintained throughout the sampling event in the field notebook. The individual datum and final location of documentation are presented below:

Category	Data	Location
Project Metadata:	Project Name, Project Number, Project Location	VI Sampling Data Sheet
Sampler Information	Sampler Name, Affiliation, Receiving Laboratory	
Sample Information	Sample ID, Sample Location, UTM Coordinates, Sample Source, Sample Duration, Parent/Duplicate Associations	
Canister Information	Canister Size, Canister Number, Flow Regulator Number, Batch Clean or 100% Certified Clean	
Sample Duration	Sample Start/End Date & Time	
Vacuum Information	Initial Vacuum & Final Vacuum	
Photos of Sample Locations		Electronic Project File – Field/VI/Event Date/Photos
Sketch of Sample Location		Field Notebook
Chronology of Site Events / Communication Log		Field Notebook
Ambient Conditions		VI Sampling Data Sheet

11.0 EXCEPTIONS & INTERFERENCES

- Review State regulations prior to implementation of this SOP to ensure procedures comply with local regulatory requirements.
- Precipitation may influence the ability to collect an AA sample. If precipitation occurs, secure an umbrella with duct tape or a chain and lock and key over the canister and flow controller assembly being sure the umbrella does not rest directly upon the top of it.
- If precipitation occurs, discuss sampling options with the Project Manager or other designated project technical lead.
- If potential background sources of contamination are observed and/or unavoidable, discuss sample placement options with your Project Manager or other designated project technical lead.

12.0 CROSS-REFERENCES/SOURCES

- August Mack SOP No. 157 *Vapor Intrusion Sample Train Assembly & Tightness Testing*
- August Mack SOP No. 311 *Written Field Documentation*
- August Mack SOP No. 312 *Field Photography*
- August Mack Activity Hazard Analysis, *Vapor Intrusion Port Installation and Sampling*
- Indiana Department of Environmental Management (IDEM). (March 22, 2012). *Remediation Closure Guide.*
- U.S. EPA. (June 2015). *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air.*

13.0 ATTACHMENTS

1. Vapor Intrusion Field Sampling Data Sheet

ATTACHMENTS

Vapor Intrusion Sampling Data Sheet

VAPOR INTRUSION SAMPLING DATA SHEET (TO-15)

August Mack ENVIRONMENTAL

Project Name:		Field Team:	
Project Number:		Company:	*August Mack Environmental, Inc.*
Sampling Address (es):		Laboratory:	
Weather:	Temp:	Canister Clean Certification:	Batch [x] 100% [ ]

Sample I.D.	Pre-Sampling Information						Post-Sampling Information		
	Sample Location	Canister Size	Canister #	Flow Regulator Serial #	Sample Start Date /Time	Initial Vacuum ("Hg)	Sample Stop Date/Time	Final Vacuum ("Hg)	NOTES
	UTM:								
	UTM:								
	UTM:								
	UTM:								
	UTM:								
	UTM:								
	UTM:								

Additional Questions:

Were "*Instructions for Occupants*" provided to tenant? ☐ Yes ☐ No ☐ NA

NOTES:

Windows open during sampling period? ☐ Yes ☐ No ☐ NA

Active construction in sampling period? ☐ Yes ☐ No ☐ NA

Precipitation during sampling period? ☐ Yes ☐ No

Were "*Instructions for Occupant*" followed? ☐ Yes ☐ No ☐ NA

Notes & Abbreviations

Canister Sizes: 400 mL / 1.0L Canister / 6.0L Canister

The VI Sampling Data form should be completed at the beginning and end of the sampling time frame.

Any periodic checks of canister vacuums should be noted in personnel's field books.

"Hg = vacuum in inches of mercury; NA = Not applicable

Any deviations from expected conditions should be noted in the "*Additional Questions: Notes*" section.

STANDARD OPERATING PROCEDURE

SOP NUMBER: 154

SOP TITLE: SUB-SLAB VAPOR SAMPLING USING CANISTERS

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202

REVISION DATE: February 2021

Revision Prepared By: _____

Andrew R. Tennyson, CHMM
Senior Analyst

Approved By: _____

Enter Name (add Credentials)
Enter Title

1.0 PURPOSE AND SUMMARY

The following Standard Operating Procedure (SOP) has been developed for sub-slab vapor (also known as sub-slab soil gas [SSGS]) sample collection during August Mack Environmental, Inc. (AME) vapor investigation projects. This SOP will be followed by August Mack technical personnel when collecting SSGS canister samples for laboratory analysis. The procedures are subject to change if unusual or unanticipated field conditions are encountered. Deviations from this SOP must be pre-approved by the Project Manager or other designated project technical lead.

This SOP documents AME procedures for SSGS sample collection. Procedures associated with other canister sampling techniques (i.e. ambient air samples, crawl space air samples, and exterior soil gas samples) can be found under separate covers. This SOP will cover two methods for SSGS sample collection, specifically via Vapor-Pin installation, and traditional installation.

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3.0 RESPONSIBILITIES

It is the responsibility of the Project Manager to ensure that each project involving SSGS sampling is properly planned and executed. The Project Manager is also responsible for understanding specific requirements or regulations regarding indoor air sampling activities, and to ensure the procedures comply with applicable local, State, and/or Federal requirements.

Field personnel are responsible for verifying and documenting that procedures and requirements contained in this SOP are followed. Field personnel are responsible for ensuring that all work is conducted in a safe and professional manner. Field personnel implementing this SOP are encouraged to contact the Project Manager if there are any questions on the SOP or the task, as needed.

4.0 DEFINITIONS

Ambient Air (AA) – The outdoor air surrounding a building or site.

HVAC – Heating, Ventilation, and Air Conditioning. Typically refers to the systems used to control indoor temperature and humidity.

Indoor Air (IA) – The air within a building or structure.

Passivated Sample Canisters ("Canisters") – Stainless steel canisters with specially treated interior surfaces, such as electro-polishing processes or fused silica coatings.

Regulating Assembly – The vacuum gauge, flow controller, and connectors which represent the transition from the sampling cannister to the sampling train.

Sub-slab Soil Vapor – Vapors within the interstitial spaces beneath the foundation of structures. Synonymous with sub-slab soil gas.

Swagelok® or equivalent stainless steel fittings – Includes tube fittings, valves, tubing, and gauges, specifically the compression tube fitting, a commonly used family of connectors for high and low pressure stainless steel tubing.

Vapor – A substance in the gaseous state as distinguished from the liquid or solid state.

Vapor Intrusion (VI) – The migration of potentially hazardous vapors from any subsurface contaminant source, such as contaminated soil or groundwater, through the vadose zone and into a building or structure.

5.0 EQUIPMENT AND SUPPLIES

Equipment and supplies necessary to implement work described in this SOP include the following:

- Hammer Drill or Rotary Hammer
- Alternating Current (AC) Extension Cord(s)
- AC generator, if AC power is not available on-Site
- Hammer or Rotary Hammer drill bit, 5/8" diameter
- Hammer or Rotary Hammer SDS-MAX type drill bit, 1.5" diameter
- Portable vacuum cleaner
- Laboratory supplied Canisters with flow regulators
- VaporPin®
- VaporPin® protective cap
- VaporPin® flush mount cover
- VaporPin® installation/extraction tool
- 65cc Vacuum Syringe or adjustable portable air pump
- Dead blow hammer
- Bottle brush ¾-inch diameter
- Personal Protective Equipment (PPE)
- Flashlight
- Two (2), 6-inch adjustable crescent wrenches
- ¼" Outer Diameter (OD) x 1/8" Inner Diameter (ID) Teflon or Teflon-lined tubing
- Duct tape
- Chalk or other non-permanent marking implement
- Camera
- Field notebook
- Appropriate AME records and forms

Refer to the VaporPin® manufacturer's instructions in **Attachment A** for detailed descriptions of proprietary tools and materials necessary to perform the work.

6.0 RECORDS AND FORMS

The following records and forms used to implement work described in this SOP include the following:

- Site-specific Health and Safety Plan (HASP) (fully executed by the Project Manager, Field/Site Supervisor, and the Environmental Health and Safety Manager)
- Field instructions (provided to field team during the kick-off meeting)
- Access agreement, if necessary
- Previous site documentation
- Field notebook
- Vapor Sampling Indoor Air Building Survey (4 pages)

  - Initial Information
  - Day-of-Event Information
  - Chemical Inventory
  - Instructions
- Common Sources of Indoor Air Background Contamination (field reference guide)
- Recommended Instructions for Homeowners
- Vapor Intrusion Sampling Data Sheet (aka VI Data Sheet)
- Shut-in Testing Form
- Port Integrity Testing Form
- Sample ID tags and laboratory Chain of Custody

7.0 HEALTH AND SAFETY CONSIDERATIONS

Personnel conducting vapor sampling activities should be qualified in proper safety procedures. Refer to the Site-Specific Health and Safety Plan (HASP); task-specific Activity Hazard Analysis (AHA) for guidelines on safety precautions and proper Personal Protective Equipment (PPE) for implementation; and AME Health Standards of Practice for work-related activities. Typically, August Mack vapor sampling projects require OSHA Modified Level D PPE (i.e. hard hat, steel-toed shoes, high-visibility vest, and eye protection).

8.0 PROCEDURES

Two types of samples can be collected with canisters: grab or time-integrated. During grab sampling, the canister is opened and allowed to fill rapidly. During time-integrated sampling, the canister is filled at a specific rate set within the flow controller. Know your sample timeframe prior to deploying sample canisters. With either type of sample collection, the following general procedures should be followed.

8.1 Pre-Sampling Activities

1. Perform a detailed survey of the building being investigated and document observations in accordance with *SOP 158 – Vapor Sampling Building Surveys*. Pay special attention and document any cracks, sumps, drains, and/or other openings in the foundation in the immediate vicinity (~10 foot radius) of the proposed vapor port locations.
2. If the building will be occupied during the sampling event, review the *Recommended Instructions for Homeowners* with the occupant, stressing the importance of following instructions on the potential sample results. If logistically necessary, provide the instructions in advance.
3. Ensure and document that doors and windows are closed and whether or not a mechanical HVAC system is operational during the sampling event.

4. Perform a utility locate of the proposed area for vapor port installation. Request that the locator provide you details regarding thicknesses of the foundation. Also request that the locator provide you details regarding the presence and locations of rebar reinforcements and/or wire mesh within the concrete. Request that the locator mark these elements on the sampling area with chalk or other non-permanent indicator. Photograph the located proposed vapor point, such as:




8.2 VaporPin® Installation

For VaporPin® installation procedures, see the VaporPin® Installation and Extraction SOP included as **Attachment A**. Photographs of completed pin installations are below.



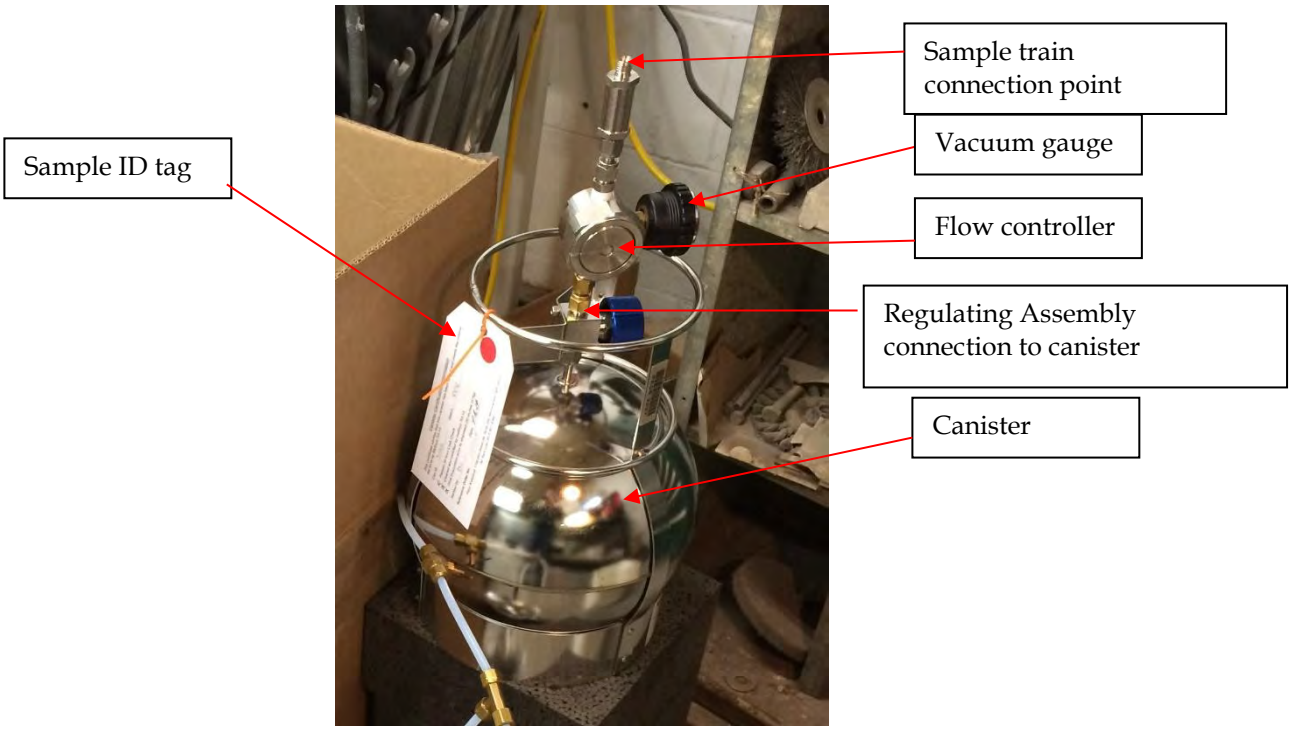

8.3 Vapor Port Integrity Testing

The integrity of the vapor port shall be verified prior to or during sample collection. A water dam test or a helium shroud test shall be specified in the field instructions for port integrity testing. Follow the applicable procedures outlined in SOP 156 – *Vapor Port Integrity Testing*.

8.4 Canister Setup and Placement

The canister may or may not come with the Regulating Assembly pre-attached to the cannister. If it is not pre-attached, connect the canister to the Regulating Assembly by securing the stainless steel nut to the top of the canister using the adjustable crescent wrenches. Do not overtighten the connection; generally a 1/8 to ¼ turn is sufficient.

The cannister should be placed on stable footing as near as reasonably possible to the sample port to minimize sample train connective tubing length. Create at least one extra fully assembled canister. This will allow for quick substitution if any canisters fail quality control checks.



If duplicate SSGS samples are being collected, follow the procedures outlined in SOP 157 *Assembling & Testing Vapor Sampling Trains*. The analyzing laboratory may send a premade duplicate-specific Regulating Assembly or it may need created by the field team prior to the sampling event.

8.5 Sample Train Assembly and Shut-in Testing

The cannisters require a sample train to connect to the sample port. The sample train consists of three primary components combined together in a "T" configuration:

- the connection tubing to the canister;
- the connection tubing to the vapor sampling port; and
- a valved stub used to purge the sample train and vapor port of stagnant air.

Note that the configuration will be modified slightly to accommodate the sampling of a quality control duplicate (See SOP 157 for details on duplicate train assembly).

The sample train must be documented to not leak, which is accomplished via "shut-in" testing. Shut-in testing involves creating a closed system, applying a vacuum to the system, and then verifying no unacceptable vacuum loss over a given period of time. Details regarding Sample train assembly and shut-in testing are included in SOP 157. Once the sample train is verified to not leak, connect it to the vapor sampling port either via a stub of flex tubing (as pictured below), or, if a semi-permanent assembly is present, by the appropriate ferrule/nut combination. An example of a completed sample train for an original and duplicate SSGS sample and a port connection are depicted in the photos below.

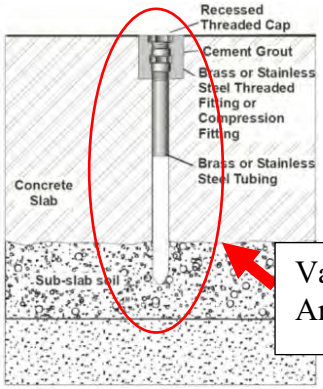




8.6 Purging the Sample Train and Vapor Port

The stagnant air within the sample train and port shall be purged prior to sample collection. Three sample volumes should be removed from the line to ensure appropriate collection of foundation vapors. Calculate the volume of stagnant air in the sample train and vapor port annulus. Since the purging syringes are typically listed in cubic centimeters (cc) instead of milliliters, volumes below are also reported as cc, although the two are equivalent. Certain laboratories may supply their own purging manifold assemblies (**Attachment B**). If so, follow the instructions provided.

8.6.1 Calculate Volume of Vapor Port Annulus



Assume the drill bit advances approximately two-inches (2″) beyond the bottom of the foundation. The volume of stagnant air in the vapor port must be accounted for and purged prior to sample collection. The diagram to the left depicts where stagnant air in the port is accumulated.

Assuming a 5/8″ diameter drill bit, the volume of the vapor port for typical concrete thicknesses are as follows:

$$Port\ \&\ Annulus\ Volume\ (cc) =$$

$$\left([Concrete\ Thickness\ (in) + Annulus\ (\sim 2in)]\ *\ \frac{2.54\ cm}{in}\right) * \left(\frac{\frac{5}{8}in * \frac{2.54cm}{in}}{2}\right)^2$$

Concrete Thickness (inches)	Vapor Port Annulus Volume (cc)
4 inches	~10
6 inches	~13
8 inches	~16
10 inches	~20
12 inches	~23

8.6.2 Calculate Volume of Sample Train Tubing

For the purposes of this calculation, assume connection fittings are approximately the same inner diameter as the tubing as their contributions are insignificant. Add the sample train length (assuming 1/8″ID Teflon-lined tubing), and any duplicate tee assembly tubing, to the calculated vapor port volume and multiply total by three:

$$Tubing\ Volume\ (cc) = \left(Tubing\ Length\ (ft) * \frac{30.48\ cm}{ft}\right) * \left(\frac{\frac{1}{8}in * \frac{2.54cm}{in}}{2}\right)^2$$

Tubing Length (feet)	Tubing Volume (cc)	Total Volume (w/6" Concrete) (cc)	3 Purge Volumes (cc)
5 feet	~4	~17	~60
7 feet	~6	~19	~60
10 feet	~8	~21	~65
15 feet	~12	~25	~75

8.6.3 Purge the Sample Train and Vapor Port

With the sample train connected to the cannister and the port, open the valve on the purging end of the sample train. Apply the vacuum pump (such as a graduated vacuum syringe [pictured below], motorized pump, or hand pump) and evacuate three volumes from the system. Document how much volume was purged from the line. Following purging, close the valve.



8.7 Vapor Sample Collection

1. Perform a final review of the sampling assembly. Verify the regulator on the canister is set for the appropriate sampling period. Verify DUP regulators either have double exposure or have two separate regulators on the sample train. Take precautions as necessary to ensure the canister is not knocked over or otherwise disrupted during the collection period.
2. Open the valve on the canister to initiate sample collection.
   a. Note, if you hear any distinguishable continuous sound (i.e. hissing) after the canister is turned on, there is a potential leak in the canister-assembly connection.
      i. Turn the canister off before additional troubleshooting.

ii. Unscrew the connection and re-connect, ensuring the threads of the stainless steel nut and canister are aligned.
iii. Discuss this issue with your Project Manager or other project technical lead and note any corrective action taken in your field notebook.

b. When the sample canister is turned on, the vacuum gauge should read between -25 and -30 inches of mercury (in. Hg). If the vacuum gauge is greater than -25 in. Hg (i.e. between 0 and -25 in. Hg), contact the Project Manager or other project technical lead. A new canister might need to be substituted for sample collection. Document initial canister vacuum on VI Data Sheet (**Attachment C**).

3. Document sample start date and time as well as set-up activities in the field notebook and the VI Data Sheet per SOP 311 *Written Field Documentation*.
4. Photograph the canister, vacuum gauge, and sample location per SOP 312 *Field Photography* following the start of sample collection to document field conditions.
5. Sketch the general location of the samples, and/or mark them on a field map. Be sure to identify the location of an ambient air samples collected simultaneously.
6. Periodically check the vacuum gauges throughout the sample duration and document the time and vacuum in the field notebook.
7. Be prepared to arrive at the site at least one hour prior to end of the predetermined sample collection time period (i.e. 23 hours after a 24-hour sample collection period began or seven hours after an eight hour sample collection period began). The canister must be turned to the off position before the vacuum gauge reaches 0 in. Hg. Document this end vacuum on the VI Data Sheet.
8. Following sample collection, ensure the sample ID tag is attached to the canister and is completed with pertinent information.
9. Document date and time of the end of sampling activities in the field notebook and the VI Data Sheet per SOP 311 *Written Field Documentation*.
10. Submit sample canisters to the laboratory with the sampling Chain of Custody.
11. Submit field data sheets and copies of field notes to the Project Manager in accordance with SOP 311 *Written Field Documentation*.

8.8 Post-Sample Collection Activities

Depending on whether or not the vapor ports are expected to be sampled again in the future, the field instructions will identify whether a protective flush-mounted cap should be installed, or if the port should be abandoned.

If the port will be re-used, install a cap in accordance with manufacturer's instructions included in **Attachment A**. If the port is to be abandoned, remove the vapor port from the foundation and backfill the hole with complementing materials, usually concrete. Document the abandonment procedures performed in your field notebook.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Various aspects of SSGS sampling procedures will depend on project-specific objectives and circumstances; however, general quality assurance/quality control measures should include the following at a minimum.

9.1 Pre-Mobilization:

- Inspect equipment and supplies prior to use.
- Sampling canisters should either be batch certified clean or 100% clean by the laboratory prior to sampling activities. Document the cleaning method specific to the sampling event on the VI Data Sheet per SOP 311 *Written Field Documentation*.
- Stainless steel connectors (e.g. Swagelok®) parts should be decontaminated and not appear damaged prior to use.
- Equipment and supplies should be stored in an appropriate manner away from potential contaminants, including fuel canisters, exhaust fumes, or other confounding vapor sources, to prevent cross-contamination.

9.2 Transportation:

- Secure equipment and supplies in vehicle prior to transport to minimize shifting loads and potential damage.
- Avoid exposure to exhaust fumes or other vapor sources during transport.

9.3 Sampling:

- A duplicate sample may be requested to determine if the sampling effort meets acceptable precision guidelines based on project objectives.
- An ambient air sample may be collected concurrently during the sampling event to determine if external confounding vapor influences may affect sample results.

10.0 DOCUMENTATION SUMMARY

The following data shall be obtained and documented over the course of the sampling event. A chronology of site activities beginning at arrival and ending at departure, noting with timestamps any visitors, communications with project team, sampling issues, or other noteworthy events should be maintained throughout the sampling event in the field notebook. The individual datum and final location of documentation are presented below:

Category	Data	Location
Project Metadata:	Project Name, Project Number, Project Location	VI Sampling Data Sheet
Sampler Information	Sampler Name, Affiliation, Receiving Laboratory	
Sample Information	Sample ID, Sample Location, UTM Coordinates (if requested), Sample Type, Sample Duration, Parent/Duplicate Associations	
Canister Information	Canister Size, Canister Number, Flow Regulator Number, Batch Clean or 100% Certified Clean	
Sample Duration	Sample Start/End Date & Time	
Vacuum Information	Initial Vacuum & Final Vacuum	
Sample Train Testing	Test date/time, test results	Shut-in Test Data Sheet
Port Integrity Testing	Test type, test date/time, test results	Leak Testing Data Sheet
Building Information	Building construction information, HVAC info, demographics, potential vapor concerns	IA Building Survey Checklist
Background Sources	Potential background sources of contamination; removal status	
Photos of Sample Locations		Electronic Project File – Field/VI/Event Date/Photos
Sketch of Sample Location		Field Notebook
Chronology of Site Events / Communication Log		Field Notebook
Ambient Conditions		VI Sampling Data Sheet

11.0 EXCEPTIONS & INTERFERENCES

- The thickness of a concrete slab may vary from structure to structure. A structure may also have a single slab where the thickness varies. A slab may contain steel reinforcement. Drill bits of various sizes and cutting ability may be required to penetrate slabs of varying thicknesses or those that are steel-reinforced.

- Do not use indelible ink markers (e.g. Sharpie®) to complete the sample ID tag due to the potential for vapor contamination.
- Review State regulations prior to implementation of this SOP to ensure procedures comply with local regulatory requirements.
- Sometimes the foundation materials are so tightly packed that all available sub-slab vapor is evacuated during purging. This creates a pseudo-closed system, as evidenced by increasing resistance on the purging pump. If this occurs, notify your project manager as the location may require abandonment or additional time to re-equilibrate.
- An HVAC system creates pressure gradients that can affect sample results. Be sure to document if the HVAC is operational during sample collection.
- According to ASTM D5466-15, the volume of air within the sample train should be less than 2% of the volume of the sampling canister. Therefore, for a six (6)-liter canister using ¼" inner diameter tubing, 150 linear feet of tubing should be considered the upper limit of tubing length employed in sampling.

12.0 CROSS-REFERENCES/SOURCES

- ASTM, 2015. *Standard Test Method for Determination of Volatile Organic Compounds in Atmospheres (Canister Sampling Methodology) D5466-15*. American Society of Testing and Materials, 2015.
- August Mack SOP No. 158: *Vapor Sampling Building Surveys*
- August Mack SOP No. 157: *Assembling & Testing Vapor Sampling Trains*
- August Mack SOP No. 311 *Written Field Documentation*
- August Mack SOP No. 312 *Field Photography*
- Cox Colvin, S*tandard Operating Procedure: Installation and Removal of the VaporPin®*
- U.S. EPA. (June 2015). *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air.*

13.0 ATTACHMENTS

A. Standard Operating Procedure: Installation and Removal of the VaporPin®
B. Pace Analytical – Purging Manifold Assembly Instructions
C. Vapor Intrusion Field Sampling Data Sheet

14.0 FIGURES

Figure 1: Typical Sample Collection Apparatus

ATTACHMENTS

ATTACHMENT A

Standard Operating Procedure: Installation and Removal of the VaporPin®

Standard Operating Procedure Installation and Extraction of the Vapor Pin®

Updated September 9, 2016

Scope:

This standard operating procedure describes the installation and extraction of the VAPOR PIN® for use in sub-slab soil-gas sampling.

Purpose:

The purpose of this procedure is to assure good quality control in field operations and uniformity between field personnel in the use of the VAPOR PIN® for the collection of sub-slab soil-gas samples or pressure readings.

Equipment Needed:

- Assembled VAPOR PIN® [VAPOR PIN® and silicone sleeve(Figure 1)]; Because of sharp edges, gloves are recommended for sleeve installation;
- Hammer drill;
- 5/8-inch (16mm) diameter hammer bit (hole **must** be 5/8-inch (16mm) diameter to ensure seal. It is recommended that you use the drill guide). (Hilti™ TE-YX 5/8" x 22" (400 mm) #00206514 or equivalent);
- 1½-inch (38mm) diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch (19mm) diameter bottle brush;
- Wet/Dry vacuum with HEPA filter (optional);
- VAPOR PIN® installation/extraction tool;
- Dead blow hammer;
- VAPOR PIN® flush mount cover, if desired;
- VAPOR PIN® drilling guide, if desired;
- VAPOR PIN® protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel for repairing the hole following the extraction of the VAPOR PIN®.



Figure 1. Assembled VAPOR PIN®

Installation Procedure:

1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.

2) Set up wet/dry vacuum to collect drill cuttings.

3) If a flush mount installation is required, drill a 1½-inch (38mm) diameter hole at least 1¾-inches (45mm) into the slab. Use of a VAPOR PIN® drilling guide is recommended.

4) Drill a 5/8-inch (16mm) diameter hole through the slab and approximately 1-inch (25mm) into the underlying soil to form a void. Hole **must** be 5/8-inch (16mm) in diameter to ensure seal. It is recommended that you use the drill guide.

VAPOR PIN® protected under US Patent # 8,220,347 B2, US 9,291,531 B2 and other patents pending

5) Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.

6) Place the lower end of VAPOR PIN® assembly into the drilled hole. Place the small hole located in the handle of the installation/extraction tool over the vapor pin to protect the barb fitting, and tap the vapor pin into place using a dead blow hammer (Figure 2). Make sure the installation/extraction tool is aligned parallel to the vapor pin to avoid damaging the barb fitting.



Figure 2. Installing the VAPOR PIN®

During installation, the silicone sleeve will form a slight bulge between the slab and the VAPOR PIN® shoulder. Place the protective cap on VAPOR PIN® to prevent vapor loss prior to sampling (Figure 3).



Figure 3. Installed VAPOR PIN®

7) For flush mount installations, cover the vapor pin with a flush mount cover, using either the plastic cover or the optional stainless-steel Secure Cover (Figure 4).



Figure 4. Secure Cover Installed

8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to re-equilibrate prior to sampling.

9) Remove protective cap and connect sample tubing to the barb fitting of the VAPOR PIN®. This connection can be made using a short piece of Tygon™ tubing to join the VAPOR PIN® with the Nylaflow tubing (Figure 5). Put the

Nylaflow tubing as close to the VAPOR PIN® as possible to minimize contact between soil gas and Tygon™ tubing.



Figure 5. VAPOR PIN® sample connection

10) Conduct leak tests in accordance with applicable guidance. If the method of leak testing is not specified, an alternative can be the use of a water dam and vacuum pump, as described in SOP Leak Testing the VAPOR PIN® via Mechanical Means (Figure 6). For flush-mount installations, distilled water can be poured directly into the 1 1/2 inch (38mm) hole.



Figure 6. Water dam used for leak detection

11) Collect sub-slab soil gas sample or pressure reading. When finished, replace the protective cap and flush mount cover until the next event. If the sampling is complete, extract the VAPOR PIN®.

Extraction Procedure:

1) Remove the protective cap, and thread the installation/extraction tool onto the barrel of the VAPOR PIN® (Figure 7). Turn the tool clockwise continuously, don't stop turning, the VAPOR PIN® will feed into the bottom of the installation/extraction tool and will extract from the hole like a wine cork, DO NOT PULL.

2) Fill the void with hydraulic cement and smooth with a trowel or putty knife.



Figure 7. Removing the VAPOR PIN®

- Prior to reuse, remove the silicone sleeve and protective cap and discard. Decontaminate the VAPOR PIN® in a hot water and Alconox® wash, then heat in an oven to a temperature of 265° F (130° C) for 15 to 30 minutes. For both steps, **STAINLESS – ½ hour, BRASS 8 minutes**

3) Replacement parts and supplies are available online.

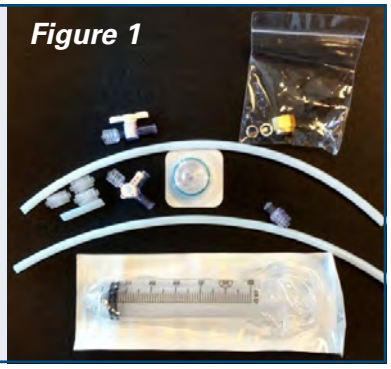
ATTACHMENT B

Example Purge Manifold Assembly Instructions

Assembly of the Purge Manifold Assembly (PMA)

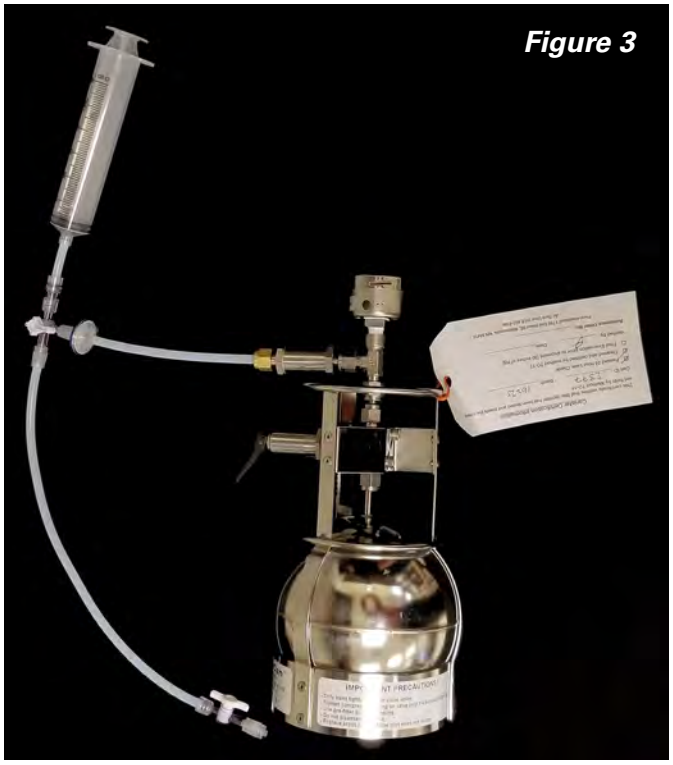
Each PMA should include the following:

2-1′ sections of tubing, 1-1″ section of tubing, 1-four way valve, 1-two way valve, 1-unidirectional valve, 3-male slip adapters, 1-set of fittings and ferrules, 1-moisture filter and 1-60mL syringe *(Figure 1)*.


Figure 1

Assemble the manifold in accordance with *Figure 2* and *Figure 3*. Ensure that the orientation of the unidirectional valve matches the figures below or purging the manifold will not be possible.


Figure 2


Figure 3

Purging the manifold

(General guidelines, subject to state or client specific guidelines).

1. **DISCLAIMER: Do not open canister until ready to collect sample.**
2. The purge manifold assembly contains four valves, including the canister valve. They are as follows:
   a. Canister valve – attached to the canister. Do not open until ready to collect sample.
   b. 4-way valve – attached to canister assembly via Teflon tubing. This valve has 3 directions "open" at a time with only one closed direction (indicted by the "OFF" tab).
   c. Unidirectional vale – Attached to the male luer fitting on the 4-way valve. This valve will allow volume to exit the assembly, but cannot be pushed back into the assembly in this direction. Once installed, the valve will be active.
   d. 2-way valve – This is the valve closest to the sampling point. It is used to close off the sampling point to allow purging of ambient air in the Teflon lines prior to sampling. It is closed when the white valve is perpendicular to the valve body.
3. After assembly, set the 2-way valve to the closed position. See *Figure 1*.
4. Turn the 4-way valve OFF tab to the direction on the 4-way valve that will allow flow in all three connected directions (the "OFF" tab should face in the only direction without a connection). See *Figure 2*.
5. Attach the syringe to the unidirectional valve with a 1" piece of Teflon tubing. Pull aliquots of the syringe out of the unidirectional valve until the gauge on the canister reaches the required vacuum level. See *Figure 3* and *Figure 4*.
6. Allow the canister and Purge Manifold to sit undisturbed for the desired amount of time, and read the canister gauge. If notable drops in pressure occur, inspect the system for potential leaks and retest. If no pressure change is observed, proceed to step 7. The manifold assembly has now been determined to be free of leaks.
7. Open the two way valve to allow air from the sampling point to fill the lines of the Purge Manifold Assembly. The canister pressure should return to 0.
8. (**Optional**) Using the syringe, purge the line with the desired aliquots of sampling point volume. Multiple purges may be necessary.
9. Open the canister to collect sample.


Figure 1


Figure 2


Figure 3


Figure 4

ATTACHMENT C

Vapor Intrusion Sampling Data Sheet

August Mack ENVIRONMENTAL

VAPOR INTRUSION SAMPLING DATA SHEET (TO-15)

Project Name:		Field Team:	
Project Number:		Company:	*August Mack Environmental, Inc.*
Sampling Address (es):		Laboratory:	
Weather:	Temp:	Canister Clean Certification:	Batch [x] 100% [ ]

Sample I.D.	Pre-Sampling Information						Post-Sampling Information		
	Sample Location	Canister Size	Canister #	Flow Regulator Serial #	Sample Start Date /Time	Initial Vacuum ("Hg)	Sample Stop Date/Time	Final Vacuum ("Hg)	NOTES

Additional Questions:

Were "*Instructions for Occupants*" provided to tenant? ☐ Yes ☐ No ☐ NA

NOTES:

Windows open during sampling period? ☐ Yes ☐ No ☐ NA

Active construction in sampling period? ☐ Yes ☐ No ☐ NA

Precipitation during sampling period? ☐ Yes ☐ No

Were "*Instructions for Occupant*" followed? ☐ Yes ☐ No ☐ NA

Notes & Abbreviations

Canister Sizes: 400 mL / 1.0L Canister / 6.0L Canister

The VI Sampling Data form should be completed at the beginning and end of the sampling time frame.

Any periodic checks of canister vacuums should be noted in personnel's field books.

"Hg = vacuum in inches of mercury; NA = Not applicable

Any deviations from expected conditions should be noted in the "*Additional Questions: Notes*" section.

STANDARD OPERATING PROCEDURE

SOP NUMBER: 157

SOP TITLE: ASSEMBLING & TESTING VAPOR SAMPLING TRAINS

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202

REVISION DATE: February 2021

Revision Prepared By: _____
Mary Hile, CHMM
Project Manager

Approved By: _____
James A. Berndt
Principal of Technical Services

1.0 PURPOSE AND SUMMARY

The following Standard Operating Procedure (SOP) has been developed to support vapor sample collection during August Mack Environmental, Inc. (August Mack) field Vapor Intrusion (VI) investigation projects. This SOP will be followed by August Mack technical personnel when creating sampling trains to connect a vapor collection point to a sampling cannister. The procedures are subject to change if unusual or unanticipated field conditions are encountered. Deviations from this SOP shall be approved by the Project Manager or other designated project technical lead.

This SOP documents August Mack procedures for the creation of sample trains and the associated leak testing performed to verify sample trains are acceptable to be used in sample collection. Procedures associated with indoor air samples, crawl space air samples, exterior soil gas samples, and sub-slab vapor samples are provided in SOP 151, SOP 153, SOP SOP 155, and SOP 154, respectively.

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3.0 RESPONSIBILITIES

It is the responsibility of the Project Manager to ensure that each project involving vapor sampling is properly planned and executed. The Project Manager is also responsible for understanding specific requirements or regulations regarding vapor sampling activities, and to ensure the procedures comply with applicable local, State, and/or Federal requirements.

Field personnel are responsible for verifying and documenting that procedures and requirements contained in this SOP are followed. Field personnel are responsible for ensuring that work is conducted in a safe and professional manner. Field personnel implementing this SOP are encouraged to contact the Project Manager or other project technical lead if there are any questions on the SOP or the task, as needed.

4.0 DEFINITIONS

Background vapor source – The origin(s) and location(s) of a vapor-forming chemical(s), other than vapor intrusion, and not associated with or emanating from a site-related release(s) to the environment. Background vapor sources may include indoor or outdoor sources.

Duplicate Sample - Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner.

Passivated Sample Canisters ("Canisters") – Stainless steel canisters with specially treated interior surfaces, such as electro-polishing processes or fused silica coatings.

Regulating Assembly – The vacuum gauge, flow controller, and connectors which represent the transition from the sampling cannister to the sampling train.

Sample Train – The tubing and associated fittings that connect the sample cannister to the sampling point. The sample train consist of three primary components, the connection tubing to the canister, the connection tubing to the vapor sample port, and a valved stub used to purge the sample train and vapor port of stagnant air.

Subsurface vapor source – Refers to a vapor-forming chemical(s) present in the subsurface environment arising from a release(s) to the environment.

Swagelok® or equivalent stainless steel or brass fittings – Includes tube fittings, valves, tubing, and gauges, specifically the compression tube fitting, a commonly used family of connectors for high and low pressure stainless steel tubing.

Vapor – A substance in the gaseous state as distinguished from the liquid or solid state.

Vapor Intrusion – The migration of potentially hazardous vapors from any subsurface contaminant source, such as contaminated soil or groundwater, through the vadose zone and into a building or structure.

5.0 EQUIPMENT AND SUPPLIES

Equipment and supplies necessary to implement work described in this SOP include the following:

- Laboratory supplied Canisters with flow regulators
- Personal Protective Equipment (PPE)
- Two (2), 6-inch adjustable crescent wrenches or pliers
- Stainless Steel or Brass (or equivalent) Union Tee[1], with tube fittings for a ¼" outside diameter (OD) tube
- Stainless Steel or Brass (or equivalent) Union Cross[1], with tube fittings for a ¼" OD tube
- Stainless Steel or Brass (or equivalent) Nut with Front and Back Ferrule (for connection to canister regulator or regulator assembly apparatus), for ¼" OD tube
- Stainless Steel or Brass (or equivalent) Ball Valve[1], for ¼" OD tube
- Teflon or Teflon-Lined Low Density Polyethylene (LDPE) Tubing, ¼"OD x 1/8" inside diameter (ID)
- Tube cutter
- Measuring tape
- Hand or automated pump with gauge or vacuum gauge and syringe
- Camera
- Field notebook
- Appropriate AME records and forms

6.0 RECORDS AND FORMS

The following records and forms used to implement work described in this SOP include the following:

- Site-specific Health and Safety Plan (HASP) (fully executed by the Project Manager, Field/Site Supervisor, and the Environmental Health and Safety Manager)
- Field instructions (provided to project team during the kick-off meeting)

[1] Tube fittings may have compression fittings or push to connect fittings.

- Access agreement, if necessary
- Previous site documentation
- Field notebook
- Sample Train Shut-In Testing form

7.0 HEALTH AND SAFETY CONSIDERATIONS

Personnel conducting vapor sampling activities should be qualified in proper safety procedures. Refer to the Site-Specific Health and Safety Plan (HASP), task-specific Activity Hazard Analysis (AHA) for guidelines on safety precautions and proper Personal Protective Equipment (PPE) for implementation, and August Mack Health Standards of Practice for work-related activities. Typically, August Mack vapor sampling projects require OSHA Modified Level D PPE (i.e. hard hat, steel-toed shoes, high-visibility vest, and eye protection).

8.0 PROCEDURES

See the appropriate SOP for vapor sampling activities preceding the call for assembly of a sample train. Sample trains are assembled to connect the cannisters to the sample point. The sample train consists of three primary components:

- the connection tubing to the cannister(s);
- the connection tubing to the vapor sampling point; and
- a valved stub used to purge the sample train and vapor port of stagnant air.

8.1 Sample Train Assembly

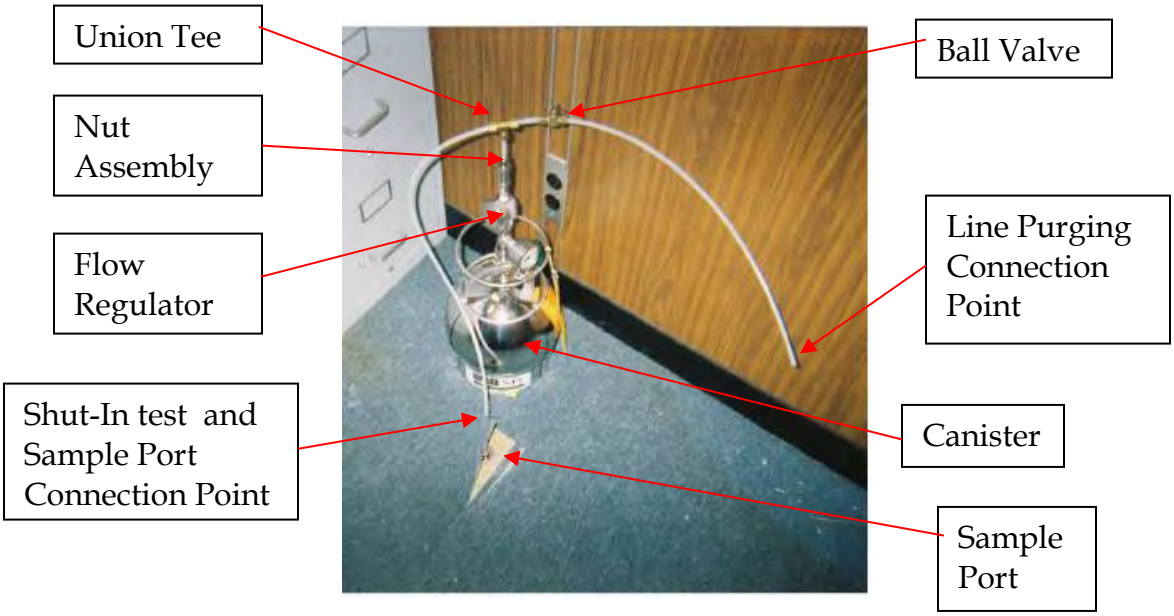
See Section 5.0 above for specs on tubing and parts. Tube fittings may be compression type fittings (screw down fitting after insertion of the tube to seal) or push to connect type fittings (see Section 8.2 for additional detail on fittings). Tubing lengths discussed below may vary depending on the sample set-up. If appropriate, trains may be assembled in the office prior to mobilizing to the site.

Single Sample Collection Train – see **Figure 1**

- Using a tube cutter, cut three (3) sections of Teflon or Teflon-lined tubing, each approximately 4-inches in length.
- Attach two (2) of the 4-inch lengths of tubing to a Union Tee, one (1) in the upper opening and (1) in the lower opening. Push the tubing into the openings and secure.
- Attach the Nut with Front and Back Ferrule to the other end of the tubing that was inserted into the lower opening of the Union Tee. Slide the Nut and Ferrules on to the tubing and secure the Nut to the canister flow regulator using the adjustable crescent wrenches or pliers. Do not overtighten the connection.

- Attach a Ball Valve to the other end of the tubing that was inserted into the upper opening of the Union Tee. Push the tubing into the tube fitting of the Ball Valve and secure.
- Attach the remaining 4-inch length of tubing to the other tube fitting of the Ball Value (this end of the train will be used to purge air from the system after leak testing has been completed and the train has been connected to the sample point, see the appropriate SOP for the type of vapor sampling being conducted) and secure.
- Cut a length of tubing sufficient to reach the sample point (while the Nut portion of the train is attached to the canister flow regulator) and insert into the remaining upper opening of the Union Tee and secure. Do not attach the other end of the tubing to the sample point.

Image 1:



Most laboratories utilized by August Mack provide the appropriate regulator assembly apparatus (tee fitting) when collecting a duplicate sample, that will allow the "Single" sampling train assembly to connect to the two canisters from one connection. Below (**Image 2**) are two variations of the regulator assembly apparatus, one with the tee fitting directly connected to each canister with one flow regulator after the tee fitting. And the second with individual flow regulators connected to each canister, with a tee fitting connected to each regulator.

Image 2:



Tee fitting after one flow controller/restrictor



Tee fitting before two flow controllers/restrictors

Image 3:



Connection point of the Regulatory Assembly Apparatus and Sample Train

Lab provided Regulator Assembly Apparatus

Canister Regulators

"Single" Sample Collection Train

However, there are cases when a "Duplicate" sampling train will need to be assembled in order to connect to both canisters, when the laboratory does not provide the regulator assembly apparatus (tee fitting).

Duplicate Sample Collection Train – see **Figure 2**

- Using a tube cutter, cut four (4) sections of Teflon or Teflon-lined tubing, each approximately 4-inches in length.
- Attach three (3) of the 4-inch lengths of tubing to a Union Cross. Push the tubing into the openings and secure.
- Attach two (2) Nuts with Front and Back Ferrule, to the ends of the two (2) lengths of tubing that are aligned within the Union Cross. Slide the Nut and Ferrules onto the tubing and secure each nut to the canister flow regulators of the sample and duplicate canisters using the adjustable crescent wrenches or pliers. Do not overtighten the connection.
- Attach a Ball Valve to the other end of the tubing that was inserted into the third opening of the Union Cross. Push the tubing into the tube fitting of the Ball Valve and secure.
- Attach the remaining 4-inch length of tubing to the other tube fitting of the Ball Value (this end of the train will be used to purge air from the system after leak testing has been completed and the train has been connected to the sample point, see the appropriate SOP for the type of vapor sampling being conducted) and secure.
- Cut a length of tubing sufficient to reach the sample point (while the Nut portions of the train are attached to the canister flow regulators) and insert into the remaining opening of the Union Cross and secure. Do not attach the other end of the tubing to the sample point.

8.2 Tube Fittings

August Mack uses both push to connect type fittings (aka "quick-connect") and compression type fittings. If using a push to connect type fitting you simply insert the tubing into the tube fitting and the fitting will bite down to create a seal. If using a compression type fitting, unscrew (if attached) the nut from the body of the part (union cross, union tee, ball valve) and slide the nut over the tubing with threads facing the fitting. Slide the back ferrule onto the tubing with the fat end facing the nut. Slide the front ferrule onto the tubing with the fat end facing the nut. Insert the tubing into the connecting body and screw the nut onto the connecting body to create a seal around the tubing. Using a wrench or pliers, tighten the nut with a 1/8 to ¼ turn, do not over tighten. See below (**Image 4**).

Image 4:



8.3 Shut-in Testing

Prior to collecting samples with canisters, the regulating assembly and sample trains should be subjected to shut-in testing. After the sampling train has been assembled and attached to the canister flow regulator, shut-in testing will be performed and documented prior to sample collection, in order to test the system for leaks. Shut-in testing involves creating a closed system, applying a vacuum to the system, and then verifying no unacceptable vacuum loss over a given period of time.

- Do not attach the sample train to the sample point. Instead attach the line of the sample train (that will be later attached to the sample point) to the device that will be used to apply vacuum. For example, a hand or automated pump

with built-in vacuum gauge can be attached to the end of the sample line or a vacuum gauge and syringe can be utilized to apply vacuum.

- While keeping the canister and any sampling pump and valves in the "off" or "closed" position, apply vacuum to the sampling line using a pump or by drawing back the syringe plunger.
- Withdraw air from the sampling train until a vacuum of approximately -15 in. Hg. is achieved. Observe the induced vacuum for at least 1 minute.
- If a change in vacuum over the observation period is equal to or less than 0.5 in. Hg., the system leak rate is acceptable.
- If the change in vacuum over the observation period is greater than 0.5 in. Hg., check, tighten, or replace the fittings and connections, and repeat the shut-in test.
- Document the shut-in test on the Sample Train Shut-In Testing form. An example Sample Train Shut-In Testing form is provided in **Attachment A**.
    - Be sure to document the vacuum device (pump/model number or vacuum gauge and syringe) employed during the test within the "Notes" section of the form.
- When fittings and connections are verified leak-free, disconnect sample train from the vacuum device, and connect tubing to the sample point as described in the appropriate SOP for the type of vapor sampling being conducted. **After the sampling train has been verified tight, try not to adjust or jostle the sampling train.** Sampling may proceed as outlined in the appropriate SOP for the type of vapor sampling being conducted.

8.4 Post Sampling Procedure

- Following use, disassemble the sampling trains and discard the tubing. Stainless Steel or brass parts are decontaminated for reuse utilizing procedures in SOP 616 *Equipment Decontamination*.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Various aspects of vapor sampling procedures will depend on project-specific objectives and circumstances; however, general quality assurance/quality control measures should include the following at a minimum.

9.1 Pre-Mobilization:

- Inspect equipment and supplies prior to use.
- Stainless steel or brass connections should not appear damaged prior to use and should be properly decontaminated utilizing standard procedures in SOP 616 *Equipment Decontamination*.

- Equipment and supplies should be stored in an appropriate manner to ensure no cross-contamination occurs.
- Equipment and supplies should be stored in an appropriate manner away from potential contaminants, including fuel canisters, exhaust fumes, or other confounding vapor sources, to prevent cross-contamination.

9.2 Transportation:

- Secure equipment and supplies in vehicle prior to transport to minimize shifting loads and potential damage.
- Avoid exposure to exhaust fumes or other vapor sources during transport.

9.3 Sampling Precision via Duplicate Collection

Collection of a duplicate sample is often a requirement for a VI sampling program. In order to eliminate potential precision errors, original/duplicate sample pairs are collected simultaneously from the same sample collection point. There are three (3) basic setups discuss in previous sections; two which utilize the "Single" Sample Train setup and one (1) that utilizes the "Duplicate" Sample Train setup. No matter which setup is used, both samples are fed via the same sample collection point.

Most laboratories utilized by August Mack provide the appropriate regulator assembly apparatus (tee fitting) when collecting a duplicate sample, that will allow the "Single" sampling train assembly to connect to the two canisters from one connection. The laboratory supplied regulatory assembly apparatus has two (2) basic variations. See **Image 2** above for the two (2) variations. One (1) variation has the tee fitting directly connected to each canister with one flow regulator after the tee fitting. And the second variation includes individual flow regulators connected to each canister, with a tee fitting connected to each regulator. It should be noted the setup utilizing one (1) shared flow regulator, is set to collect double the volume, therefore, it is imperative you understand the intended setup by the laboratory and it is not appropriate to use only one regulator if the laboratory provides two (2). Depending on the orientation of the regulator assembly apparatus (i.e. sample collection point pointed up or pointed to the side), the field setup may differ slightly from the reference image.

The third duplicate set-up utilizes the "Duplicate" sample train setup. In this case the laboratory does not provide a regulatory assembly apparatus (tee fitting). In this setup, both canisters are connected via tubing from each of their respective regulators to the Union Cross fitting of the sample train. Refer to **Figure 2** for an illustration of the "Duplicate" Sample Train.

9.4 Sampling Train Length Limitations:
In accordance with ASTM D5466-15, the volume of air within the sample train should be less than 2% of the volume of the sampling canister. Therefore, for a six (6)-liter canister using ¼" inner diameter tubing, 150 linear feet of tubing should be considered the upper limit of tubing length employed in sampling.

10.0 DOCUMENTATION SUMMARY

The following data must be obtained and documented during construction and testing of the sampling train. A chronology of site activities beginning at arrival and ending at departure, noting with timestamps any visitors, communications with project team, sampling issues, or other noteworthy events should be maintained throughout the sampling event in the field notebook. Refer to the appropriate SOP for the type of vapor sampling being conducted for additional required documentation during vapor sampling. The individual datum and final location of documentation to be collected during the construction and testing of the sampling train are presented below:

Category	Data	Location
Project Metadata:	Project Name, Project Number, Sampling Address	Shut-In Testing Data Sheet
Sampler Information	Sampler Name, Affiliation	
Sample Information	Sample ID, Sample Location, Duration, Parent/Duplicate Associations	
Test Information	Type of vacuum device employed	
Chronology of Site Events / Communication Log		Field Notebook

Document the shut-in test on the Sample Train Shut-In Testing form. An example Sample Train Shut-In Testing form is provided in **Attachment A**. Be sure to document the vacuum device (pump/model number or vacuum gauge and syringe) employed during the test within the "Notes" section of the form.

11.0 EXCEPTIONS & INTERFERENCES

- Review State regulations prior to implementation of this SOP to ensure procedures comply with local regulatory requirements.
- If potential background sources of contamination are observed and/or unavoidable, discuss sample placement options with your Project Manager or other designated project technical lead.

12.0 CROSS-REFERENCES/SOURCES

- ASTM D5466-15, *Standard Test Method for Determination of Volatile Organic Compounds in Atmospheres (Canister Sampling Methodology).*
- ASTM D7663-12 (Reapproved 2018), *Standard Practice for Active Soil Gas Sampling in the Vadose Zone for Vapor Intrusion Evaluations.*
- August Mack SOP No. 151 *Collection of Indoor Air Samples*
- August Mack SOP No. 153 *Collection of Crawlspace Air Samples*
- August Mack SOP No. 154 *Collection of Sub-Slab Air Samples*
- August Mack SOP No. 155 *Collection of Soil Gas Samples*
- August Mack SOP No. 311 *Written Field Documentation*
- August Mack SOP No. 312 *Field Photography*
- August Mack Activity Hazard Analysis, *Vapor Intrusion Port Installation and Sampling*
- Indiana Department of Environmental Management (IDEM). (March 22, 2012). *Remediation Closure Guide.*
- U.S. EPA. (June 2015). *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air.*

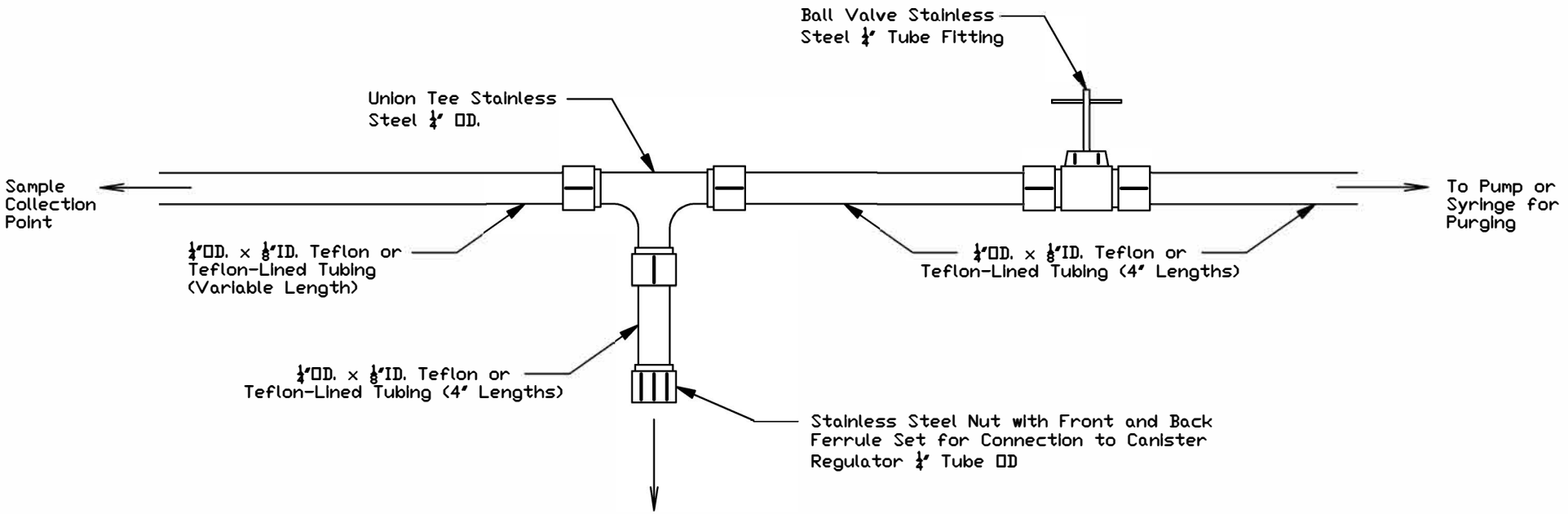
13.0 FIGURES

1. Vapor Sampling Train (Single Sample Collection)
2. Vapor Sampling Train (Duplicate Sample Collection)

14.0 ATTACHMENT

A. Sample Train Shut-In Testing Form

FIGURES

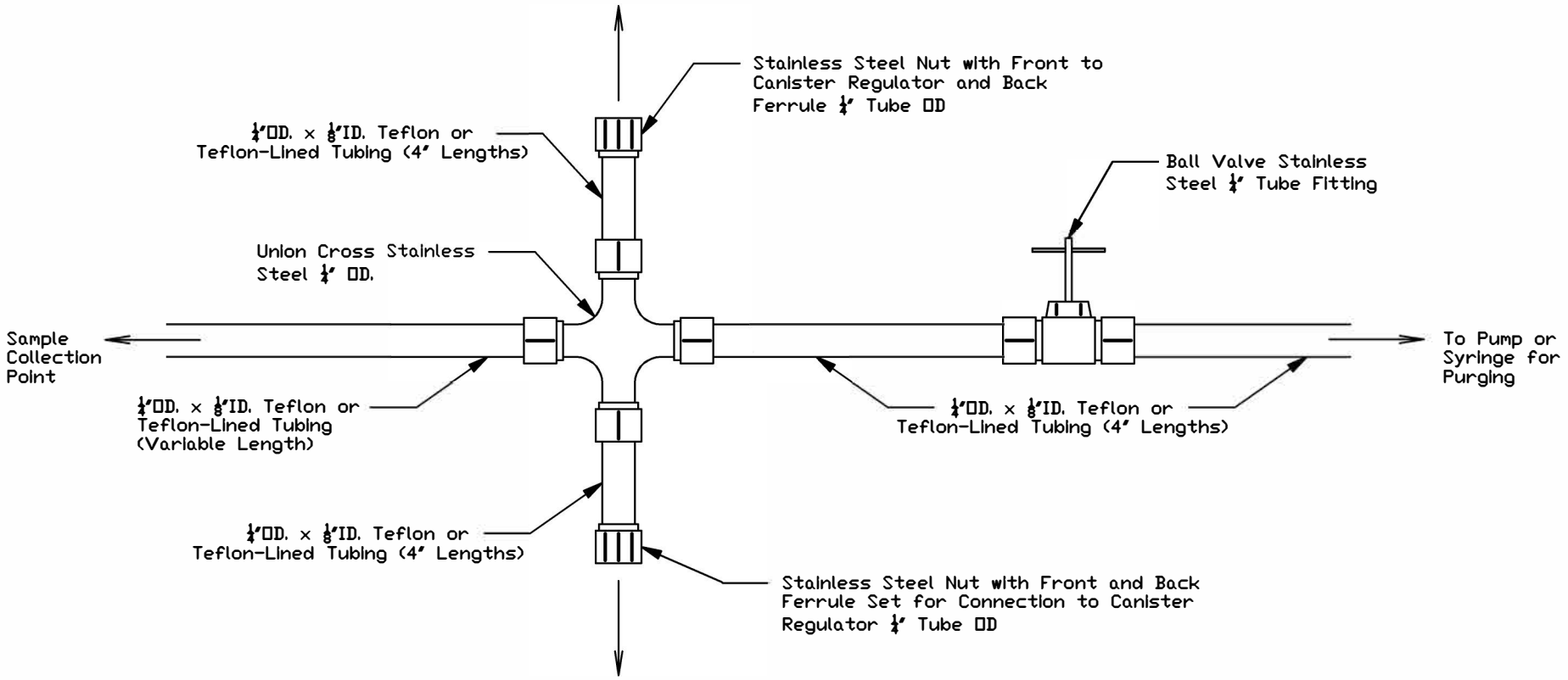


1302 N. MERIDIAN ST., STE. 300
INDIANAPOLIS, INDIANA 46202
(317) 916-8000
(317) 916-8001 FAX

August Mack ENVIRONMENTAL

Vapor Sampling Train (Single Sample Collection)

PROJECT No.:	FILENAME: N:/Shared/ballen/CAD Templates/CS Sarrpling Template.dwg		DATE: 02/03/2021
DRAWN BY: BA	MODIFIED BY: BA	SCALE: Not to Scale	FIGURE: 1



1302 N. MERIDIAN ST., STE. 300
INDIANAPOLIS, INDIANA 46202
(317) 916-8000
(317) 916-8001 FAX

August Mack ENVIRONMENTAL

Vapor Sampling Train
(Duplicate Sample Collection)

PROJECT No.:	FILENAME: N:/Shared/ballen/CAD Templates/CS Sampling Template.dwg		DATE: 02/03/2021
DRAWN BY: BA	MODIFIED BY: BA	SCALE: Not To Scale	FIGURE: 2

ATTACHMENT A

Sample Train Shut-In Testing Form

August Mack ENVIRONMENTAL

SAMPLE TRAIN SHUT-IN TESTING

Project Name:		Field Team:	
Project Number:		Company:	*August Mack Environmental, Inc.*
Sampling Address (es):		Laboratory:	
Weather:	Temp:	Canister Clean Certification:	Batch [x] 100% [ ]

Sample /Port ID	Parent Sample of Duplicate (NA or DUP ID)	Date Test Performed	Start Vacuum (in Hg)	Duration (target 60 sec)	End Vacuum (in Hg)	Vacuum Loss < 0.5 in Hg (Yes {PASS} or No {FAIL})	Comments
	NA						
	NA						
	NA						
	NA						
	NA						
	NA						

NOTES

Equipment Used: ☐ Hand Syringe ____cc ☐ Automated Pump: Model _____ ☐ Hand Pump: Model _____

STANDARD OPERATING PROCEDURE

SOP NUMBER: 158

SOP TITLE: VAPOR SAMPLING BUILDING SURVEYS

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202

REVISION DATE: December 2019

Revision Prepared By: _____

Andrew R. Tennyson, CHMM
Senior Analyst

Approved By: _____

Enter Name (add Credentials)
Enter Title

1.0 PURPOSE AND SUMMARY

The following Standard Operating Procedure (SOP) has been developed to supplement vapor sample collection during August Mack Environmental, Inc. (August Mack) vapor investigation projects. This SOP will be followed by August Mack technical personnel when collecting vapor samples for laboratory analysis for any interior vapor sampling. The procedures are subject to change if unusual or unanticipated field conditions are encountered. Deviations from this SOP must be pre-approved by the Project Manager or other designated project technical lead.

Vapor Intrusion occurs when contamination volatilizes and migrates from groundwater, soil, or non-aqueous phase liquids through the soil or some preferential pathway into nearby buildings. Any vapor investigation that obtains discrete samples must take into consideration the ambient baseline conditions (i.e. building construction information, anomalies at time of sampling, and/or potential indoor vapor sources) of an indoor environment. This qualitative assessment allows the investigator to distinguish a background vapor source from a potential subsurface vapor source.

This SOP documents August Mack procedures for documenting the ambient conditions prior to and during indoor vapor sampling events. Specific procedures associated with the sampling of ambient air, crawl space air, indoor air, and sub-slab air samples can be found under separate covers.

2.0 TABLE OF CONTENTS

1.0 Purpose and Summary
2.0 Table of Contents
3.0 Responsibilities
4.0 Definitions
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6.0 Records and Forms
7.0 Health & Safety Considerations
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    8.1 Initial Information Documentation
    8.2 Day of Event Documentation
    8.3 Chemical Inventory Documentation
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11.0 Exceptions & Interferences
12.0 Cross References/Sources
13.0 Attachments

3.0 RESPONSIBILITIES

It is the responsibility of the Project Manager to ensure that each project involving vapor sampling is properly planned and executed. The Project Manager is also responsible for understanding specific requirements or regulations regarding vapor sampling activities, and to ensure the procedures comply with applicable local, State, and/or Federal requirements.

Field personnel are responsible for verifying and documenting that procedures and requirements contained in this SOP are followed. Field personnel are responsible for ensuring that work is conducted in a safe and professional manner. Field personnel implementing this SOP are encouraged to contact the Project Manager if there are any questions on the SOP or the task, as needed.

4.0 DEFINITIONS

Ambient Air – The outdoor air surrounding a building or site.

Background – Refers to a vapor-forming chemical(s) or location(s) that is(are) not influenced by the releases from a site, and is usually described as naturally occurring or anthropogenic.

Background vapor source – The origin(s) and location(s) of a vapor-forming chemical(s), other than vapor intrusion, and not associated with or emanating from a site-related release(s) to the environment. Background vapor sources may include indoor or outdoor sources.

Indoor Air – The air within a building or structure.

Subsurface vapor source – Refers to a vapor-forming chemical(s) present in the subsurface environment arising from a release(s) to the environment.

Vapor – A substance in the gaseous state as distinguished from the liquid or solid state.

Vapor Intrusion – The migration of potentially hazardous vapors from any subsurface contaminant source, such as contaminated soil or groundwater, through the vadose zone and into a building or structure.

5.0 EQUIPMENT AND SUPPLIES

Equipment and supplies necessary to implement work described in this SOP include the following:

- Personal Protective Equipment (PPE)
- Flashlight
- Camera
- Field notebook
- Appropriate AME records and forms

6.0 RECORDS AND FORMS

The following records and forms used to implement work described in this SOP include the following:

- Site-specific Health and Safety Plan (HASP) (fully executed by the Project Manager, Field/Site Supervisor, and the Environmental Health and Safety Manager)
- Field instructions (provided to field team during the kick-off meeting)
- Access agreement, if necessary
- Previous site documentation
- Field notebook
- Indoor Air Building Survey Checklist – Initial Information
- Indoor Air Building Survey Checklist – Day-of-Event Information
- Indoor Air Building Survey Checklist – Chemical Inventory
- Indoor Air Building Survey Checklist – Instructions Page
- Common Household Sources of Background Contamination (field reference guide)

7.0 HEALTH AND SAFETY CONSIDERATIONS

Personnel conducting indoor air sampling activities should be qualified in proper safety procedures. Refer to the Site-Specific Health and Safety Plan (HASP); task-specific Activity Hazard Analysis (AHA) for guidelines on safety precautions and proper Personal Protective Equipment (PPE) for implementation; and August Mack Health Standards of Practice for work-related activities.

8.0 PROCEDURES

Vapor sampling projects may consist of indoor air sampling, sub-slab soil gas sampling, crawl space air sampling, and ambient air sampling, in any combination. Vapor sampling events that obtain samples from within a structure shall follow this SOP for documentation of property condition and day-of-sampling ambient conditions.

8.1 Initial Information

Initial information consists of building construction details, heating, ventilation, and air conditioning (HVAC) information, and an assessment of potential vapor sources on nearby or adjacent properties. This information is not expected to change between the time of the survey being completed and the sampling being performed.

1. Perform a detailed survey of the building being investigated and document observations on the Indoor Air Building Survey Checklist (**Attachment A):** Initial Information Page.
2. Each field requires an entry. If not applicable, enter "NA". If the form does not accurately reflect the field conditions, provide additional information in the notes section at the bottom of the page.
    a. The "Instructions" page provides definitions for each of the fields of information to be collected.

Certain projects may require the Initial Information page to be completed by a third-party in advance of a sampling event, such as a homeowner, a property owner, or a Site manager. Ideally, these forms should be received and reviewed for completeness prior to mobilization for vapor sampling. If the forms are incomplete, they should be completed by the field sampling team to the best of their ability using field observations during the sampling event.

8.2 Day-of-Event Information

Day-of-Event information provides information on the building conditions at the time of sampling, such as weather conditions, wind direction, or nearby construction activities. Day-of-Event information also documents any changes from a previous sampling event, such as new paints, occupant smoking habits, or changes in occupants and/or sensitive subpopulations. This form is to be completed in the field immediately prior to and/or during sampling.

Most vapor investigations are performed in fully enclosed spaces such as commercial buildings or residences. In industrial buildings, garage doors may be left open, HVAC systems may be defunct or otherwise non-operational, or other ventilation may be present (i.e. broken windows or gaps in walls). Field teams shall document and photograph these conditions when encountered (See SOP 312 – *Field Photography*).

Space is provided for a sketch of the sample location; if a sketch is provided on a separate page, note as such on the bottom of the form.

8.3 Chemical Inventory

Similar to the Day-of-Event information, the chemical inventory form **(Attachment A)** shall be completed immediately prior to or during sampling. The chemical inventory provides information on the potential vapor sources that may skew or otherwise affect the sampling results. Review the "*Common Household Sources of Background Contamination*" (**Attachment B)** field reference guide for a better understanding of what potential sources to target.

The chemical inventory form includes a listing of typical indoor air sources of vapor contamination and the typical place where these items are stored. The actual location of the source of contamination shall be documented in such a manner that the location can be cross-referenced to the final vapor sample placement.

Projects may require that potential sources of vapor contamination be removed from the building prior to sampling. In these cases, the "Removed" column on the chemical inventory form should be documented as "YES". In the notes section, the temporary storage location of the removed sources shall be documented.

Examples of Temporary Source Removal:





8.4 Post-Sampling Debriefing

The building survey documentation is critical to successful execution and analysis of vapor investigation projects. The necessary documentation to be obtained during the sampling event should be listed on the field instructions. Required documents shall be submitted with the field information packet to the project coordinator or designated recipient upon completion of the sampling event. Field documentation shall not remain

with the sampling teams. Submit field data sheets and copies of field notes to the Project Manager in accordance with SOP 311 *Written Field Documentation*.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Completeness: Each form area or field should have some marking. Fields that are gray indicate a space to provide additional information. For those areas with checkboxes, at least one box should be checked, or "NA" written in that form area and additional explanation provided in the "Notes" section.

10.0 DOCUMENTATION SUMMARY

The following data shall be obtained and documented over the course of the sampling event. A chronology of site activities beginning at arrival and ending at departure, noting with timestamps any visitors, communications with project team, sampling issues, or other noteworthy events should be maintained throughout the sampling event in the field notebook (See SOP 311 – Written Documentation). The individual pieces of information and final location of documentation are presented below:

Category	Data	Location
Building Information	Building construction information, HVAC info, demographics, potential vapor concerns	Initial Information Page
Event Information	Changes in building (i.e. paints, furnishings); changes in demographics, weather & precipitation.	Day-of-Event Page
Background Sources	Potential background sources of contamination; removal status	Chemical Inventory Page
Sketch of Sample Location		Day-of-Event Page, separate submitted page, or Field Notebook
Chronology of Site Events / Communication Log		Field Notebook

11.0 EXCEPTIONS & INTERFERENCES

- The qualitative information necessary to assess vapor investigation as documented on the building survey described herein mirror the information required by the Indiana Department of Environmental Management and other regulatory agencies. Obtaining this information may not be a requirement of other states, but should be considered a best practice for vapor investigations.

- If potential background sources of contamination are observed and/or unavoidable, discuss canister placement options with your Project Manager or other designated project technical lead.
- Occupants may refuse to remove potential background sources of contamination. If so, document discussions with occupant and items remaining inside of the building. Discuss findings with the Project Manager or other technical project lead.

12.0 CROSS-REFERENCES/SOURCES

- August Mack SOP No. 311 *Written Field Documentation*
- August Mack SOP No. 312 *Field Photography*
- Crump, 2011. *Nature and Sources of Indoor Chemical Contaminants.* Accessed January 21, 2021. Available at: https://www.iloencyclopaedia.org/part-vi-16255/indoor-air-quality/item/526-nature-and-sources-of-indoor-chemical-contaminants

13.0 ATTACHMENTS

A. Building Survey Checklist
B. Common Vapor Sources of Contaminants
C. Common Household Sources of Background Contamination White Paper (Crump, 2011)

ATTACHMENTS

ATTACHMENT A

BUILDING SURVEY CHECKLIST

Vapor Intrusion Building Survey (Initial Information)

August Mack Environmental

Project Name:	
Project Number:	Survey Date:

Sampling Address:		Person Completing Survey:	
		Company/ Association:	
Information Provider (name/entitiy):		Phone:	
		Email:	
Relation to Site: ☐ Owner ☐ Occupant ☐ Site Manager	Interviewed: ☐ Yes ☐ No	Mailing Address:	

Building Construction:

☐ Stand Alone Single Family ☐ Attached Garage
☐ Single Family Attached to one or more buildings
☐ Multi-Family
☐ Commercial: One-Story
☐ Commercial: Multi-Story

Floors: (#)

Above Grade	
Below Grade	

Year Constructed:

☐ <1940 ☐ 1940-1949 ☐ 1950-1959
☐ 1960-1969 ☐ 1970-1979 ☐ 1980-1989
☐ 1990-1999 ☐ 2000-2009 ☐ 2010-Current
☐ Fire in history of structure

Sub-Level Construction (check all that apply):

Foundation Type:	☐ Basement	☐ Crawlspace	☐ Slab on Grade	☐ Other:	**Other Sub-Level Installations:**
Basement Occupancy:	☐ Occasionally	☐ Full Time	☐ Almost Never	☐ N/A	☐ Floor Drains ☐ None
Floor Materials:	☐ Concrete	☐ Dirt	☐ Stone	☐ Other:	☐ Moisture Barrier
Concrete Floor:	☐ Unsealed	☐ Sealed	☐ Sealed With:		☐ Radon System
Floor Covering:	☐ Uncovered	☐ Covered	☐ Describe:		☐ VI Mitigation System
Foundation Walls:	☐ Poured	☐ Block	☐ Stone	☐ Other/NA	☐ Passive Vents/Louvers
Basement Finished:	☐ Unfinished	☐ Finished	☐ Partial Finish	☐ Other/NA	☐ Perimeter Drainage System
Basement Moisture:	☐ Wet	☐ Damp	☐ Dry	☐ Moldy	**Construction Notes:**
Sump Pump Present:	☐ Yes ☐ No	If yes, is Water present?:	☐ Yes ☐ No		
Water Supply:	☐ Public Water	☐ Private Well	☐ Other:		
Sewage Disposal:	☐ Public Sewer	☐ Septic Tank	☐ Leach Field		

Above-Grade Construction (check all that apply):

Interior Walls:	☐ Brick	☐ Wood	☐ Drywall	☐ Concrete	☐ Other:
Exterior Walls:	☐ Brick	☐ Wood	☐ Concrete	☐ Other:	
Pressed Wood:	☐ Particleboard	☐ Plywood	☐ Fiberboard	☐ None Observed	

Yard: ☐ Pavement ☐ Garden ☐ Forested ☐ Lawn ☐ Other:

Heating System:
☐ Gas Furnace ☐ Radiator: Air ☐ Kerosene
☐ Hot Air Circ. ☐ Radiator: Water ☐ Radiant Floor
☐ Heat Pump ☐ Radiator: Steam ☐ None
☐ Wood Stove ☐ Electric ☐ Other

Furnace Location:
☐ Main Fl.
☐ Basement
☐ Outdoors

Fuel Source:
☐ Coal ☐ Natural gas
☐ Electric ☐ Wood
☐ Solar ☐ Fuel Oil
☐ Other

Cooktop:
☐ Electric
☐ Natural gas

Air Conditioning:
☐ Central Air ☐ Window Units ☐ Range Exhaust Fan
☐ Attic Fan ☐ Ceiling Fans ☐ Bathroom Vent Fan

If Central Air:
☐ Refrigerative ☐ Re-circulates Air
☐ Evaporative ☐ Outside Air

Where:
☐ Bedrooms ☐ Entire Building
☐ Offices ☐ Living Area

Ambient Air Sources:

Nearby Vehicle Traffic:
☐ Heavy Highway ☐ Moderately Busy
☐ Busy ☐ Quiet Paved Road ☐ Dirt Road

Potential VOC Emission Sources: (describe)
☐ Fueling Stations ☐ Manufacturing Plants
☐ Parking Lots ☐ Emissions Stacks
☐ None Observed ☐ Drycleaners

Distance & Direction:
☐ <500 ft ☐ 1,000-2,000 ft
☐ 500-1,000 ft ☐ >2k ft & <1mi
☐ N ☐ S ☐ E ☐ W

Notes:

Vapor Intrusion Building Survey (Day-of-Event Information)

August Mack ENVIRONMENTAL

Project Name:	
Project Number:	Survey Date:

Sampling Address:		Person Completing Survey:	
		Company/Association	

Sampling Site Status Update: (or within 6mths - provide detail on timing in notes)

- ☐ Occupants have changed
- ☐ Renovations
- ☐ Fresh paint or stain
- ☐ Structure Fire
- ☐ Significant Cracks/ Penetrations in basement floor/walls
- ☐ New Textiles/Furniture
- ☐ Pesticide/Insecticide Application
- ☐ None

Garage: ☐ Not applicable
- ☐ Cars Parked inside
- ☐ Gas powered equip. stored inside
- ☐ Fuel can(s) present
- ☐ Cleaners, chemicals, solvents present

Secondary Heat Sources in use:
- ☐ Wood Stove
- ☐ Coal Stove
- ☐ Electric Space Heater
- ☐ None Observed
- ☐ Fuel Space Heater
- ☐ Other:
- ☐ Fireplace

Air Purifiers in use:
- ☐ None
- ☐ Filtered
- ☐ Ion
- ☐ Electrostatic
- ☐ Charcoal
- ☐ Other:
- ☐ Mechanical Fans

Ambient Air & Wind Direction:
: (ex. NNW, S, SW)

Outdoor Air Sample Collected? ☐ Yes ☐ No

☐ OA Sample placed upwind?

Occupant-Specific Information:

Sensitive Populations:
- ☐ Daycare/School
- ☐ None
- ☐ Hospital
- ☐ Nursing Home

Demographics		Smoking:	Daily Freq.:	Location	Solvents Used? (details in Notes)	Clothes Dry Cleaned?
Number of Occupants		☐ Cigarettes	☐ <1/2 Pack	☐ Inside	☐ Work	☐ Weekly
Adult(18-65)		☑ Cigars	☐ 1 Pack	☐ Outside	☐ Home	☐ Monthly
Child		☐ Pipe	☐ 2 Packs		☐ None	☐ <6 times per year
Senior		☐ None	☐ N/A	☐ N/A		☐ None

During Sampling Event:

Construction Activities within 250 ft?
- ☐ Yes (describe in "Notes")
- ☐ No

Occupants smoking near samples?	☐ Yes	☐ No
Windows closed during sampling event?	☐ Yes	☐ No
"*Instructions for Occupant*" provided?	☐ Yes	☐ No

Precipitation *(during event)*:
- ☐ Heavy Rain
- ☐ Snow / Ice
- ☐ Light Rain
- ☐ None

Notes and General Observations:

Sample Location Sketch: *(include rough outline of basic structure, room dividers, canister locations & names, and points of interest (e.g. fans, sumps, furnaces). Provide one sketch for each floor/area of sampling (basement, main, crawl space). Use additional sheets as necessary.*

Office Use Only:

☐ Precipitation : Per "Weather Underground" online precipitation database: _____ inches of precipitation was recorded at: _____

Vapor Intrusion Building Survey: Chemical Inventory

Project Name:	
Project Number:	Date Prepared:

Sampling Address:		Person Completing Survey:	
		Company/Association	

Potential Indoor Air Background Sources of

Identify all potential indoor sources found in the building (including attached garages) the location of the source (floor & room), and whether the item was removed from the building 24-48 hours prior to the indoor air sampling event.

- In the "Removed" column, enter "Yes", "No" or "NA" if the souce material was removed 24-48 hrs prior to the sampling event.

TYPICAL LOCATIONS	POTENTIAL BACKGROUND CONTAMINATION SOURCE	LOCATION OF SOURCE (FLOOR / ROOM)	REMOVED (Yes/No/NA)
Garage	Paints, Paint Thinners, Paint Strippers		
	Gas Powered Equipment		
	Fuel Cans		
	Insecticides, Pesticides, Herbicides		
Kitchen / Living Area	Cleaning Supplies		
	Air Fresheners		
	Oven Cleaners		
	Carpet / Upholstry Cleaner		
	Polishes / Waxes		
	Other Household Cleaning Products:		
	Appliance Cleaners		
	Furniture / Floor Polishes		
	Hobby Supplies (Solvents, Paints, Lacquers, Glues, Photographic Darkroom Chemicals)		
	Scented Trees, wreaths, potpourri, etc.		
	New Furniture / Upholstery		
	New Carpeting / Flooring		
	New Drapes / Curtains		
Bathrooms	Air Fresheners		
	Perfume / Colognes		
	Hairspray		
	Nail Polish / Polish Remover		
	Bathroom Cleaners		
Closets	Moth Balls		
Bottom Floor	Fuel Tank (Inside Building)		
	Wood Stove or Fireplace		
Inside Structure	Other Potential Sources:		

Notes:	

Vapor Intrusion
Building Survey
INSTRUCTIONS

Project Metadata:

Metadata Details:		Contents:
Project Metadata:	Project Name:	Common name of project
	Project Number:	AME / EFS Project Number
	Sampling Address:	Address where VI Sampling is occurring (use multiple surveys for multiple addresses)
	Survey Date:	Date when Indoor Air Survey is performed (not always same as sample date)
	Person Completing Survey:	Field Team members, or if submitted to owner rep in advance, then owner rep name.
	Company / Affiliation:	EFS/AME or Affiliation of Owner Rep completing survey

INITIAL INFORMATION SURVEY PAGE

Information Provider Details:		Contents:
	Information Provider (name):	Name of Person providing survey information (same as Person Completing Survey if survey is sent to owner's representative in adv
	Information Provider (entity)	If the IP works for a company involved in the sampling effort, list the company name.
	IP Phone:	Phone number for IP
	IP Email:	Email Address for IP
	Relation to Site:	Relation of IP to the Site
	Interviewed (Y/N):	Yes: IP was directly questioned by the Person Completing Survey. No: IP filled out survey in advance and was not interviewed by field teams.
	Mailing Address:	Mailing address for IP (or their associated company's mailing address)
Building Construction Details:		**Contents:**
	Building Construction:	Select any boxes that accurately describe the subject property (multiple boxes may be selected.)
	Floors:	Enter # of floors above grade and below grade (basements)
	Year Constructed	Select closest range. If actual year known, write it in the margins.
	Fire In History of Structure:	Select if a fire is known or documented to have occurred at the subject property.
Sub-level Construction Details:		**Contents:**
	Foundation Type	Select all that apply. If multiple, provide more detail in notes section.
	Basement Occupancy	Occasional can be assumed to be <1hr per day.
	Floor Materials	Select all that apply. If multiple, provide more detail in notes section.
	Concrete Floor	Concrete is often sealed with either paint or a moisture barrier. If any sealant is present, note it.
	Floor Covering	If covered, describe the covering (e.g. carpet, floor tile, wood laminant, etc.)
	Foundation Walls	Select all that apply. If multiple, provide more detail in notes section.
	Basement Finished	If partial, describe which is finished vs. unfinished in the notes section.
	Basement Moisture	Wet has standing water or puddles. Damp is anything in-between wet and dry.
	Sump Pump Present	If unknown and/or basement inaccessible, then note "unknown".
	Water Supply	If unknown then list "Unknown" in the "Other" field.
	Sewage Disposal	If unknown then list "Unknown" in the construction notes field.
	Other Sub-Level Installations	Select all that apply, else select none.
Above-Grade Construction Details		**Contents:**
	Interior Walls	Select all that apply. If multiple, provide more detail in notes section.
	Exterior Walls	Select all that apply. If multiple, provide more detail in notes section.
	Pressed Wood	If identified during your inspection, select all that apply. Else, select "None Observed".
	Yard	Describe the exterior area in the subject property / sampling area.
	Heating System	Select all that apply; usually only one primary system is present.
	Furnace Location	Which floor is the heating system located.
	Fuel Source	Select all that apply.
	Cooktop	If a kitchen is present, note what type of cooking source(s) are available.
	Air Conditioning	Select all that apply
	If Central Air	Refrigerative: A standard air conditioning unit cools warm air it has taken from the rooms in your home by passing it over a set of coils that are filled with a refrigerant. The cooled air is then blown back into your home until the room or rooms reach the desired temperature.
		Evaporative: AKA "Swamp Cooler". A fan draws in air from the outside and forces it through a set of damp pads. These pads are moistened by a small pump that draws water from a pan below the unit. The air causes the water to evaporate, which in turn cools the air that is pushed into your home.
		Recirculated: Return air that is diverted from the exhaust route, mixed with incoming outside air, conditioned, and delivered to the conditioned space. Recycling the air circulating through an HVAC system reduces energy requirements.
		Outside Air: Fans draw in outside air directly.
	Where:	Where are air conditioning units? If Central air, select "Entire Building"
Ambient Air Sources		**Contents:**
	Nearby Vehicle Traffic	What are the nearest roads traffic conditions
	Potential VOC Sources	If an obvious source of VOC emissions is nearby, note it. Based on observation.
	Distance & Direction	Select approximate distance and cardinal direction. Select both cardinal directions for combos (i.e. NW).

August Mack ENVIRONMENTAL

Vapor Intrusion
Building Survey
INSTRUCTIONS

DAY-OF-EVENT INFORMATION SURVEY PAGE

Site Status Update		Contents:
	Status Updates	Select all that apply if the change or event has occurred within the last six months.
	Garage Status	Select all that apply at the time of sampling.
	Secondary Heat in Use	Select all that apply at the time of sampling.
	Air Purifiers in Use	Select all that apply at the time of sampling.
	Ambient Air & Wind Direction	Note prevalent wind direction (i.e. NW means wind is blowing NW and upwind would be SE).
Occupant Specific Information		**Contents:**
	Sensitive Populations	If the area is used for care/residence of children or seniors during the sampling period, describe in notes.
	Demographics	Estimated # of Occupants or Employees. If Child/Senior is unknown, put "UK".
	Smoking	Carefully complete if people smoke inside the building. Otherwise select "Outside" and n/a.
	Solvents Used	If the workers/occupants frequently use a solvent that would result in a VOC detection,note the solvent.
	Clothes Dry Cleaned	If the occupants of the area being sampled use dry cleaning, ask the frequency, especially if recent.
During Sampling Event		**Contents:**
	Construction Activities	Are any construction activities happening in proximity to the sampling event? Describe in notes.
	Precipitation	What type of precipitation was observed during the sampling event.

ATTACHMENT B

COMMON HOUSEHOLD SOURCES OF BACKGROUND CONTAMINATION FIELD REFERENCE GUIDE

COMMON HOUSEHOLD SOURCES OF BACKGROUND CONTAMINATION

Acetone	rubber cement, cleaning fluids, scented candles, and nail polish
Benzene	automobile exhaust, gasoline, cigarette smoke, scented candles, scatter rugs, and carpet glue
Bromomethane	soil or space fumigant
1,3-Butadiene	automobile exhaust and residential wood combustion
2-Butanone (MEK)	automobile exhaust, printing inks, fragrances and flavoring agents in candy and perfume, paint, glue, cleaning agents, and cigarette smoke
Chlorobenzene	scented candles, plastic foam insulation, and paint products
Chloroethane	refrigerant
Chloroform	generated from chlorinated waters (i.e. showers or boiling water)
Cyclohexane	gasoline, paint thinner, paint and varnish remover
1,4-Dichlorobenzene	moth balls, general insecticide in farming, air deodorant and toilet disinfectant
Dichlorodifluoromethane	refrigerant (chlorofluorocarbons [CFCs]) and cleaning solvent
1,1-Dichloroethane	plastic products (i.e. food and other packaging materials) and flame retardant fabrics
1,2-Dichloroethane	polyresin molded decorations (particularly from China)
1,1-Dichloroethene	plastic products (food and other packaging materials), adhesives, and flame retardant fabrics
1,3-Dichloropropene	fungicides
Ethylbenzene	paint, paint thinners, insecticides, wood office furniture, scented candles, and gasoline
Formaldehyde	building materials (i.e. particle board), furniture, insulation, and cigarette smoke
n-Heptane	gasoline, nail polishes, wood office furniture, and petroleum products

COMMON HOUSEHOLD SOURCES OF BACKGROUND CONTAMINATION (continued)

n-Hexane	gasoline, rubber cement, typing correction fluid, and aerosols in perfumes
Methylene Chloride	hairspray, paint stripper, rug cleaners, insecticides, and furniture polish
Methyl isobutyl ketone (MIBK)	paints, varnishes, dry cleaning preparations, naturally found in organics grapes and vinegar
Methyl *tert* butyl ether	gasoline (oxygenating agent)
Naphthalene	cigarette smoke, automobile exhaust, residential wood combustion, insecticides, and moth balls
Styrene	cigarette smoke, automobile exhaust, fiberglass, rubber, and epoxy adhesives, occurs naturally in various fruits, vegetables, nuts, and meats
Tertiary butyl alcohol	gasoline (oxygenating agent)
1,1,2,2-Tetrachloroethane	solvent, paint and rust removers, varnishes, and lacquers
Tetrachloroethene (PCE)	dry cleaning, metal degreasing, adhesives and glues, insecticides, scented candles, and rug cleaners
Toluene	gasoline, automobile exhaust, polishes, nail polish, synthetic fragrances, paint, scented candles, paint thinner, adhesives, and cigarette smoke
1,1,1-Trichloroethane	spot cleaner, glues, insecticides, drain cleaners, shoe polish
Trichloroethene (TCE)	glues, adhesives, paint removers, spot removers, rug cleaning fluids, paints, metal cleaners, typewriter correction fluids, and automobile cleaning and degreasing products
1,2,4-Trimethylbenzene	gasoline and automobile exhaust
1,3,5-Trimethylbenzene	gasoline and automobile exhaust
2,2,4-Trimethylpentane	gasoline and automobile exhaust
Xylenes, total	water sealer, gasoline, automobile exhaust, markers, paint, floor polish, and cigarette smoke

[1] = List obtained from New Jersey Department of Environmental Protection Site Remediation Program, March 2013

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Wednesday, 09 March 2011 21:49

Nature and Sources of Indoor Chemical Contaminants

Written by **Crump, Derrick**

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Characteristic Chemical Pollutants

Chemical contaminants of the indoor air can occur as gases and vapors (inorganic and organic) and particulates. Their presence in the indoor environment is the result of entry into the building from the outdoor environment or their generation within the building. The relative importance of these indoor and outdoor origins differs for different pollutants and may vary over time.

The major chemical pollutants commonly found in the indoor air are the following:

1. carbon dioxide (CO_2), which is a metabolic product and often used as an indicator of the general level of air pollution related to the presence of humans indoors
2. carbon monoxide (CO), nitrogen oxides (NO_x) and sulphur dioxide (SO_2), which are inorganic combustion gases formed predominantly during the combustion of fuels and ozone (O_3), which is a product of photochemical reactions in polluted atmospheres but may also be released by some indoor sources
3. organic compounds that originate from a variety of indoor sources and outdoors. Hundreds of organic chemicals occur in indoor air although most are present at very low concentrations. These can be grouped according to their boiling points and one widely used classification, shown in Table 1, identifies four groups of organic compounds: (1) very volatile organic compounds (VVOC); (2) volatile

(VOC); (3) semi-volatile (SVOC); and (4) organic compounds associated with particulate matter (POM). Particle-phase organics are dissolved in or adsorbed on particulate matter. They may occur in both the vapor and particle phase depending on their volatility. For example, polyaromatic hydrocarbons (PAHs) consisting of two fused benzene rings (e.g., naphthalene) are found principally in the vapor phase and those consisting of five rings (e.g., benz[*a*]pyrene) are found predominantly in the particle phase.

Table 1. Classification of indoor organic pollutants

Category	**Description**	**Abbreviation**	**Boiling range (°C)**	**Sampling methods typically used in field studies**
1	Very volatile (gaseous) organic compounds	VVOC	<0 to 50-100	Batch sampling; adsorption on charcoal
2	Volatile organic compounds	VOC	50-100 to 240-260	Adsorption on Tenax, carbon molecular black or charcoal
3	Semivolatile organic compounds	SVOC	240-260 to 380-400	Adsorption on polyurethane foam or XAD-2
4	Organic compounds associated with particulate matter or particulate organic matter	POM	380	Collection filters

An important characteristic of indoor air contaminants is that their concentrations vary both spatially and temporally to a greater extent than is common outdoors. This is due to the large variety of sources, the intermittent operation of some of the sources and the various sinks present.

Concentrations of contaminants that arise principally from combustion sources are subject to very large temporal variation and are intermittent. Episodic releases of volatile organic compounds due to human activities such as painting also lead to large variations in emission with time. Other emissions, such as formaldehyde release from wood-based products may vary with temperature and humidity fluctuations in the building, but the emission is continuous. The emission of organic chemicals from other materials may be less dependent upon temperature and humidity conditions but their concentrations in indoor air will be greatly influenced by ventilation conditions.

Spatial variations within a room tend to be less pronounced than temporal variations. Within a building there may be large differences in the case of localized sources, for example, photocopiers in a central office, gas cookers in the restaurant kitchen and tobacco smoking restricted to a designated area.

Sources within the Building

Elevated levels of pollutants generated by combustion, particularly nitrogen dioxide and carbon monoxide in indoor spaces, usually result from unvented, improperly vented or poorly maintained combustion appliances and the smoking of tobacco products. Unvented kerosene and gas space heaters emit significant quantities of CO, CO_2, NO_x, SO_2, particulates and formaldehyde. Gas cooking stoves and ovens also release these products directly into the indoor air. Under normal operating conditions, vented gas-fired forced air heaters and water heaters should not release combustion products into the indoor air. However flue gas spillage and backdrafting can occur with faulty appliances when the room is depressurized by competing exhaust systems and under certain meteorological conditions.

Environmental tobacco smoke

Indoor air contamination from tobacco smoke results from sidestream and exhaled mainstream smoke, usually referred to as environmental tobacco smoke (ETS). Several thousand different constituents have been identified in tobacco smoke and the total quantities of individual components varies depending upon the type of cigarette and the conditions of smoke generation. The main chemicals associated with ETS are nicotine, nitrosamines, PAHs, CO, CO_2, NO_x, acrolein, formaldehyde and hydrogen cyanide.

Building materials and furnishings

The materials which have received greatest attention as sources of indoor air pollution have been wood-based boards containing urea formaldehyde (UF) resin and UF cavity wall insulation (UFFI). Emission of formaldehyde from these products results in elevated levels of formaldehyde in buildings and this has been associated with many complaints of poor indoor air quality in developed countries, particularly during the late 1970s and early 1980s. Table 2 gives examples of materials that release formaldehyde in buildings. These show that the highest emission rates may be associated with the wood-based products and UFFI which are products often used extensively in buildings. Particleboard is manufactured from fine (about 1 mm) wood particles which are mixed with UF resins (6 to 8 weight%) and pressed into wood panels. It is widely used for flooring, wall panelling, shelving and components of cabinets and furniture. The plies of hardwood are bonded with UF resin and are commonly used for decorative wall panelling and components of furniture. Medium-density fibreboard (MDF) contains finer wood particles than those used in particleboard and these are also bound with UF resin. MDF is most often used for furniture. The primary source of formaldehyde in all these products is the residual formaldehyde trapped in the resin as a result of its presence in excess needed for the reaction with urea during the manufacture of the resin. Release is therefore highest when the product is new, and declines at a rate dependent upon product thickness, initial emission strength, presence of other formaldehyde sources, local climate and occupant behaviour. The initial decline rate of emissions may be 50% over the first eight to nine months, followed by a much slower rate of decline. Secondary emission can occur due to hydrolysis of the UF resin and

hence emission rates increase during periods of elevated temperature and humidity. Considerable efforts by manufacturers have led to the development of lower-emitting materials by use of lower ratios (i.e. closer to 1:1) of urea to formaldehyde for resin production and the use of formaldehyde scavengers. Regulation and consumer demand have resulted in widespread use of these products in some countries.

Table 2. Formaldehyde emission rates from a variety of construction material furnishings and consumer products

	Range of formaldehyde emission rates (mg/m^2/day)
Medium-density fiberboard	17,600-55,000
Hardwood plywood panelling	1,500-34,000
Particleboard	2,000-25,000
Urea-formaldehyde foam insulation	1,200-19,200
Softwood plywood	240-720
Paper products	260-680
Fiberglass products	400-470
Clothing	35-570
Resilient flooring	<240
Carpeting	0-65
Upholstery fabric	0-7

Building materials and furnishings release a wide range of other VOCs which have been the subject of increasing concern during the 1980s and 1990s. The emission can be a complex mixture of individual compounds, though a few may be dominant. A study of 42 building materials identified 62 different chemical species. These VOCs were primarily aliphatic and aromatic hydrocarbons, their oxygen derivatives and terpenes. The compounds with the highest steady-state emission concentrations, in decreasing order, were toluene, *m*-xylene, terpene, *n*-butylacetate, *n*-butanol, *n*-hexane, *p*-xylene, ethoxyethylacetate, *n*-heptane and *o*-xylene. The complexity of emission has resulted in emissions and concentrations in air often being reported as the total volatile organic compound (TVOC) concentration or release. Table 3 gives examples of rates of TVOC emission for a range of building products. These show that significant differences in emissions exist between products, which means that if adequate data were

available materials could be selected at the planning stage to minimize the VOC release in newly constructed buildings.

Table 3. Total volatile organic compound (TVOC) concentrations and emission rates associated with various floor and wall coverings and coatings

Type of material	Concentrations (mg/m^3)	Emission rate (mg/m^2hr)
Wallpaper		
Vinyl and paper	0.95	0.04
Vinyl and glass fibres	7.18	0.30
Printed paper	0.74	0.03
Wall covering		
Hessian	0.09	0.005
PVC[a]	2.43	0.10
Textile	39.60	1.60
Textile	1.98	0.08
Floor covering		
Linoleum	5.19	0.22
Synthetic fibres	1.62	0.12
Rubber	28.40	1.40
Soft plastic	3.84	0.59
Homogeneous PVC	54.80	2.30
Coatings		
Acrylic latex	2.00	0.43
Varnish, clear epoxy	5.45	1.30
Varnish, polyurethane, two-component	28.90	4.70

Varnish, acid-hardened	3.50	0.83

[a] PVC, polyvinyl chloride.

Wood preservatives have been shown to be a source of pentachlorophenol and lindane in the air and in dust within buildings. They are used primarily for timber protection for outdoor exposure and are also used in biocides applied for treatment of dry rot and insect control.

Consumer products and other indoor sources

The variety and number of consumer and household products change constantly, and their chemical emissions depend on use patterns. Products that may contribute to indoor VOC levels include aerosol products, personal hygiene products, solvents, adhesives and paints. Table 4 illustrates major chemical components in a range of consumer products.

Table 4. Components and emissions from consumer products and other sources of volatile organic compounds (VOC)

Source	Compound	Emission rate
Cleaning agents and pesticides	Chloroform 1,2-Dichloroethane 1,1,1-Trichloroethane Carbon tetrachloride m-Dichlorobenzene p-Dichlorobenzene n-Decane n-Undecane	15 $\mu g/m^2.h$ 1.2 $\mu g/m^2.h$ 37 $\mu g/m^2.h$ 71 $\mu g/m^2.h$ 0.6 $\mu g/m^2.h$ 0.4 $\mu g/m^2.h$ 0.2 $\mu g/m^2.h$ 1.1 $\mu g/m^2.h$
Moth cake	p-Dichlorobenzene	14,000 $\mu g/m^2.h$
Dry-cleaned clothes	Tetrachloroethylene	0.5-1 $mg/m^2.h$
Liquid floor wax	TVOC (trimethylpentene and dodecane isomers)	96 $g/m^2.h$
Paste leather wax	TVOC (pinene and 2-methyl-1-propanol)	3.3 $g/m^2.h$
Detergent	TVOC (limonene, pinene and myrcene)	240 $mg/m^2.h$
Human emissions	Acetone Acetaldehyde	50.7 mg/day 6.2 mg/day

	Acetic acid Methyl alcohol	19.9 mg/day 74.4 mg/day
Copy paper	Formaldehyde	0.4 µg/form
Steam humidifier	Diethylaminoethanol, cyclohexylamine	—
Wet copy machine	2,2,4-Trimethylheptane	—
Household solvents	Toluene, ethyl benzene	—
Paint removers	Dichloromethane, methanol	—
Paint removers	Dichloromethane, toluene, propane	—
Fabric protector	1,1,1-Trichloroethane, propane, petroleum distillates	—
Latex paint	2-Propanol, butanone, ethylbenzene, toluene	—
Room freshener	Nonane, decane, ethylheptane, limonene	—
Shower water	Chloroform, trichloroethylene	—

Other VOCs have been associated with other sources. Chloroform is introduced into the indoor air chiefly as a result of dispensing or heating tap water. Liquid process copiers release isodecanes into the air. Insecticides used to control cockroaches, termites, fleas, flies, ants and mites are widely used as sprays, fogging devices, powders, impregnated strips, bait and pet collars. Compounds include diazinon, paradichlorobenzene, pentachlorophenol, chlordane, malathion, naphthalene and aldrin.

Other sources include occupants (carbon dioxide and odours), office equipment (VOCs and ozone), mould growth (VOCs, ammonia, carbon dioxide), contaminated land (methane, VOCs) and electronic air cleaners and negative ion generators (ozone).

Contribution from the external environment

Table 5 shows typical indoor-outdoor ratios for the major types of pollutant that occur in indoor air and average concentrations measured in outdoor air of urban areas in the United Kingdom. Sulphur dioxide in the indoor air is normally of outdoor origin and results from both natural and anthropogenic sources.

Combustion of fossil fuels containing sulphur and smelting of sulphide ores are major sources of sulphur dioxide in the troposphere. Background levels are very low (1 ppb) but in urban areas maximum hourly concentrations may be 0.1 to 0.5 ppm. Sulphur dioxide can enter a building in air used for ventilation and can infiltrate through small gaps in the building structure. This depends upon the airtightness of the building, meteorological conditions and internal temperatures. Once inside, the incoming air will mix and be diluted by the indoor air. Sulphur dioxide that comes into contact with building and furnishing materials is adsorbed and this can significantly reduce the indoor concentration with respect to the outdoors, particularly when outdoor sulphur dioxide levels are high.

Table 5. Major types of chemical indoor air contaminant and their concentrations in the urban United Kingdom

Substance/group of substances	**Ratio of concentrations indoors/outdoors**	**Typical urban concentrations**
Sulphur dioxide	~0.5	10-20 ppb
Nitrogen dioxide	≤5-12 (indoor sources)	10-45 ppb
Ozone	0.1-0.3	15-60 ppb
Carbon dioxide	1-10	350 ppm
Carbon monoxide	≤5-11 (indoor source)	0.2-10 ppm
Formaldehyde	≤10	0.003 mg/m^3
Other organic compounds Toluene Benzene m-and p-xylenes	1-50	 5.2 µg/m^3 6.3 µg/m^3 5.6 µg/m^3
Suspended particles	0.5-1 (excluding ETS[a]) 2-10 (including ETS)	50-150 µg/m^3

[a] ETS, environmental tobacco smoke.

Nitrogen oxides are a product of combustion, and major sources include automobile exhaust, fossil fuel-fired electric generating stations and home space heaters. Nitric oxide (NO) is relatively non-toxic but can be oxidized to nitrogen dioxide (NO_2), particularly during episodes of photochemical pollution. Background concentrations of nitrogen dioxide are about 1 ppb but may reach 0.5 ppm in urban areas. The outdoors is the major source of nitrogen dioxide in buildings without unvented fuel appliances. As with sulphur dioxide, adsorption by internal surfaces reduces the concentration indoors compared with that outdoors.

Ozone is produced in the troposphere by photochemical reactions in polluted atmospheres, and its generation is a function of intensity of sunlight and concentration of nitrogen oxides, reactive hydrocarbons and carbon monoxide. At remote sites, background ozone concentrations are 10 to 20 ppb and can exceed 120 ppb in urban areas in summer months. Indoor concentrations are significantly lower due to reaction with indoor surfaces and the lack of strong sources.

Carbon monoxide release as a result of anthropogenic activities is estimated to account for 30% of that present in the atmosphere of the northern hemisphere. Background levels are approximately 0.19 ppm and in urban areas a diurnal pattern of concentrations is related to use of the motor vehicle with peak hourly levels ranging from 3 ppm to 50 to 60 ppm. It is a relatively unreactive substance and so is not depleted by reaction or adsorption on indoor surfaces. Indoor sources such as unvented fuel appliances therefore add to the background level otherwise due to the outdoor air.

The indoor-outdoor relationship of organic compounds is compound-specific and may vary over time. For compounds with strong indoor sources such as formaldehyde, indoor concentrations are usually dominant. For formaldehyde outdoor concentrations are typically below 0.005 mg/m^3 and indoor concentrations are ten times higher than outdoor values. Other compounds such as benzene have strong outdoor sources, petrol-driven vehicles being of particular importance. Indoor sources of benzene include ETS and these result in mean concentrations in buildings in the United Kingdom being 1.3 times higher than those outdoors. The indoor environment appears not to be a significant sink for this compound and it is therefore not protective against benzene from outdoors.

Typical Concentrations in Buildings

Carbon monoxide concentrations in indoor environments commonly range from 1 to 5 ppm. Table 6 summarizes results reported in 25 studies. Concentrations are higher in the presence of environmental tobacco smoke, though it is exceptional for concentrations to exceed 15 ppm.

Table 6. Summary of field measurements of nitrogen oxides (NO^x) and carbon monoxide (CO)

Site	NO_x values (ppb)	CO mean values (ppm)
Offices		
Smoking Control	42-51 —	1.0-2.8 1.2-2.5
Other workplaces		
Smoking Control	ND[a]-82 27	1.4-4.2 1.7-3.5
Transportation		

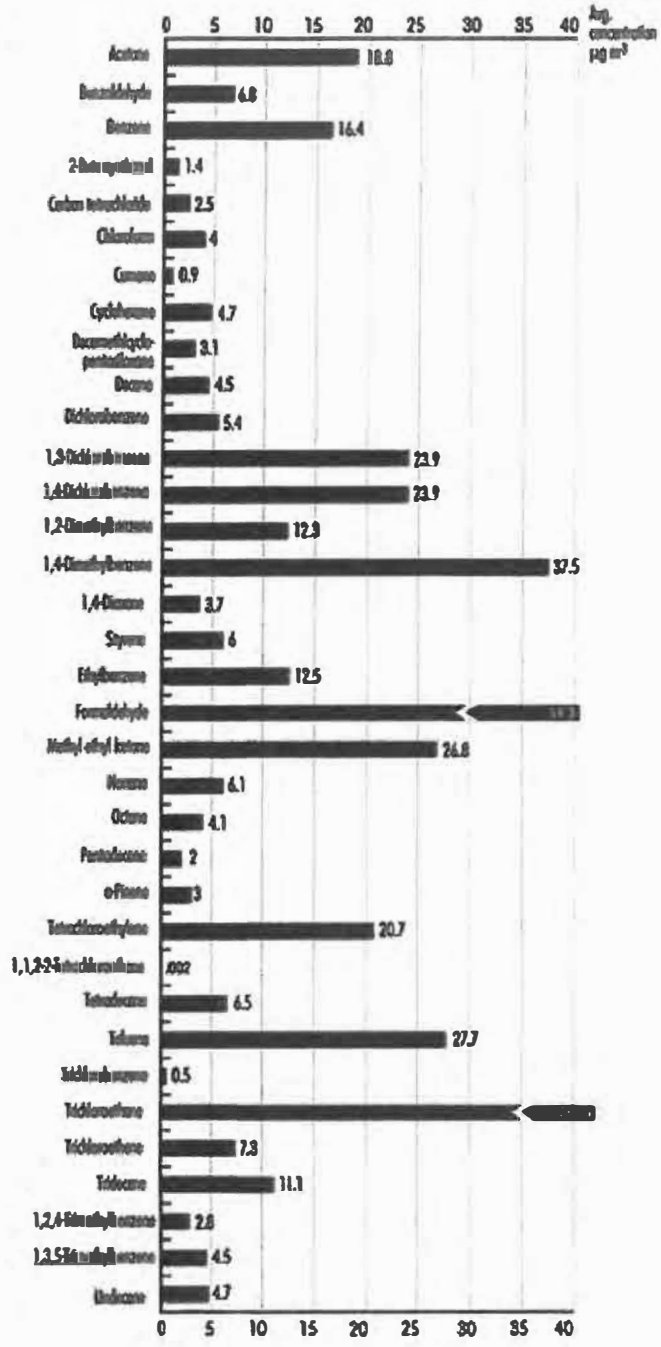
Smoking Control	150-330 —	1.6-33 0-5.9
Restaurants and cafeterias		
Smoking Control	5-120 4-115	1.2-9.9 0.5-7.1
Bars and taverns		
Smoking Control	195 4-115	3-17 ~1-9.2

[a] ND = not detected.

Nitrogen dioxide concentrations indoors are typically 29 to 46 ppb. If particular sources such as gas stoves are present, concentrations may be significantly higher, and smoking can have a measurable effect (see table 6).

Many VOCs are present in the indoor environment at concentrations ranging from approximately 2 to 20 mg/m^3. A US database containing 52,000 records on 71 chemicals in homes, public buildings and offices is summarized in Figure 3. Environments where heavy smoking and/or poor ventilation create high concentrations of ETS can produce VOC concentrations of 50 to 200 mg/m^3. Building materials make a significant contribution to indoor concentrations and new homes are likely to have a greater number of compounds exceeding 100 mg/m^3. Renovation and painting contribute to significantly higher VOC levels. Concentrations of compounds such as ethyl acetate, 1,1,1-trichloroethane and limonene can exceed 20 mg/m^3 during occupant activities, and during residents' absence the concentration of a range of VOCs may decrease by about 50%. Specific cases of elevated concentrations of contaminants due to materials and furnishings being associated with occupant complaints have been described. These include white spirit from injected damp-proof courses, naphthalene from products containing coal tar, ethylhexanol from vinyl flooring and formaldehyde from wood-based products.

Figure 1. Daily indoor concentrations of selected compounds for indoor sites.



The large number of individual VOCs occurring in buildings makes it difficult to detail concentrations for more than selected compounds. The concept of TVOC has been used as a measure of the mixture of compounds present. There is no widely used definition as to the range of compounds that the TVOC represents, but some investigators have proposed that limiting concentrations to below 300 mg/m^3 should minimize complaints by occupants about indoor air quality.

Pesticides used indoors are of relatively low volatility and concentrations occur in the low microgram-per-cubic-meter range. The volatilized compounds can contaminate dust and all indoor surfaces because of their low vapor pressures and tendency to be adsorbed by indoor materials. PAH concentrations in air are also strongly influenced by their distribution between the gas and aerosol phases. Smoking by occupants can have a strong effect on indoor air concentrations. Concentrations of PAHs range typically range from 0.1 to 99 ng/m^3.

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STANDARD OPERATING PROCEDURE

SOP NUMBER: 211

SOP TITLE: Manual Water Level Measurement

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202

REVISION DATE: January 2024

Revision Prepared By: _____

Andrew Tennyson, CHMM
Senior Analyst

Approved By: _____

Dawn Knipe, LPG
Technical Services - Principal

1.0 PURPOSE AND SUMMARY

The following Standard Operating Procedure (SOP) has been developed for Manual Water Level Measurement collection for August Mack Environmental, Inc. (August Mack) field investigation projects. This SOP will be followed by August Mack technical personnel when collecting water level measurements in the field. The procedures are subject to change if unusual or unanticipated field conditions are encountered. Deviations from this SOP must be pre-approved by the Project Manager or other designated project technical lead.

Environmental investigations often require depth to water measurements from monitoring wells. The depth of the static water level from the top of the inner well casing (or protective casing if the well has no inner casing) is measured with an electronic water level indicator or interphase probe.

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3.0 RESPONSIBILITIES

It is the responsibility of the Project Manager to ensure that each project involving Manual Water Level Measurement is properly planned and executed. The Project Manager is also responsible for understanding specific requirements or regulations for

Manual Water Level Measurement and for ensuring the procedures comply with all applicable locate, State, and/or Federal requirements.

The Field Geologist/Scientist is responsible for verifying and documenting that procedures and requirements contained in this SOP are followed. The Field Geologist/Scientist is responsible for ensuring that all work is conducted in a safe and professional manner. The Field Geologist/Scientist implementing this SOP is encouraged to contact the Project Manager if there are any questions on the SOP or the task, as needed.

4.0 DEFINITIONS

Water Level Meter - Equipment used for measuring the depth to water in wells, boreholes, standpipes or tanks. Meters differ in construction by manufacturer, but the standard is a flat Polyvinylidene fluoride (PVDF) tape on a reel, able to measure within 1/100th ft.

Reference Point – The reference point is a point of known elevation as determined by a licensed surveyor. It is usually indicated by a notch or indelible mark. If no reference mark is visible, the reference point is the highest point on the inner casing or the highest point on the outer protective casing if there is no inner casing.

5.0 EQUIPMENT AND SUPPLIES

Equipment and supplies necessary to implement work described in this SOP include the following:

- Personal Protective Equipment (PPE);
- Site control equipment;
- Decontamination equipment;
- Electronic water level meter and probe
- Plastic sheeting
- Paper towels

6.0 RECORDS AND FORMS

The following records and forms used to implement work described in this SOP include the following:

- Site-specific Health and Safety Plan (HASP) (fully executed by the Project Manager, Field/Site Supervisor, and the Environmental Health and Safety Manager)
- Field instructions (provided to field team before/during the kick-off meeting)
- Previous site documentation

- Field notebook
- Monitoring Well Gauging or Purge Sheet

7.0 HEALTH AND SAFETY CONSIDERATIONS

All personnel conducting water level measurements should be qualified in proper safety procedures; have completed 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training; have necessary 8-hour HAZWOPER refresher training; and have current medical monitoring information. Refer to the Site-Specific Health and Safety Plan (HASP), task-specific Activity Hazard Analysis (AHA) for guidelines on safety precautions and proper Personal Protective Equipment (PPE) for implementation, and August Mack Health Standards of Practice for work-related activities.

In addition, the following general Health and Safety requirements should be adhered to while performing water level measurements:

- Wear a clean pair of protective gloves for each measurement event.
- Wear safety glasses to protect the eyes from potential splashing.
- Do not lean directly over the well to prevent equipment (pens, pencil, markers, etc.) from falling into the well.
- Avoid kicking debris (rocks, dirt, etc.) into the well.

8.0 PROCEDURES

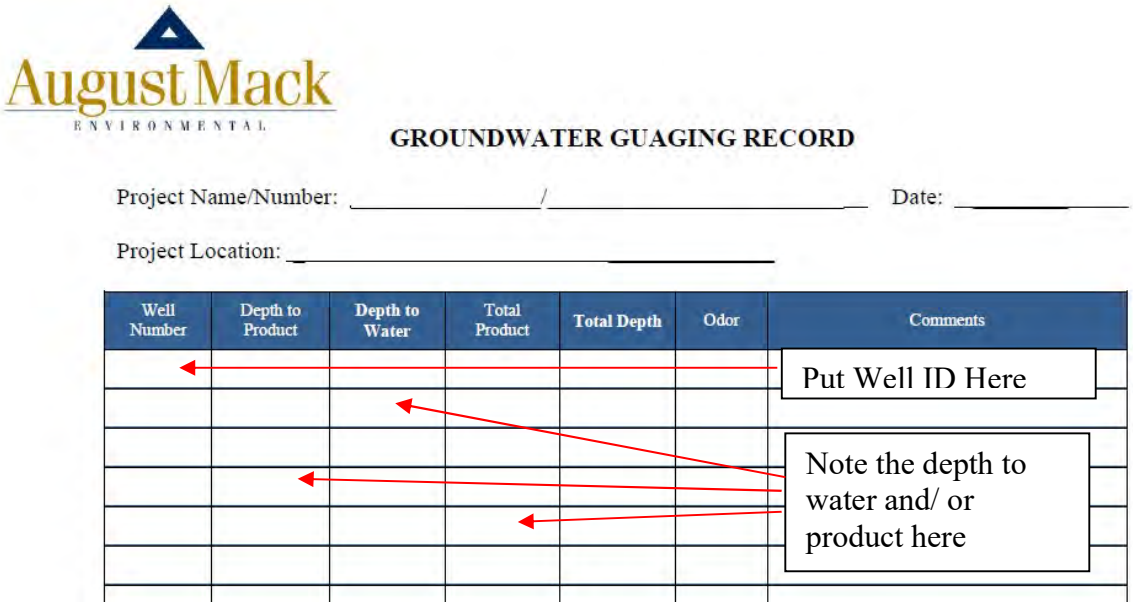
8.1 Pre-Measurement Activities

1. Test the meter prior to leaving the office.
2. Once on site, place a safety barrier (traffic cones, caution tape, etc.) around the work area. Refer to SOP 612 *Work Zone Setup and Site/Traffic Control*.
3. Measurements must be made in all wells in one continuous operation and should be made prior to any disturbance such as sampling.
4. Decontamination procedures should be conducted before and after each measurement. Refer to SOP 613 *Equipment and Personnel Decontamination*.

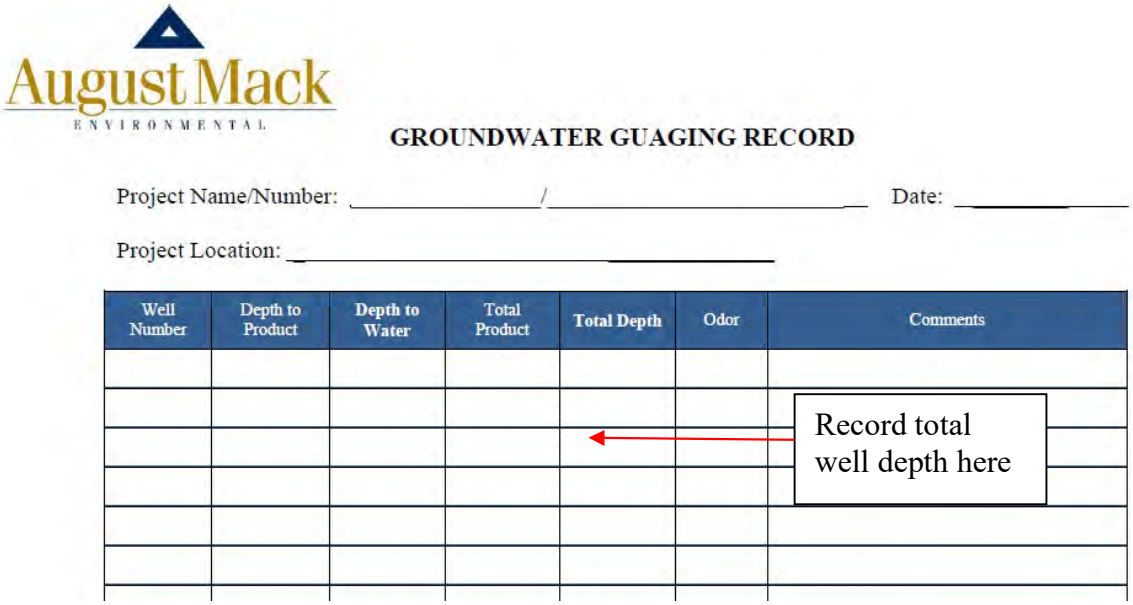
8.2 Water Level Measurement Activities

1. Open the well lid and remove the J-Plug from the top of the well to allow the water level to equilibrate.
2. Select the appropriate reference point on the well. This should be a mark or a notch on the northern point of the well.

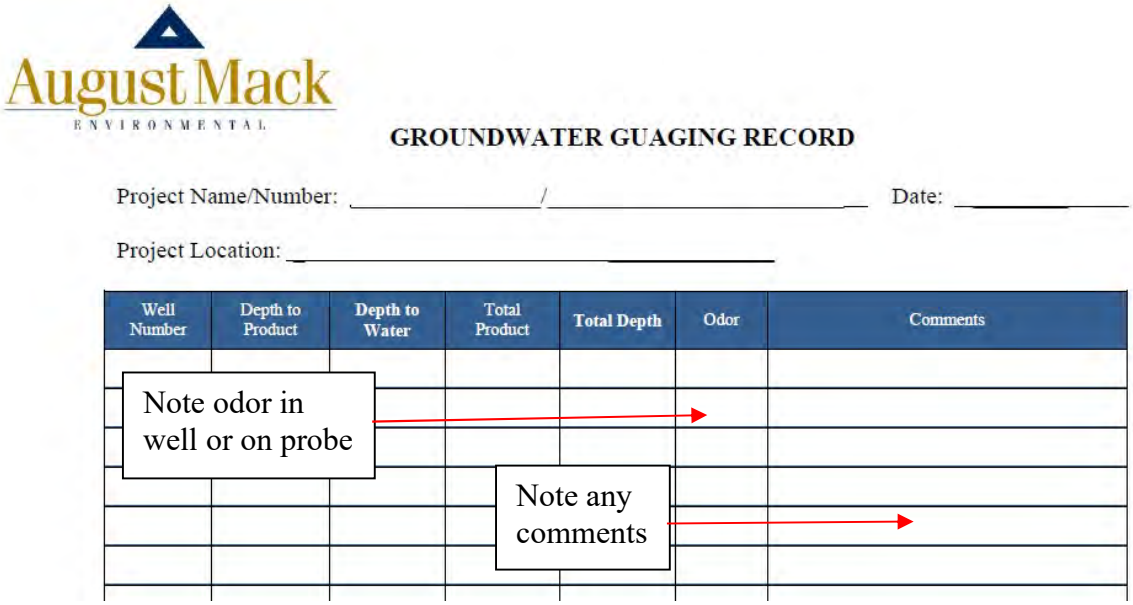
3. Turn on the probe and test by depressing the test button. Adjust the volume of the audible indicator during this step.
4. Lower the probe slowly into the well and listen for the sound of the indicator. The sound becomes audible when the probe contacts the water surface. If it is an interface probe, a solid tone will be audible when the probe contacts product in the well.
5. Pull the probe out of a few inches and, with fingers resting on the reference point, drop the probe in smaller increments. Repeat the withdrawal/lowering procedure until the water level is determined to within ± 0.01 feet. Mark on the gauging sheet the depth to water and/or intervals for product in the well.



6. After determining the water level, the total depth of the well should be measured to determine the amount of water to be purged prior to sampling and as a check on the well's integrity. The total depth will be measured by lowering the depth measuring device until the bottom of the well is felt or measuring tape becomes slack. Slowly lift the tape up until no slack remains while keeping the probe in contact with the bottom of the well. Record the well depth measurement to the nearest ± 0.01 feet.



7. Record the time, date, and all water level measurements in the field logbook and on the purge/sampling or gauging field forms. Note any odors or any comments on the gauging record as well.



8. Withdraw the tape from the well.
9. Decontaminate the probe with the appropriate decontamination solution. It is important that the measuring tape is never placed directly on the ground surface. The decontamination procedure will be performed before collecting water level measurements from the next monitoring well location.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Various aspects of the Water Level Measurement procedures will depend on project-specific objectives and circumstances.

- Inspect equipment and supplies prior to use.
- The Water Level Meter should not appear damaged prior to use.
- Equipment and supplies should be stored in the appropriate manner to ensure no cross-contamination occurs.

10.0 EXCEPTIONS

- Review State regulations prior to implementation of this SOP to ensure procedures comply with local regulatory requirements.

11.0 CROSS-REFERENCES/SOURCES

- August Mack SOP No. 311, *Written Field Documentation*
- August Mack SOP No. 612, *Work Zone Setup and Site/Traffic Control*
- August Mack SOP No. 613, *Equipment and Personnel Decontamination*
- August Mack POL No. 624, *Personal Protective Equipment*
- August Mack POL No. 625, *General Health and Safety Rules and Responsibilities*
- U.S. Geological Survey. (2001). *Introduction to Field Methods for Hydrologic and Environmental Studies.*

12.0 ATTACHMENTS

- Attachment A – Gauging Sheet
- Attachment B – Purging Sheet

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GROUNDWATER GAUGING RECORD

Project Name/Number: _____/_____ Date: _____

Project Location: _____

Well ID	Depth to Product (ft)	Depth to Water (ft)	Total Depth (ft)	Well Sampled (Y/N)	Comments[1]	Purge Record [2] (Y/N)

Drums on-Site

Material	Amount	Comment
SOIL		
WATER		
OTHER		

[1] If free-product is observed, note total amount of product removed in this section
[2] This column is to be completed by Project Coordinator following completion of sampling event

August Mack
ENVIRONMENTAL

GROUNDWATER SAMPLING/PURGE RECORD

Well/Sample Number: _____ Date: _____

Project Name/Number: _____/_____

Project Location: _____

Initial Depth to Water: (ft) _____ Total Well Depth: (ft) _____ Well Diameter: (in) ___

Type of Pump/Sampler: _____

Weather Condition: _____ Temp: (°F) _____ Pump Depth: (ft) _____

				0.1 - 0.4		+/- 3%	+/- 0.1	+/- 10 mV	+/- 3%	+/- 10 %	+/- 10%
Time	Water Level	Pump On	Pump off	Flow Rate	Volume Pumped	Temp	pH	ORP	Spec. Cond.	Turbidity	DO

Sampled/Purged By: _____ Sample Time: _____

Comments: _____

_____ MS/MSD#: ___ DUP#: ___ EB#:____

Well/Sample Number: _____ Date: _____

Project Name/Number: _____

				0.1 - 0.4		+/- 3%	+/- 0.1	+/- 10 mV	+/- 3%	+/- 10 %	+/- 10%	
Time	Water Level	Pump On	Pump off	Flow Rate	Volume Pumped	Temp	pH	ORP	Spec. Cond.	Turbidity	DO	Color/ Clarity

Modified from U.S. EPA Document EPA/600/2-85/104/Sept.198

STANDARD OPERATING PROCEDURES

FOR

MONITORING WELL INSTALLATION

PREPARED BY:

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202



REVISION DATE: APRIL 2013 (ART)

STANDARD OPERATING PROCEDURES
MONITORING WELL INSTALLATION

1.0 INTRODUCTION

The following Standard Operating Procedure (SOP) has been developed for installing groundwater monitoring wells during August Mack field investigation projects. This SOP will be followed by all August Mack technical personnel when installing groundwater monitoring wells unless site specific installation procedures are required and developed by the Project Manager. A detailed discussion of well installation and development procedures can be found in Chapter 6 of the document entitled "RCRA Groundwater Monitoring: Draft Technical Guidance" (USEPA, 1992).

2.0 DEFINITIONS

- **Annulus:** The space between the borehole wall and the outside of the well screen or riser pipe.

- **Filter Pack:** A well graded, clean sand or gravel placed around the well screen to prevent the entry of very fine soil particles.

- **Guard Pipe:** A pipe, usually made of steel, placed around that portion of the well riser pipe that extends above the ground surface. As well as providing security to a well, it may provide a fixed elevation for surveying.

- **Riser Pipe:** The section of unperforated well construction material used to connect the well screen with the ground surface. Usually, the riser pipe is constructed of the same material and has the same diameter as the well screen.

- **Road Box or Manway:** A man-hole set into the ground around a well installation. Usually constructed in areas where the monitoring well cannot extend above the ground surface for traffic or security reasons.

- **Tremie Pipe:** A small diameter pipe which will fit in the annulus and is used to inject filter sand, seal materials, or cement/bentonite grout under pressure.

- **Well Screen:** That portion of the well casing material that is perforated with slots so as to provide a hydraulic connection to the aquifer.

3.0 QUALITY ASSURANCE CONSIDERATIONS

The following aspects of monitoring well design and installation procedures will depend on project-specific objectives and circumstances. If specifically required by a project, this information should be addressed in a Quality Assurance Project Plan (QAPP).

- Construction materials for well screen, riser, filter pack and seals;
- Borehole drilling method;
- Depth and length of screen;
- Location and composition of filter pack and seals; and,
- Well head completion and protection.

Many states and EPA Regions have developed and implemented comprehensive guidelines for monitoring well installation, and for subsurface investigation procedures. These procedures will be followed, as applicable.

4.0 RESPONSIBILITIES

It will be the responsibility of the Project Manager to ensure that each project involving monitoring well installation is properly planned and executed. The Project Manager is also responsible for understanding specific requirements or regulations regarding the construction of groundwater monitoring wells, and to ensure that the well installation procedures comply with all applicable local, state and/or federal requirements.

5.0 SUPPORT MATERIALS

The monitoring well shall consist of a commercially available well screen constructed of PVC, stainless steel, teflon, or fiberglass pipe of an appropriate inside diameter (ID) to meet project objectives, typically one-inch or two-inch ID. The length of the screen and the size of the screen slots will be determined by the Project Manager or specified in the project work plan depending upon the grain-size distribution of the aquifer materials. PVC, stainless steel, teflon, or fiberglass riser pipe of an equal ID to the screen ID will be used to complete the monitoring well to the ground surface. The riser pipe will be of the same construction as the well screen and will be connected by flush-threaded, watertight joints.

The section of the riser pipe that extends above the ground surface will be protected by a steel guard pipe set at least two (2) feet into a concrete surface seal. The top of the guard pipe will have a vented, lockable cap. If a road box is installed, a watertight seal (e.g. Morrison-style locking plug) inside the riser pipe to prevent surface water from entering the monitoring well must be used.

Additional support materials used for monitoring well construction include silica sand, bentonite pellets and powder, cement, and a weighted calibrated tape measure for borehole depth and water level measurements. Monitoring well construction materials will be supplied by the drilling subcontractor.

6.0 INSTALLATION PROCEDURES

- The diameter of the borehole must be a minimum of two (2) inches (preferably 3") greater than the outside diameter of the well screen or riser pipe used to construct the well. This is necessary so that sufficient annular space is available to install filter packs, bentonite seals, and grout seals.

- Once the drilling and soil sampling activities have been completed, the borehole will be checked for total open depth with a weighted, calibrated tape measure. Record borehole depth measurement in the field logbook.

- Review the boring logs and select the saturated zone to be monitored.

- Determine well screen depth and total depth of well.

- If the borehole is deeper than the desired well depth, raise the hollow stem augers and place inert material (i.e. natural material, bentonite, grout, etc.) in the borehole until the desired well depth is obtained. Do not place potentially contaminated soil cuttings back into the borehole. Contaminated soil cuttings should be properly containerized in 55-gallon capacity drums for later disposal.

- Connect the flush threaded well screen to the riser pipe as needed to achieve proper screen length and well depth.

- Place caps on bottom and top of well string.

- Lower the casing string through the hollow-stem auger until it reaches the desired depth.

- Install the sand pack.

  - Place coarse, washed sand around the well screen by pouring it slowly through the hollow stem auger. Ensure that bridging of the sand does not occur in the borehole by checking open annulus depth at regular intervals.
  - Continually measure the depth to the sand pack using a weighted measuring tape.
  - Slowly remove the hollow-stem augers as the annular space fills with sand.
  - Continue this process until the sand pack extends 2 feet above the screened interval. Record depth to top of sand.

- Install the bentonite seal
  - Remove the hollow-stem auger to a depth of approximately 1.5 feet above the top of the sand pack.
  - Place the bentonite pellets or chips above the sand pack by pouring it slowly through the hollow-stem auger.
  - Continually measure the depth to the bentonite seal using a weighted measuring tape.
  - Continue this process until the bentonite seal extends 1 foot (preferably 2 feet) above the sand pack.

- Add approximately five (5) gallons of clean water to the bentonite.

- Allow the bentonite to hydrate for approximately 15 minutes.

- Fill the remaining annular space with grout.
  - Prepare cement/bentonite grout mixture by using Portland cement and 5% bentonite powder.
  - Place the grout in the remaining annular space using a tremie pipe.
  - Allow the grout to settle for one (1) hour and add more grout if needed to fill the remaining annular space.

- Install well cover (flush mounted manhole cover or above grade pro cover).
  - Place the well cover over the well top.
  - Place concrete around the base of the cover.
  - Slope concrete surface away from the well.
  - Cut the riser pipe approximately two (2) to three (3) inches below opening of manhole or protective cover.

- Measure the depth to water and total depth of well.

- Calculate the volume of water within the monitoring well.

- Develop the well.

- Remove water from monitoring well either by pumping or bailing until the water appears clear. For a UST site, a minimum of at least five (5) well volumes is usually sufficient. For RCRA and Superfund sites, a more aggressive development program is typically required. Refer to pages 6 through 46 of the RCRA guidance manual on monitoring well installation procedures.

- Install a locking well cap and lock on the well.

- Schedule a licensed land surveyor to determine the well top elevations. The surveyor will permanently mark the elevation reference point on each well.

7.0 QUALITY CONTROL CHECKS

- The borehole will be checked for total open depth, and extended by further drilling or shortened with a grout plug, if necessary, before any well construction materials are placed.

- Water levels will be repeatedly checked during well installation to ensure that the position of the well screen, sand pack and seal, relative to water level, conform to project requirements.

- The depth to the top of each layer of packing (i.e. sand, bentonite, grout, etc.) will be verified and adjusted if necessary to conform to the requirements of the project before the next layer is placed.

8.0 DOCUMENTATION

During the installation of groundwater monitoring wells, a series of measurements shall be taken and recorded in the field log book. These measurements will include:

- Well name/number
- Date/time of well installation
- Length of well screen
- Length of riser pipe
- Total depth of well
- Depth to stabilized water level
- Borehole diameter
- Screened interval
- Filter pack, bentonite, and grout volumes

Additional data to be documented shall include well screen and riser pipe materials, diameters of the respective components, screen slot size, type and thickness of the sand pack, thickness and different types of grouting materials. Elevation of the top of the guard pipe, established measuring point, and ground surface after surveying is complete shall also be documented.

All data shall also be recorded on a groundwater monitoring well construction diagram for inclusion into the final report and all monitoring well locations will be referenced on an appropriate site plan.

STANDARD OPERATING PROCEDURE

SOP NUMBER: 616

SOP TITLE: EQUIPMENT DECONTAMINATION

August Mack Environmental, Inc.
1302 North Meridian Street, Suite 300
Indianapolis, Indiana 46202

REVISION DATE: January 2020

Revision Prepared By: _____
Andrew Tennyson, CHMM
Senior Analyst

Approved By: _____
Greg Utz, CSPC
Health & Safety Manager

1.0 PURPOSE AND SUMMARY

The following Standard Operating Procedure (SOP) has been developed to guide equipment decontamination procedures during August Mack Environmental, Inc. (August Mack) field investigation projects. This SOP shall be followed by August Mack technical personnel when performing investigative work requiring decontamination procedures. The procedures are subject to change if unusual or unanticipated field conditions are encountered. Deviations from this SOP must be pre-approved by the Project Manager or other designated project technical lead.

Decontamination is the process of removing and/or neutralizing contaminants that may have accumulated on site workers and equipment. Decontamination has three primary purposes:

- Ensuring that compounds or contaminants which have been detected through laboratory analysis are in fact native to the sample.
- Minimizing the exposure of sampling personnel to hazardous materials.
- Preventing the introduction of new contaminants to a sampling location or prevent the inadvertent transfer of contaminants off site.

Decontamination protects workers from hazardous substances that may contaminate and permeate protective clothing, respirators, tools, vehicles, and other equipment used on-site. It protects site personnel by minimizing the transfer of harmful materials into clean areas. It helps prevent mixing of incompatible chemicals. Finally, it protects the community by preventing uncontrolled transportation of contaminants from the site.

To prevent the transfer of hazardous materials into clean areas, contamination reduction and decontamination procedures are developed and implemented. These procedures will be in effect before site workers enter a contaminated site and will continue throughout operations. Proper planning for equipment decontamination can result in increased efficiency of the job, quality samples, and decreased potential for contaminants leaving the job site. Prior to performing environmental field projects, it is essential that the level of decontamination required be understood by site personnel, as well as contractors or others on the job site. Additionally, the anticipated equipment required for decontamination must be discussed prior to mobilizing to the project site.

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2.0 Table of Contents
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5.0 Equipment and Supplies

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8.0 Procedures
8.1 Instrument and Sensitive Equipment Decontamination
8.2 Decontamination Pad Specifications
8.3 Decontamination of Hand Augers, Manual Soil Samplers, and Sediment Samplers
8.4 Decontamination of Water Level Indicators and Purge Pumps (Purging Only)
8.5 Decontamination of Low-Flow Groundwater Sampling Pumps
8.6 Direct-Push Soil and Groundwater Sampling Equipment
8.7 Hollow-Stem Augers, Rotary and Rotosonic Drilling Equipment
8.8 Drill Rig and Heavy Equipment Decontamination Procedures
9.0 Quality Assurance/Quality Control
10.0 Documentation Summary
11.0 Exceptions
12.0 Cross References/Sources

3.0 RESPONSIBILITIES

It is the responsibility of the Project Manager to establish a decontamination plan that satisfies the objectives of the project and to disseminate the information to the project team.

It is the responsibility of the August Mack Corporate Health & Safety Manager to design and implement appropriate safety procedures which provide adequate protection for on-site personnel directly involved with sampling and/or decontamination.

It is the responsibility of all on-site personnel involved with decontamination activities to adhere to the procedures outlined in this SOP and in project specific sampling plans. The field team members are responsible for maintaining safe and clean working environment and to ensure that contaminants are not negligently transferred off-site due to our work activities. The field team shall ensure that proper decontamination procedures are followed and that all generated waste is properly containerized and disposed.

It will be the responsibility of August Mack subcontractors to follow the proper, designated decontamination precedes as outlined in the site-specific HASP and/or project sampling plan. However, it is the responsibility of the August Mack field team members to ensure that these procedures are followed by the subcontractor.

4.0 DEFINITIONS

Contamination Reduction Zone (CRZ): The CRZ (or warm zone) is the transition area between the exclusion and support zones. This area is where responders enter and exit the exclusion zone and where decontamination activities take place.

Decontamination: The process of removing and/or neutralizing contaminants that may have accumulated on-site workers and equipment.

Deionized (DI) Water: Tap water that has been passed through a standard deionizing resin column, for example a 5-micron pre-filter followed by a mixed bed deionization unit. Deionized water should contain no heavy metals or other inorganic compounds at or greater than analytical detection limits. Deionized water can be obtained from environmental laboratories and environmental supply companies.

Distilled Water: Water that has been freed of dissolved and suspended solids and from organisms by distillation.

Detergent: Detergent shall be a standard brand of phosphate-free detergent, such as Liquinox® or Luminox®.

Exclusion Zone (EZ): The exclusion zone (aka "hot zone") is the area with actual or potential contamination and the highest potential for exposure to hazardous substances.

Health and Safety Plan (HASP): A plan that outlines procedures necessary to perform work in a manner that is protective of employee safety and outlines project-specific nuances to be communicated to on site workers.

Solvents: A chemical or material used to dissolve other chemicals or materials.

Support Zone (SZ): The support zone (or cold zone) is the area of the site that is free from contamination and that may be safely used as a planning and staging area.

Tap Water: Tap water is water from any potable water supply. Deionized water or distilled water may be substituted for tap water.

5.0 EQUIPMENT AND SUPPLIES

Equipment and supplies necessary to implement work described in this SOP may include some or all of the following depending on project-specific needs:

- Personal Protective Equipment (PPE) as specified in the project-specific HASP;
- Project-specific site control equipment;

- Decontamination solutions may include Liquinox, Alconox, tap water, distilled or deionized water, nitric acid, or reagent grade solvents such as methanol, isopropanol or acetone. Specific solutions to be used for decontamination will depend upon the contaminant of concern and project requirements.
- High pressure water or steam generator.
- Plastic sheeting, sealed pads with drains, or other appropriate methods for containing and collecting contaminated wash and rinse solutions spilled during decontamination.
- Drop cloths of plastic or other suitable materials on which heavily contaminated equipment and outer protective clothing may be deposited
- Collection containers, such as drums or suitably lined trash cans, for storing disposable clothing and heavily contaminated personal protective clothing or equipment that must be discarded.
- Large galvanized tubs, stock tanks, or children's wading pools to hold wash and rinse solutions. These should be at least large enough for a worker to place a booted foot in and should have either no drain or a drain connected to a collection tank or appropriate treatment system.
- Lined box with absorbents for wiping or rinsing off gross contaminants and liquid contaminants.
- Rinse solutions (tap water and/or deionized water) selected to wash off and reduce the hazards associated with the contaminants.
- Brushes to help wash and rinse off contaminants (ideally long-handled and soft bristled).
- Pressurized spray-containers containing wash and/or rinse solutions.
- Paper or cloth towels for drying protective clothing and equipment.
- Lockers, cabinets, or bins for storage of decontaminated clothing and equipment.
- Lockers or closets for clean clothing and personal item storage.
- Metal or plastic cans or drums for contaminated wash and rinse solutions.
- Shower facilities for full body wash or, at a minimum, personal wash sinks (with drains connected to a collection tank or appropriate treatment system).
- Face shield(s)
- Poly coated Tyvek suit(s)
- Rubber boots
- Nitrile gloves

6.0 RECORDS AND FORMS

The following records and forms used to implement work described in this SOP include the following:

- Site-specific HASP (fully executed by the Project Manager, Field/Site Supervisor, and the Environmental Health and Safety Manager)
- Field instructions (provided to field team during the kick-off meeting)

- Field notebook

7.0 HEALTH AND SAFETY CONSIDERATIONS

Decontamination procedures may involve chemical exposure hazards associated with the environmental medium being investigated and may involve physical hazards associated with decontamination equipment. When decontamination is performed on equipment which has been in contact with hazardous materials or when the quality assurance objectives of the project require decontamination with solvents, the measures necessary to protect on-site personnel will be addressed in the site-specific HASP. The project specific HASP shall be reviewed and approved by the August Mack Corporate Health & Safety Manager before any work activities begin. These procedures shall be adhered to by field personnel.

Decontamination procedures should be developed (as part of the site-specific HASP) and set up before any personnel or equipment may enter areas where the potential for exposure to hazardous substances exists. Work zones must be established, and decontamination must proceed in the Contaminant Reduction Zone. Proper personnel and equipment decontamination will eliminate the potential spread of any contaminants from the Exclusion Zone and Contaminant Reduction Zone to the Support Zone immediately outside of the work area.

Site-specific decontamination procedures for HASP's should include the following items:

- The number and layout of decontamination stations.
- Decontamination equipment needed.
- Decontamination methods.
- Procedures to prevent contamination of clean areas.
- Methods and procedures to minimize worker contact with contaminants during removal of PPE.
- Methods for disposing of clothing and equipment that is not completely decontaminated.

These procedures should be revised whenever the type of personal protective clothing or equipment changes, the site conditions change, or the site hazards are reassessed based on new information.

It is important to understand the specific scope of work and contaminants potentially encountered in order to develop the optimal decontamination procedures. For larger projects or projects that have existing Field Sampling Plans, Quality Assurance Project Plans (QAPPs), or other Work Plans, be sure to carefully review the required decontamination procedures. Some programs or projects may require decontamination

using special solvents for rinsing, such as methanol, hexane, or dilute acids. These require special handling considerations and disposal considerations.

Other precautionary measures can help minimize and reduce the degree of contamination during site activities, such as:

- Following SOPs and Job Hazard Analyses (JHAs) to minimize contact with hazardous materials.
- Not walking through puddles, plumes, or other areas of obvious surface contamination.
- Proper disposal of equipment and solvents used for decontamination.
- Not directly touching potentially hazardous materials.
- Covering air monitoring and field sampling equipment with plastic sheeting which can be easily decontaminated.
- Donning disposable outer garments and using disposable equipment where appropriate.
- Containing the source of the contamination.

All personnel conducting decontamination activities should be qualified in proper safety procedures; have completed 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training; have necessary 8-hour HAZWOPER refresher training; and have current medical monitoring information. Refer to the Site-Specific HASP, task-specific Activity Hazard Analysis (AHA) for guidelines on safety precautions and proper PPE for implementation.

8.0 PROCEDURES

Decontamination procedures will be followed by site personnel exiting the Exclusion Zone as defined in the site-specific HASP and the Site Control SOP. Under no circumstances (except emergency evacuation) should equipment be allowed to leave the site without decontamination.

Following is a description of decontamination procedures for various field projects. These are generalized procedures and may need to be modified based on site conditions and contaminants. These projects include:

- Soil sampling using hand-operated sampling equipment (hand augers, AMS soil samplers, sediment samplers, etc.);
- Soil and groundwater investigations using a Geoprobe or other direct-push equipment;
- Installation of wells using hollow-stem, rotary, or rotosonic techniques;
- Soil excavations; remediation system installation;
- Demolition projects; and,
- And groundwater sampling.

A description of the decontamination procedures for each of these project types is provided in the following sections. More detailed information regarding decontamination of PPE can be found in *SOP 613: Decontamination Procedures – Modified Level D PPE* and *SOP 615: Decontamination Procedures – Level C PPE.*

8.1 Instrument and Sensitive Equipment Decontamination

Delicate and sensitive sampling and monitoring equipment and instruments are very difficult to clean without damaging once contaminated. Sampling equipment or instruments taken into the EZ must be protected as much as possible from contamination by draping, masking, or otherwise covering as many of the instruments as possible with plastic, without hindering operation of the unit.

Contaminated sampling or monitoring equipment will be taken from the segregated drop area and the protective coverings removed and disposed in appropriately labeled containers. The instruments will then be placed in a clean plastic tub or container, wet wiped twice with moistened disposable wipes and dried. A small amount of soapy water on a paper towel can also be used to clean dirt, debris, or other contamination from instruments or sampling devices. The units will be checked, calibrated, and recharged as necessary for the next day's operations.

8.2 Decontamination Pad Specifications

Prior to conducting any field sampling activities, an equipment decontamination pad must be established. In some cases, such as when conducting hand sampling using a bucket auger or groundwater sampling, the decontamination pad will be moved from location to location. In other cases, such as larger drilling projects and remediation projects, a central decontamination pad will be established. Regardless of size, the decontamination pad constructed for field cleaning of sampling, drilling, and remediation equipment should meet the following specifications.

- The pad should be constructed in an area free of known contamination.
- The pad should not leak.
- Temporary pads should be composed of single pieces of impermeable material like polyethylene/plastic sheeting (visqueen). There should be no seams in the sheeting, and it should be of sufficient thickness so as not to tear during routine decontamination activities.
- The pad should be placed on a level or nearly level paved surface and should facilitate the removal of water. The latter can be accomplished by constructing one corner of the pad slightly lower than the others or by creating a pit or sump. Any pit or sump must be lined.
- Sawhorses, racks, or large tubs or troughs should be used to elevate equipment, particularly larger drilling equipment, to prevent it from being splashed.

- Water should be removed from the pad frequently.
- The pad should be of sufficient size so as to collect any overspray during equipment decontamination. For decontaminating hollow-stem augers, larger drill rods, and heavy equipment, the decontamination area should have a backsplash and sidewalls to help prevent any overspray.

8.3 Decontamination of Hand Augers, Manual Soil Samplers, and Sediment Samplers

- Set-up small decontamination pad using plastic sheeting. Fold and tape edges to create a small berm around outside of plastic.
- Place decontamination buckets or pails on the plastic.
- One bucket should contain a solution of Liquinox and tap water.
- Second bucket should contain tap water for the initial rinse.
- Third bucket should contain deionized water. An alternative to the third bucket, the deionized water can be put into squeeze bottles or pressure sprayers and poured and sprayed over the equipment. This should be conducted over the tap water rinse bucket so that fluids are contained.
- Decontaminate sampling equipment by washing with brushes with a liquinox and tap water solution.
- Rinse thoroughly with tap water.
- Rinse thoroughly with deionized water.
    - In situations where laboratory provided DI water is not available, distilled water can be substituted as the final rinse solution if approved by the Project Manager.
- Equipment must then be carefully stored so as not to re-contaminate in transport to the next sampling location. Consider temporarily staging on dedicated plastic sheeting or wrapping in foil.

8.4 Decontamination of Water Level Indicators and Purge Pumps (Purging Only)

Water level indicators and well purge pumps should be thoroughly decontaminated and properly stored between each well. Unless warranted, it is only necessary to decontaminate the wetted portion of the tape/pump leads.

- Set-up small decontamination pad using plastic sheeting. Fold and tape edges to create a small berm around outside of plastic.
- When reeling in the tape/pump, use a towel soaked in the soapy water to remove potential contaminants.
- Wash wetted portion of tape/pump and leads into solution of Liquinox and tap water.
- Rinse with tap water.
- Rinse with deionized water.
- Store in clean case or container.

8.5 Decontamination of Low-Flow Groundwater Sampling Pumps

Low-flow groundwater sampling pumps should be decontaminated between each sampling location. Due to the very low detection levels of many of the constituents that are routinely analyzed, there is great potential for cross-contamination between wells if decontamination procedures are not strictly followed. This procedure can be tailored to suit various sampling pumps.

- Set-up small decontamination pad using plastic sheeting. Fold and tape edges to create a small berm around outside of plastic.
- Place decontamination buckets or pails on the plastic.
- One bucket should contain approximately 1-2 liters of Liquinox and tap water solution.
- Second bucket should contain approximately 1-2 liters of tap water for the initial rinse.
- Third bucket should contain 1-2 liters of deionized water.
- Fourth bucket should be used to collect final deionized water rinse.
- Upon retrieval of the sample pump, remove and discard tubing, and remove any check valves and properly decontaminate.
- Disassemble the pump and wash pump and components in Liquinox/tap water solution using soft bristle brushes.
    - If the pump cannot be easily taken apart in the field, submerge the pump and wetted portions of the leads in the Liquinox/tap water solution circulate water through the impellers/lifting mechanism either manually or by activating the pump.
- Rinse thoroughly with tap water; circulate pump as necessary.
- Rinse again (second rinse) with tap water; circulate pump, as necessary.
- Perform third rinse using deionized water.
- Place pump in clean plastic bag for transport to next sampling location.

8.6 Direct-Push Soil and Groundwater Sampling Equipment

Direct-push sampling equipment including drill rods, core barrel samplers, dual-tubes, piston samplers, shoes, and groundwater screen point samplers and sheath, should be thoroughly decontaminated in the field between each boring location. For most Geoprobe projects, the decontamination pad should be established at each boring location, unless the driller has sufficient tooling and the decontamination area can be secured.

- Set-up small decontamination pad using plastic sheeting. Fold and tape edges to create a small berm around outside of plastic.
- Place decontamination buckets or pails on the plastic.
- One bucket should contain a solution of Liquinox and tap water.
- Second bucket should contain tap water for the initial rinse.\
- Third bucket should contain deionized water. An alternative to the third bucket, the deionized water can be put into squeeze bottles or pressure sprayers and poured and sprayed over the equipment. This should be conducted over the tap water rinse bucket so that fluids are contained.

- Have satisfactory brushes and sprayers to effectively clean the inside of 4-5 ft drilling rods and samplers.
- Decontaminated drilling rods and samplers should be placed on clean tool rack or on clean plastic in an uncontaminated area following decontamination.
- Be prepared to decontaminate portions of the drill rig that are potentially coming into contact with contaminated media. This typically includes the "feet" of the Geoprobe rig. Decontaminate by wiping down, and if necessary, using brushes and detergent and water, or steam cleaner

8.7 Hollow-Stem Augers, Rotary and Rotosonic Drilling Equipment

Due to the larger scale of the decontamination effort for the larger equipment, a decontamination area should be established in a designated area. The pad should meet the specification identified in Section 8.2, and should include a suitable backsplash and sidewalls to effectively prevent overspray from leaving the decontamination area.

- Inspect all drilling equipment entering the work site. Look for oil/grease, mud, debris, or significant rust.
- Identify a location and set-up decontamination pad. There should be sufficiently thick plastic for the base to prevent tearing, and a plastic sidewalls and backsplash. A horse trough or similar tub containing a rack should be used to place the augers/drilling rods during decontamination.
- Make sure there is an adequate supply of water. This should be evaluated prior to mobilizing to the Site.
- Remove significant rust or paint from the augers and equipment. All drilling equipment coming onto the job site is assumed to be dirty and must be decontaminated prior to starting drilling activities.
- Decontamination of the augers and drilling rods can be conducted using either scrub brushes or detergent solution (e.g., Liquinox and tap water, or other approved cleaning solution), or hot-pressure washer with detergent. The inside and the outside of augers, bits, and drilling rods must be cleaned.
- Following washing, the augers/drill rods and other equipment must be rinsed with tap water.
- The decontaminated drilling equipment must be placed on clean auger/drill rod rack or on plastic and secured.

8.8 Drill Rig and Heavy Equipment Decontamination Procedures

Portions of the drill rig or heavy equipment that is coming into direct contact with potentially contaminated media (e.g., kelly and mast, drilling platform, backhoe/excavator buckets or arms, etc.) must be decontaminated between locations.

- The decontamination pad should be large enough and constructed so that the back of the drill rig or excavator can be effectively decontaminated.
- Any significant particulate contaminant on the equipment will be manually removed by scraping, brushing, or other means.

- Once large material is removed, decontamination of drill rigs and heavy equipment must be conducted by brushing/wiping using detergent followed by a tap water rinse, or using a hot pressure washer with detergent and rinsing with tap water.
- All decontamination water will be contained and disposed of in an appropriate manner.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Depending on project specific objectives and requirements, decontamination quality control checks may be necessary. Quality control checks will be determined on a project specific basis and will be outlined in the project sampling plan. Quality control checks for decontamination procedures may consist of collecting and analyzing the following:

- Decontamination Rinsate Blanks
- Equipment Blanks
- Trip Blanks

These types of quality control procedures are necessary to ensure that cross-contamination of sampling equipment and/or environmental media samples does not occur in the field and that proper decontamination procedures have been developed and adequately performed by the project team.

If required, specific procedures for collecting these types of quality control samples pertaining to equipment decontamination will be outlined in the project specific sampling plan.

10.0 DOCUMENTATION SUMMARY

Accurate documentation of decontamination will be accomplished by the completion of the following tasks:

- Field logbook entries
    - Date, time and location of each decontamination event
    - Equipment decontaminated
    - Method of decontamination
    - Decontamination solutions
    - Identification of field blanks and decontamination rinsates, if collected
    - Method of blank and rinsate collection, if required
    - Date, time and location of blank and rinsate collection, if collected
- Chain-of-custody forms
    - Equipment blanks and rinsates will be labeled as samples, if required
    - Instructions for lab analyses of blanks and rinsates, if required

11.0 EXCEPTIONS

- Review State and local agency regulations prior to implementation of this SOP to ensure procedures comply with local regulatory requirements.
- For projects where solvents are deemed necessary to decontamination, pesticide-grade isopropanol or other solvents should be used. Pesticide-grade acetone or methanol is acceptable. However, it should be noted that if pesticide-grade isopropanol or acetone is used, the detection of acetone in samples collected with solvent rinsed equipment is considered suspect. Pesticide-grade methanol is much more hazardous to use than either pesticide-grade acetone or isopropanol, therefore its use is discouraged. Solvents used to clean equipment cannot be reused.

12.0 CROSS-REFERENCES/SOURCES

- August Mack SOP No. 612, *Work Zone Setup and Site / Traffic Control*
- August Mack SOP No. 613, *Decontamination Procedures –Modified Level D PPE*
- August Mack SOP No. 615, *Decontamination Procedures –Level C PPE*
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities;* National Institute for Occupational Safety and Health (NIOSH) Occupational Safety and Health Administration (OSHA) U.S. Coast Guard (USCG) U.S. Environmental Protection Agency (EPA), October 1985.
- The Field Branches Quality System and Technical Procedures: Field Equipment Cleaning and Decontamination; U.S. EPA Region 4, SESD Operating Procedure SESDPROC-205-R2, December 2011, 17 p.

ATTACHMENT G

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

MATERIAL SCIENCES CORPORATION
460 WEST MAIN STREET
CANFIELD, OHIO
OEPA NUMBER: OHD000810283

PROJECT NUMBER: JZ0412.372

SUBMITTED TO:

Ohio Environmental Protection Agency
Northeast District Office
2110 East Aurora Road
Twinsburg, OH 44087

ON BEHALF OF:

Material Sciences Corporation
460 West Main Street
Canfield, Ohio

PREPARED BY:

August Mack Environmental, Inc.
7830 North Central Drive, Suite B
Lewis Center, OH 43035

ISSUE DATE:

SEPTEMBER 2025
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Document Approval Page

Quality Assurance Project Plan

Site Name:	Material Sciences Corporation
Site Location:	Canfield, Ohio
Regulatory Oversight:	Ohio Environmental Protection Agency
Regulatory Program:	RCRA
Site ID Number:	OHD000810283
Project Phase:	RCRA Facility Investigation
Prepared By:	**August Mack Environmental, Inc.**
Version Number:	**Version 1.0**
Version Date:	**May 2025**

Project Team Approvals:

Brandon Lewis, CHMM
August Mack Environmental, Inc.
Regional Director

Jim Wegener, CHMM
Environmental Field Services
Field Operations Manager

Andrew Tennyson, CHMM
August Mack Environmental, Inc.
Senior Analyst

Dorothy J. Leeson
Eurofins Cleveland
Quality Assurance Manager

ACRONYMS

AES ..... Atomic Emission Spectroscopy
AHAs ..... Activity Hazards Analyses
AOC ..... Area of Concern
ASTM ..... American Society for Testing and Materials
AME ..... August Mack Environmental, Inc.
BR ..... Blank Results
CA ..... Corrective Action
CFR ..... Code of Federal Regulations
CHMM ..... Certified Hazardous Materials Manager
CLC ..... Common Laboratory Contaminant
CLP ..... Contract Laboratory Program
CN ..... Cyanide
COCs ..... Contaminants of Concern
COPC ..... Constituents of Potential Concern
DC SLs ..... Direct Contact Screening Levels
DFFO ..... Director's Final Findings and Orders
DOT ..... Department of Transportation
DQA ..... Data Quality Assessment
DQI ..... Data Quality Indicator
DQO ..... Data Quality Objective
EB ..... Equipment Blank
ECD ..... Electron Capture Detector
EDD ..... Electronic Data Deliverable
GC ..... Gas Chromatograph
GC/MS ..... Gas Chromatograph / Mass Spectrometer
GW ..... Groundwater
HASP ..... Health and Safety Plan
HAZWOPER ..... Hazardous Waste Operations and Emergency Response
ICP ..... Inductively Coupled Plasma
IDW ..... Investigation Derived Waste
LCS ..... Laboratory Control Sample
LPG ..... Licensed Professional Geologist
MB ..... Method Blank
MCL ..... Maximum Contaminant Level
MDL ..... Method Detection Limit
MSC ..... Material Sciences Corporation
MS/MSD ..... Matrix Spike/Matrix Spike Duplicate
MW ..... Monitoring Well
NELAP ..... National Environmental Laboratory Accreditation Program
NFGs ..... U.S. EPA National Functional Guidelines for Inorganic/Organic Data Review
NJDEP ..... New Jersey Department of Environmental Protection

NOV ..... Notice of Violation
Ohio EPA ..... Ohio Environmental Protection Agency
OSHA ..... Occupational Safety and Health Administration
PA ..... Preliminary Assessment
PAH ..... Polycyclic Aromatic Hydrocarbons
PC ..... Potential Contaminant
PDF ..... Portable Document Format
PE ..... Professional Engineer
PID ..... Photoionization Detector
PPE ..... Personal Protective Equipment
PQOs ..... Project Quality Objectives
QA ..... Quality Assurance
QAM ..... Quality Assurance Manual
QAPP ..... Quality Assurance Project Plan
QC ..... Quality Control
QMS ..... Quality Management System
%R ..... Percent Recovery
RB ..... Rinsate Blank
RCRA ..... Resource Conservation and Recovery Act
RL ..... Reporting Limit
RPD ..... Relative Percent Difference
RSL ..... Regional Screening Level
SA ..... Senior Analyst
SAF ..... Sample Acknowledgement Forms
SAP ..... Sampling and Analysis Plan
SB ..... Soil Boring
SD ..... Standard Deviation
SDG ..... Sample Delivery Group
SLs ..... Screening Levels
SOP ..... Standard Operating Procedure
SR ..... Sample Results
SRMs ..... Standard Reference Materials
TBs ..... Trip Blanks
TCLP ..... Toxicity Characteristic Leaching Procedure
THQ ..... Target Hazard Quotient
TR (or TCR) ..... Target Cancer Risk
U.S. EPA ..... United States Environmental Protection Agency
VIGWSLs ..... Vapor Intrusion Groundwater Screening Levels
VOA ..... Volatile Organic Analysis
VOC ..... Volatile Organic Compound
WAD ..... Weak Acid Dissociable
WP ..... Work Plan

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1. INTRODUCTION

Facilities generating data, gathering information and/or evaluating, analyzing, or assessing such data has the responsibility to implement minimum procedures to assure that the precision, accuracy, completeness, and representativeness of its activities are known and documented. To ensure the responsibility is met uniformly, each party must prepare a written QAPP covering each project it is to perform.

This QAPP documents planning, implementation, and assessment of technical and quality aspects of the project, generally conforming with the March 2002 U.S. EPA QAPP guidelines (U.S. EPA, 2002) and the *Uniform Federal Policy for QAPPs* (IDQTF, 2005). Project specific procedures of QA/QC activities that will be applied during investigation and remediation activities are outlined throughout this document. Descriptions of project management, project information generation and acquisition, assessment and oversight, and data verification, validation and usability are detailed within this QAPP.

QA/QC procedures will be in accordance with applicable professional technical standards, regulatory requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared by AME in general accordance with the State and Federal guidance documents listed in the reference section of this document.

This QAPP is prepared in addition to a Site-specific HASP or AHAs that specifically address health and safety aspects of the work activities and are therefore not covered within this QAPP.

2. PROJECT MANAGEMENT AND OBJECTIVES

2.1 Distribution List

Name	Title
Christopher Biro	Project Manager, Ohio Environmental Protection Agency
Material Sciences Corporation Contact: Mike Cocanig	Chief Operating Officer
Ice Miller, LLP Contact: Terri Czajka	Legal Counsel
Brandon Lewis AME	Project Director
Bryant Hoffer AME	Senior Manager
Will Bedel AME	Project Manager
Andrew Tennyson, CHMM AME	Senior Analyst
Jim Wegener, CHMM Environmental Field Services	Field Services Manager

Over the life of the project, the primary distribution list may be updated depending on the evolving roles of the project team. This QAPP may be updated as necessary to reflect the current role of the key project team members.

2.2 Project Organization

The remediation activities for the Site will involve Ohio EPA, AME, and the environmental laboratory. The breakdown of responsibilities of the key positions in the organization are described below. A responsibility chart (**Attachment A**) depicts the relationships and lines of communication between project participants.

2.2.1 Regulatory Division

The Ohio EPA will have overall charge for all phases of the remedial work.

2.2.2 Site Manager

Material Sciences Corporation or their authorized representative will act as the Site Manager.

2.2.3 Director/Senior Manager, August Mack Environmental, Inc.

The Director/Senior Manager role is responsible for client satisfaction and proper completion of the contracted scope of work. The Senior Manager will assist the Project Manager in obtaining necessary corporate and technical support. The Senior Manager is also the client's advocate and will assist in resolving technical, contractual, financial, or scheduling problems that cannot be resolved through the normal client/project relationship.

2.2.4 Project Manager, AME

The AME Project Manager's responsibilities include scheduling activities, project communication, and general overview of project execution. The Project Manager will brief the project team regarding the specific goals of the project and their specific responsibilities to ensure that all data collected during the course of field investigation are recorded on the appropriate forms and are consistent with the requirements established during project design. The Project Manager will properly route collected data to other members of the project team, maintain copies of data obtained on the appropriate forms in the project file, select a project member who can check that all transcription of field data and analytical data has been performed properly, and budget project time for the review of data (analytical data and field data) to ensure accuracy in its transcription.

2.2.5 Senior Analyst, AME

The Senior Analyst will be responsible for overall quality assurance oversight. These duties will include overseeing implementation of the QAPP requirements, data verification, data validation as necessary per project quality objectives, data assessment, and ensuring that internal performance and system audits are conducted.

2.2.6 Field and Sampling Personnel, AME

AME Field Personnel will be primarily responsible for overseeing the day-to-day field activities. The Field Personnel must have a thorough understanding of their responsibilities and of the data control requirements within the project. The Field Personnel will be responsible for communicating the status of the task to the Project Manager and notifying the Project Manager of any problems, delays, etc. Field Personnel will be responsible for/assist in the coordination effort and effective use of all personnel on site and for maintaining a record of field activities. The Field Personnel will also be responsible for field quality control including issuance and maintenance of measurement and test equipment; the proper

labeling, handling, storage, shipping, and chain-of-custody procedures used at the time of sampling; and control and collection of field documentation (logbooks, notebooks, data sheets, etc.) during the field investigation.

2.2.7 Laboratory Services

The primary laboratory selected to perform environmental data analyses is Eurofins Cleveland, although additional laboratories may be contracted depending on project and data needs. Analytical testing for Site contaminants of concern (COCs) will be performed primarily at the Cleveland facility. The laboratory will utilize the following personnel.

- Laboratory Technicians: Personnel will deliver sample containers to AME and pick up samples.
- Laboratory Analysts: The analysts will perform analytical procedures in accordance with U.S. EPA or other approved methods for selected analytes.
- Laboratory Project Manager: The laboratory project manager will be responsible for overall management of laboratory operations to meet project commitments, including scheduling of personnel and physical resources.
- Laboratory QA Manager: The laboratory QA Manager will be responsible for implementing and managing the laboratory QA/QC program. The QA manager functions independently from the laboratory operations and is responsible for coordinating QA/QC procedures for the laboratory, data review procedures, laboratory accreditation and certification, internal auditing, and implementation and maintaining the QA/QC program.

The data assessment activities associated with this program will be the primary responsibility of AME in conjunction with the analytical laboratory. Responsibility for external performance and system audits will be with Ohio EPA.

2.2.8 Health and Safety Manager, AME

The Health and Safety Manager is responsible for:

- Review and acceptance or denial of project level HASPs;
- Review and acceptance or denial of subcontractor pre-qualification questionnaires that fall outside the performance range delegated to the Project Manager;
- Review and acceptance or denial of subcontractor training records and Site-specific safety procedures prior to start of subcontractor's field operations;
- Support field personnel oversight of subcontractor (and lower-tier subcontractors) health and safety practices.

2.2.9 Administrative/Project Coordinators, AME

The project coordinators are responsible for:

- Coordinating subcontractors;
- General scheduling;
- Word processing and data input;
- General clerical duties;
- Documentation reproduction, report binding and filing; and
- Proofreading and editing of project documents.

2.3 Special Training Requirements and Certification

Field activities pose certain risks. Employees must obtain the proper training to recognize and protect themselves from hazardous chemicals known or suspected to be present at contaminated sites. Employees with questions about the risks they might be dealing with should use existing resources and contact their manager. The AME Health and Safety Manager reviews all HASPs frequently to ensure that risks are being properly mitigated and controlled. The Health and Safety Manager can recommend and supply appropriate PPE for work at specific sites.

August Mack and subcontractor personnel working on the project will be properly trained and qualified individuals. Prior to commencement of work, personnel will be given instruction specific to this project, covering the following areas:

- Organization and lines of communication and authority;
- QA/QC considerations;
- Documentation requirements;
- Decontamination requirements; and
- Health and Safety considerations.

2.3.1 OSHA HAZWOPER 40-Hour Site Worker Certifications

People entering the work zone(s) will be required to have 40-hour OSHA 29 CFR 1910.120, 40-hour HAZWOPER training and the necessary 8-hour refresher training, unless specifically exempted by the Health and Safety Manager based on the work being performed. People entering the work zone(s) at the Site will be required to review and sign the task-specific HASP.

2.3.2 DOT Hazardous Waste Transportation Training

If hazardous waste is generated, employees shall be trained in the proper management of hazardous waste. If hazardous shipments are moved off Site, employees shall be trained in compliance with the requirements for shipping

hazardous materials as mandated by the DOT in conjunction with the International Air Transportation Association.

2.3.3 Licensed Professional Certifications

In accordance with RCRA guidelines, project documents (e.g. QAPPs and WPs) will be approved by a licensed environmental professional, such as a CHMM, LPG, or PE, as needed.

2.3.4 Analytical Method Proficiency

The analysts performing chemical analysis of samples for the project will be trained in and will have exhibited proficiency of the analytical methods to be employed. The project laboratory will be responsible for ensuring appropriate training protocols are in place and are validated through proficiency testing.

2.3.5 Other Certifications

Depending on the project phase, other certifications may be necessary to meet project objectives or execute Site work. Appropriate certifications will be identified, and certified employees engaged prior to the implementation of work.

2.4 Project Planning / Problem Definition

This section provides a regulatory, programmatic, and historical context for the project and conveys the project background regarding the environmental problem, the work performed to date to investigate or resolve the problem, as well as defines the environmental questions to be answered by the work to be performed under the purview of the QAPP.

AME recognizes that regulatory actions and environmental decision-making requires data and information of the appropriate quality to meet project objectives. Consequently, AME has implemented a QMS. Every procedural aspect, from project planning, sample collection, laboratory analysis, and data assessment, imparts a significant and often critical bearing on environmental decisions.

2.4.1 Project Planning

AME employs a team-based project planning approach. The planning team defines the problem and incorporates steps of the DQOs process. Task-specific quality objectives are often further defined by individual Project Managers in field instructions. This "graded" approach to QMS ensures that quality activities are

conducted throughout the project but allows for flexibility to tailor quality-related activities to individual efforts.

2.4.2 Problem to be Addressed by the Project

Contaminants of concern (COCs) have been identified at the Site due to historical use of the Site as a metal galvanizing and coil coating facility. The nature and extent of contamination is not fully defined.

2.4.3 Environmental Questions Being Asked

What is the lateral and vertical extent of COCs at or adjacent to the Site in soil, groundwater, surface water, and soil vapor? Are concentrations of COCs in excess of risk-based criteria based on anticipated land-use?

2.4.4 Synopsis of Site Background

2.4.4.1 Site Physical History

The Site is located at 460 West Main Street in the Canfield, Mahoning County, Ohio. One warehousing and plating facility totaling approximately 86,500 square feet is located on the south portion of the subject property. One (1) approximately 6,000-square-foot storage warehouse is located north of the plating facility.

The property has been occupied by industrial operations since approximately 1950, when the current structures were built on-site. MSC, who acquired the property in 2013, generated hazardous waste mostly related to metal plating operations. MSC operations have continued through present day. Industrial operations primarily take place on the south portion of the Site, within an industrial building.

2.4.4.2 Discovery Summary

MSC operates a metal coating business at the Site, which generated hazardous waste as defined by ORC §3734.01(J) and OAC rules 3745-50-10 and 3745-51-03. In 2001, MSC notified U.S. EPA of its hazardous waste activities. The Site was assigned U.S. EPA number OHD000810283. Records indicate the MSC facility is currently classified as a Large Quantity Generator of Hazardous Waste, and has been since at least 2001.

On July 11, 2024, brown liquid was visually observed in the ditch by a pedestrian on the Mill Creek Metroparks bikeway who notified the local Canfield Fire Department. The Canfield Fire Department then notified MSC and Ohio Environmental Protection Agency (Ohio EPA) of the discharge.

2.4.4.3 Summary of Historical Site Documentation

Environmental studies and activities have been performed at the Site, the details of which are documented in the following reports:

- AME, 2025. Wetland and Downstream Sawmill Creek Sampling Implementation Report. July 3, 2025
- AME, 2025. Wetland and Downstream Sawmill Creek Sampling Work Plan. April 18, 2025
- AME 2025. Ditch IM Monitoring Plan. April 8, 2025.
- AME, 2025. Trichloroethylene (TCE) Interim Measures Report. March 31, 2025.
- AME, 2025. Ditch Interim Measures Sampling Plan. March 11, 2025.
- AME, 2025. Groundwater and Vapor Intrusion Report. February, 24, 2025.
- AME, 2025. TCE Interim Measures Work Plan. January 14, 2025.
- AME, 2024. Initial Site Investigation. December 9, 2024.
- AME, 2024. Ditch Interim Measures Plan. November, 15, 2024.
- AME, 2024. Notice of Violation (NOV) Response. October 25, 2024.
- AME, 2024. Ditch Interim Measures Plan Draft. October 7, 2024.
- AME, 2024. Sampling and Analysis Plan. September 30, 2024.

2.4.4.4 Regulatory Background

MSC was issued a NOV from the Ohio EPA on October 11, 2024. The Director's Final Findings and Orders (DFFO) were then established to address the NOV and future actions at the Site. The DFFO was effective on December 31, 2024, and the Site is currently undergoing RCRA Closure through the RCRAFIRST pathway. Details associated with the environmental activities conducted at the Site continue to be discussed with Ohio EPA weekly and submitted in monthly reports.

This QAPP is being submitted as part of Site investigation activities to satisfy Ohio EPA quality guidelines set forth in the DFFO.

2.4.5 Contaminant Classes and Affected Matrices

Based on the facility's historical Site usage and metal galvanizing/coating processes, the ISI results, and a Corrective Action Framework meeting with Ohio EPA in February 2025, the following compounds were identified as the primary Site COCs:

- Total cyanide
- Free cyanide
- Zinc
- Hexavalent Chromium
- TCE and breakdown products

Free cyanide is regulated and will evaluated. Total cyanide is a screening parameter and is not regulated by Ohio EPA.

2.5 Project Quality Objectives

PQOs define the type, quantity, and quality of data that are needed to answer specific environmental questions and support proper environmental decisions (IDQTF, 2005). A systematic planning process is employed to develop PQOs, as outlined in the U.S. EPA guidance (U.S. EPA, 2006). The purpose of this section is to provide qualitative and quantitative guidelines that should be used to define goals and PQOs. The overall QA objective is to develop and implement procedures for data acquisition, management, analysis, and reporting that will provide results that are legally defensible in the court of law.

2.5.1 Data Quality Objectives

DQOs are qualitative and quantitative statements that specify the quality of the data required to support activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. The DQOs specific to this phase of project work will be considered PQOs.

The U.S. EPA (U.S. EPA, 2006) presents a seven step DQO process:

- Step 1: State the problem;
- Step 2: Identify the goals of the study;
- Step 3: Identify information inputs;
- Step 4: Define the boundaries of the study;
- Step 5: Develop an analytic approach (i.e. decision rules);
- Step 6: Specify performance or acceptance criteria; and
- Step 7: Develop the detailed plan for obtaining data.

2.5.2 Step 1: State the Problem

As referenced in previous sections, use of the Site as a metal galvanizing and coil coating has resulted in subsurface soil, surface water, and groundwater contamination.

2.5.3 Step 2: Identify the Goals of the Study

Based on the investigation strategy proposed in the project WP, the study is meant to satisfy multiple goals concurrently:

Goal #1	Identify potential soil contamination source areas and delineate the extent of contaminants in unsaturated surface and subsurface soils.
Goal #2	Identify and/or delineate the lateral extent of contaminants in shallow groundwater and evaluate the potential for vapor intrusion.
Goal #3	Characterize the nature and extent of downstream surface water contamination and delineate the lateral and vertical extent of identified contaminants.
Goal #4	Estimate localized shallow groundwater flow direction and perched groundwater flow mechanisms.
Goal #5	Determine appropriate methods for disposal of IDW.

DQOs are qualitative and quantitative criteria for clarifying project objectives and defining the appropriate types of data needed. DQOs are part of a systematic planning process used to generate environmental data appropriate for its intended use. The key element of the DQO process is the development of principal study questions and decision statements. The principal study questions for the investigative phase are presented in the following sections. The individual areas that are being evaluated at the Site for potential contamination are referred to as Areas of Concern (AOCs). AOCs were not defined at the time of the RCRA PA, but were determined after emergency response activities to better categorize areas of future work. The DQOs for each of these AOCs are identified below. The AOCs are depicted on **Figure 1** and **Figure 2**.

2.5.3.1 AOC-1 (Adjacent Ditch 1)

- To what extent have potential Site contaminants migrated off Site to groundwater, surface water, and soils in the adjacent ditch?
- The Interim Measures have been successful in segregating surficial water flow from contaminated groundwater upwelling.
- Is sufficient information available to proceed to a final remedy?

2.5.3.2 AOC-2 (Wetland Area) and AOC-3 (Sawmill Creek)

- Investigative activities have documented residual impacts in the wetland and in surface soil further downstream. Is the density of data that defines the nature and extent of residual impacts sufficient to design a remedy protective of receptor populations?

2.5.3.3 AOC-4 (Sitewide Perched Water and Shallow Soil

- Are potential shallow soil Site contaminants present and yet unidentified?

2.5.3.4 AOC-5 (Sitewide Groundwater)

- Are the groundwater impacts sufficiently delineated to determine the nature and extent of impacts? Is sufficient data available to move to final remedy design?

2.5.3.5 AOC-6 (Building One),

- Are potential Site contaminants present and yet unidentified?

2.5.4 Step 3: Identify Information Inputs

Soil Information Inputs	PID Field Measurements	Used to estimate the presence/absence of lighter petroleum hydrocarbon and solvent contamination
	Analytical Results	Used to determine nature & extent of the contamination profile, refine the CSM, and determine appropriate IDW disposal
	Soil Lithology	Used to refine CSM and fate/transport mechanisms
	Visual/Olfactory Observation	Used to identify potential source areas or areas of gross impact
	Soil Saturation Depth	Used to determine appropriate installation depths for monitoring wells
	Geospatial Data	Used for mapping purposes

Surface Water Information Inputs	Flow information / Water Surface Elevation	Used to estimate stream capacity, baseflow, and recharge
	Analytical Results	Used to determine nature & extent of the contamination profile, refine the CSM, and determine appropriate ecological actions
	Visual/Olfactory Observation	Used to identify potential source areas or areas of gross impact and to determine in-stream surface soil depths
	Geospatial Data	Used for mapping purposes

Groundwater Information Inputs	GW Elevation Measurements	Used to determine potentiometric surface and groundwater flow direction
	Purging Stability Parameters	Used to ensure appropriate communication with surrounding aquifer prior to GW sample collection

	MW Construction Information	Used to verify appropriate communication with surrounding aquifer
	Analytical Results	Used to determine nature & extent of the contamination profile, refine the CSM, determine appropriate IDW disposal, and evaluate vapor intrusion potential
	Geospatial Data	Used for mapping purposes

Vapor Information Inputs	Canister Details	Used to determine if sufficient sample is collected based on canister vacuums.
	Leak Testing Results	Used to ensure the sampling point is appropriately isolated and there are no leaks in the sampling train.
	Building Survey Information	Used to provide context to analytical results in the presence of confounding vapor influences.
	Analytical Results	Used to determine nature & extent of the vapor contamination profile, refine the CSM, and evaluate vapor intrusion potential
	Geospatial Data	Used for mapping purposes

Miscellaneous Information Inputs	Subsurface Utility Mapping	Used to determine potential preferential pathways and refine the CSM
	IDW Quantities	Used to determine appropriate waste disposal logistics
	Geospatial Data	Used for mapping Site features and notable objects/installations
	Photos	Document Site conditions at time of investigation

2.5.5 Step 4: Define the Study Boundaries

The study boundary covered by this QAPP will include the Site and affected off-Site areas including the adjacent ditch, wetland, and Sawmill Creek.

2.5.6 Step 5: Develop a Decision Rule

The decision rules for this phase of the project will be:

Soil Decision Rules	Soil Field Screening Measurements & Visual /Olfactory Observation	Soil sampling locations and depths will be based on data gaps identified in existing data. In areas where contaminant presence is unknown, the unsaturated soil interval with the highest field screening result and/or visual/olfactory evidence of contamination will be collected for laboratory analysis, unless a specific targeted interval is requested (based on previous data).
	Laboratory Analytical Results	Analytical results will initially be compared to the applicable U.S. EPA site-specific Residential RSLs and

		Industrial RSLs calculated with a THQ of 0.1 and a TR of $1x10^{-6}$. Results will be used to determine the nature and extent of contamination present. If results are below applicable RSLs, contamination may be considered delineated. If results are in excess of RSLs, delineation may not be considered complete and further Site investigation will be evaluated. If analytical results are in excess of hazardous waste limits defined in 40 CFR 261.24 multiplied by 20 (TCLP 20x Rule), IDW may need to be disposed of as a hazardous material unless the media can be determined to be non-hazardous via additional characterization (i.e. TCLP extraction and analysis). Soils containing listed hazardous waste will be disposed as hazardous waste.
	Soil Saturation Depth	Monitoring wells will be installed with sufficient well screen to span smear zone based on soil saturation depth.
	Other Information Inputs	Used to document Site conditions and environmental media being sampled.

Groundwater Decision Rules	GW Elevation Measurements	If elevated concentrations of Site COCs are identified in excess of regulatory screening levels, groundwater flow direction may be used to determine appropriate placement of additional monitoring wells during future Site investigations, if deemed necessary.
	Purging Stability Parameters	If groundwater stability parameters (e.g. dissolved oxygen, oxidation reduction potential, turbidity, pH, temperature, and specific conductivity) reach stability in accordance with the groundwater sampling SOP, groundwater sampling will commence for all constituents proposed in the SAP.
	Laboratory Analytical Results	Analytical results will be compared to the U.S. EPA GWPSs, defined as either the associated MCL or Tap Water RSL (whichever is lower), calculated using a THQ of 0.1 and a TR of $1x10^{-6}$. Results will be used to determine the nature and extent of contamination. If results are below applicable GWPSs, contamination may be considered delineated. If results are in excess of GWPSs, delineation may not be considered complete and further Site investigation will be evaluated. If analytical results are in excess of hazardous waste limits defined in 40 CFR 261.24, or if waste contains

		listed hazardous waste, then IDW will need to be documented and disposed of as hazardous waste.
	Other Information Inputs	Used to document Site conditions, hydrological and hydrogeological conditions, and the environmental media being sampled.

Vapor Decision Rules	Canister Details	Sampling will cease prior to canister vacuum being exhausted as well as a minimum of 10 Hg" must be collected for the sample to be viable.
	Leak Testing Results	If leak testing results indicate port or sample train integrity issues corrective action will ensue and leak testing will be repeated.
	Laboratory Analytical Results	Analytical results will be compared to the U.S. EPA VISLs, calculated using a THQ of 1.0 and a TR of $1x10^{-5}$. Results will be used to determine the nature and extent of contamination. If results are below applicable VISLs, contamination may be considered delineated. If results are in excess of VISLs, delineation may not be considered complete and further Site investigation will be evaluated.
	Other Information Inputs	Used to document Site conditions and the environmental media being sampled.

Miscellaneous Decision Rules	IDW Quantities	If waste characterization results from project waste streams, including soil cuttings and purge or decontamination water, are above applicable hazardous waste disposal standards, the wastes will be segregated for disposal at an approved hazardous waste disposal facility. IDW quantities will determine the hazardous waste generator status of the responsible party and any additional reporting obligations.
	Other Information Inputs	Used to document Site conditions.

2.5.7 Step 6: Specify Performance or Acceptance Criteria

Performance Criteria	Analytical Results	Acceptance rates (e.g. false positive [α] or false negative[β]) will not be derived as environmental media will be evaluated on a point-by-point basis against applicable regulatory screening levels as stated above for each media.

2.5.7.1 Soil Screening Criteria

Remedial Goals have not been established for this matrix yet. Soil data will be screened using direct contact RSLs based on land-use. Soil data will also be evaluated against the following comparative criteria to assist with determining viable exposure pathways, disposal needs, and refinement of the conceptual site model.

- U.S. EPA Maximum Leachable Contaminant (i.e., 40 CFR 261 x 20);
- U.S. EPA Residential RSLs assuming TCR 1E-6 /HI 0.1
- U.S. EPA Industrial RSLs assuming TCR 1E-5 / HI 1.0
- U.S. EPA Recreator RSLs assuming TCR 1E-5 /HI 1.0
- U.S. EPA Soil Migration to Groundwater RSLs assuming TCR 1E-6 /HI .0.1
- U.S. EPA Construction Worker Screening Criteria (developed using the U.S. EPA RSL Calculator based on design assumptions for the installation of the water collection and management system).

A summary of containers, hold time, QA/QC acceptance criteria, RLs, MDLs and comparative criteria is included on **Table 1**.

2.5.7.2 Groundwater Screening Criteria

Initial investigations have identified impacts in Site groundwater. Remedial Goals have not been established for this matrix yet. Groundwater data will be screened using U.S. EPA MCLs. Groundwater data will also be evaluated against the following comparative criteria to assist with determining viable exposure pathways, disposal needs, and refinement of the conceptual site model.

- U.S. EPA characteristically hazardous thresholds from 40 CFR 261;
- U.S. EPA MCLs
- U.S. EPA Tapwater RSLs assuming TCR 1E-6 /HI .0.1
- U.S. EPA Residential VISLs assuming TCR 1E-6 /HI .0.1
- U.S. EPA Industrial VISLs assuming TCR 1E-5 /HI 1.0
- Construction worker risks associated with contacting trench groundwater will be compared to the Virginia Unified Risk Assessment Model (VURAM) groundwater direct contact screening levels. The VURAM model assumes a target cancer risk of 1E-6 and target hazard of 1.0.

A summary of containers, hold time, QA/QC acceptance criteria, RLs, MDLs and comparative criteria is included on **Table 2**.

2.5.7.3 Vapor Screening Criteria

Initial investigations have identified TCE that may create indoor inhalation risk via the vapor intrusion pathway. Vapor investigations to date have not demonstrated elevated impacts in soil vapor and indoor air.

Remedial Goals have not been established for this matrix yet. Vapor data will be compared to U.S. EPA VISLs for residential and industrial use assuming a target cancer rate of 1E-5 and target hazard quotient of 1.0. A summary of containers, hold time, QA/QC acceptance criteria, RLs, MDLs and comparative criteria is included on **Table 3**.

2.5.7.4 Surface Water Screening Criteria

Initial investigations have identified impacts in Site surface water. Remedial goals have not been established for this matrix yet. Surface water data will be screened against Ohio River Basin Aquatic Life and Human Health Tier I Criteria pursuant to OAC 3745-1. QA/QC guidelines for this work will be developed under a QAPP submitted under separate cover. A summary of containers, hold time, QA/QC acceptance criteria, RLs, MDLs and comparative criteria is included on **Table 4**.

2.5.8 Step 7: Develop a Plan to Obtain Data

This QAPP will govern data collection efforts associated with the RCRA Facility Investigation. Specific investigation elements are discussed in greater detail in the RFI WP. A summary of major investigation efforts is provided below.

2.5.8.1 Subsurface Soil Investigation

Soil borings will be advanced on-Site using a Geoprobe® direct-push drill rig sampling system or hand auger (or equivalent such as shovel, trowel, and/or slide hammer) depending on access and logistics. Borings will be advanced to various target depths depending on the DQO being evaluated. Proposed soil investigations will include the following:

- Assessment of contaminant nature and extent within the Building One footprint.
- Assessment of contaminant nature and extent in the areas of perched water surface expressions.
- Assessment of contaminant nature and extent in the off-Site wetland area.
- Assessment of contaminant nature and extent in the off-Site Sawmill Creek.
- Assessment of contaminant nature and extent in the off-Site Adjacent Ditch.
- Characterization of soils for waste disposal during monitoring well installation activities.

2.5.8.2 Monitoring Well Installation

Additional monitoring wells will be installed on- and off-Site to delineate the vertical and horizontal extent of groundwater impacts.

2.5.8.3 Groundwater Sampling

Depth to water at each groundwater monitoring well will be gauged to provide information to produce a potentiometric surface contour map and calculate groundwater flow direction. One groundwater sample will be collected from each monitoring well via U.S. EPA low-flow sampling procedures (U.S. EPA, 1996) and submitted for laboratory analysis.

Grab groundwater samples will be used to support characterizing the nature and extent of shallow perched water on-Site.

2.5.8.4 Vapor Sampling

Further VI assessment will be based on the delineated nature and extent of the groundwater plume.

2.5.8.5 Surface Water Sampling

Grab surface water samples will be collected at locations within the creek to assess the extent of impacts associated with historical Site use.

2.6 Measurement Performance Criteria

Data for remediation activities must be of known quality as defined by standard DQIs presented in the various regulatory guidance documents (U.S. EPA 2001, 2002, and 2005). Data quality, as defined by the DQIs, is a function of both field and laboratory operations that can be addressed through the following seven elements, each of which is described in detail below: Precision, Bias, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity.

Of these seven (7) elements there are five (5) principal DQIs. Precision and bias are the quantitative measures, representativeness and comparability are qualitative, and completeness is a combination of both quantitative and qualitative measures.

To meet specific DQI objectives, field personnel and laboratories analyzing samples must perform and retain sufficient notes and QC documentation to demonstrate and support the level of data quality required for the project. The Field and Laboratory QC Elements and Assessment Criteria Table is included as **Attachment B** for this QAPP.

2.6.1 Data Acquisition

Information that is non-representative and possibly biased and is used uncritically can lead to decision errors. Care and skepticism should be applied to the

generation of new data and previously compiled data. The acceptance criteria for each collection of data being considered for use in this project must meet the following:

- **Representativeness.** The data collected from a population must be sufficiently similar to the population of interest and the population boundaries. Methods should be used to minimize potentially confounding effects which can alter the summary information.
- **Bias.** Characteristics of the data set should not shift the conclusions. Any bias in analysis should be documented.
- **Precision.** The estimate of variability should be within acceptable control criteria defined in the QAPP by method by media.
- **Qualifiers.** Data should be evaluated to permit logical decisions on whether or not the data are applicable to the current project. The QAPP presents a system for qualifying and flagging data adequately in order to combine data sets.
- **Summarization.** A systematic data summarization process will be used to ensure there is sufficient consistent data to meet the goals of this project. Observations and transformation equations are available so that their assumptions can be evaluated against the objectives of this project.

Data gathered from this project can only estimate the true state of the media. The data collection design was systematically chosen to control the possibility of making a decision error.

2.6.2 Control Limits

Control Limits are the maximum and/or minimum values defining a range for specific parameters, as outlined within each analytical procedure considered to satisfactorily meet quality control criteria. When the parameter falls outside that range, the procedure is considered to be out-of-control. Whenever the analytical procedure is, or becomes, out-of-control, corrective action must be taken to bring the analysis back into control. The corrective action must include: (1) finding the cause of the problem, (2) correcting the problem, (3) demonstrating the problem has been corrected by reanalyzing appropriate laboratory reference samples, and (4) repeating the analyses of any investigative samples that may have been affected by the control problem.

Exceptions will be made, on a case-specific basis. If the control limit is technically impracticable for a particular sample or analysis, documentation and a narrative

explanation should be submitted with the data report and raw data. The documentation must include evidence that a good faith effort was made to meet the control limit; this will generally include two attempts to analyze the sample.

2.6.3 Precision

Precision is a measure of agreement among replicate measurements of a sample property, under prescribed similar conditions. Overall project precision is measured by collected data from co-located field duplicate samples. Precision specific to the laboratory is measured by analyzing laboratory duplicate samples. A MS/MSD pair may be used for precision measurements for analyses where contaminants are not routinely detected.

2.6.3.1 Duplicate Types

Four unique duplicate types may be collected over the course of the project.

- **Co-Located Duplicates:** two separate samples are collected from adjacent locations.
- **Subsample Field Duplicates**: two representative portions are taken from a single sample.
- **Laboratory Duplicates**: two aliquots of the same sample are prepared and analyzed by a laboratory.
- **Analytical Duplicates**: two aliquots of the same sample are analyzed in duplicate after preparation (e.g. digestion or extraction).

2.6.3.2 Duplicate Precision Calculation

Duplicate precision is evaluated by calculating an RPD, the absolute value of the difference between two observations divided by their average expressed as a percentage, using the following equation:

$$RPD = \frac{|x_1 - x_2|}{\frac{(x_1 + x_2)}{2}} \, x \, 100$$

2.6.3.3 Duplicate Collection Frequency

Field events will include at least one subsample field duplicate for every 20 samples collected by matrix (i.e. 5% frequency). Duplicates should not exceed 10 percent of the total number of samples collected. If required by the analytical method (e.g. metals analysis), laboratory duplicates will be performed at a frequency of 5%.

2.6.3.4 Precision Control Measures

For concentrations or measurements that are five times greater than the method RL, the control limit for precision measurements must have RPD less than the matrix specific control limit. For concentrations less than five times the RL, the absolute value of the reporting limit will be used as the control limit. Therefore, precision will be considered in control if one of the following conditions is satisfied:

$$If\ x_1 \geq (5 * RL), then \qquad \frac{|x_1 - x_2|}{\frac{(x_1 + x_2)}{2}}\ x\ 100 < CL_m$$

or

$$If\ x_1 < (5 * RL), then \qquad |x_1 - x_2| \leq RL$$

Where:

x_1= Original Sample Concentration
x_2= Duplicate Sample Concentration
CL_m= Matrix-specific control limit
RL = Reporting Limit

The laboratory may run duplicate analysis on samples not associated with this project (i.e. batch QC). Field duplicate precision will not be included in the data usability assessment if the duplicates are batch QC.

If the original sample has a detection above the reporting limit, but the duplicate does not, the reporting limit will be utilized in the calculation of RPD. If analytes are detected between the MDL and RL (laboratory J-flag), RPD will not be calculated.

2.6.3.5 Duplicate Control Limits

The Project Manager may set looser or stricter quality-control limits in task-specific field instructions/SAPs with approval from the Senior Manager or regulating agency. Control limits may be varied based upon sampling location, sample matrix, analytical method, and/or analyte or property of measurement. The analytical laboratory will determine its own control limit for precision measurements for analytical duplicates. Until the analyzing laboratory has collected sufficient data, it is acceptable to arbitrarily set the control limit to that presented in the cited method.

For the purposes of the project phases detailed within this QAPP, precision will be considered in control if duplicate analysis satisfies the following matrix-specific control limits:

- Solid Samples – 35%
- Aqueous Samples – 20%
- Air Samples – 20%

2.6.3.6 Precision Corrective Action

Precision measurements outside these control limits should be confirmed or disproved through a corrective action investigation, which may include but is not limited to, review of associated QA/QC samples, sampler interview, laboratory verification of results, or re-analysis.

Data usability assessments of duplicates outside control criteria must evaluate the relative concentrations of the duplicate pair to the PQOs and/or project closure levels or screening levels. Poor duplicate performance for organic analyses will only qualify data associated with the original/duplicate pair. Poor duplicate performance for inorganic analyses will qualify samples associated with the duplicate pair at 5% frequency (one duplicate associated to up to 20 original samples).

Field duplicate results should be evaluated along with any laboratory duplicate results in an attempt to identify whether the issue is related to the sample matrix, collection technique, or the laboratory analysis of the sample.

- If the laboratory duplicates are acceptable, but the field duplicates are not, the likely source is heterogeneity of the matrix or the sampling and/or compositing technique.
- If the laboratory duplicates are not acceptable, laboratory method performance may be compromised.

2.6.3.7 Duplicate Reporting

If required by the analytical method, each analytical laboratory must report analytical duplicates within the quality control section of the analytical report. Final co-located duplicate results will be presented on project tables, similar to original results.

2.6.4 Accuracy / Bias

Accuracy is the measure of closeness of an individual measurement to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that result from sampling and analytical operations. Accuracy is determined by analyzing a reference material of known concentration or by reanalyzing a sample to which a material of known concentration has been added. Accuracy is expressed either as a percent recovery (P) or as a percent bias (P - 100). Determination of accuracy always includes the effects of variability (precision); therefore, accuracy can evaluate a combination of bias and precision. The combination is known statistically as mean square error. Accuracy is inferred from recovery data determined from the analysis of SRMs and by MSs. Some organic methods require surrogate spikes on each sample, from which accuracy can also be assessed.

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias assessments for environmental measurements are made using personnel, equipment, and spiking materials or reference materials as independent as possible from those used in the calibration of the measurement system. When possible, bias assessments should be based on analysis of spiked environmental samples rather than reference materials so that the effect of the matrix on recovery is incorporated into the assessment. Bias is generally identified with the precision and accuracy measurements.

2.6.4.1 Spike Accuracy/Bias Calculation

Analytical accuracy is determined based on %R of spiked SRMs, such as deionized water for aqueous samples. This lab-derived sample is known as the LCS. Given a known amount of spike added to a SRM, the percent recovery is calculated by dividing the amount spiked by the amount recovered via the analytical process.

Bias is determined in a similar manner, but spike amounts are added to samples representative of field conditions (i.e., MS/MSDs). To wit:

$$\%R = \frac{C_s}{C_r} \text{ x } 100$$

Where:

%R = Percent Recovery
C_s= Concentration of Spike Added to SRM/Sample
C_r= Concentration Recovered via Analytical Method

2.6.4.2 Accuracy Evaluation Frequency

The frequency of LCS samples is dictated by the analytical method. For most methods, the frequency is the lesser of 5% frequency or one LCS per analytical batch if the batch is less than 20 samples.

2.6.4.3 Bias Evaluation Frequency

MS/MSDs provide information about the effect of the sample matrix bias on the preparation and measurement methodology. MS/MSD samples will be submitted to the laboratory for analyses from at least one sampling location per project and laboratory used. Unless specified in the task-specific field instructions, the project dictated frequency of MS/MSD samples must be at least one per 20 samples or at 5% of the sample size. In the absence of MS samples, accuracy must be assessed using SRMs at a frequency of at least 5%. If possible, MS/MSD samples should be collected from a location expected to be relatively free from contamination, since the samples will be used for laboratory quality control purposes. The MS/MSD samples should be clearly identified as "MS/MSD" on the Chain-Of-Custody Record.

2.6.4.4 Accuracy/Bias Control Measures

Acceptable %Rs are unique to each laboratory and are dependent on the analytical method, matrix, and QA/QC sample type (e.g. LCS or MS/MSD). The laboratory determines acceptable limits for each compound being analyzed. Control limits for LCS and MS/MSD samples are included within the DQO summaries on **Tables 1-3.**

Data users will never adjust laboratory reported compounds or RLs based on percent recovery results. Project-specific spikes will never be requested on sampling blanks (i.e. field blanks, trip blanks, rinsate blanks, or equipment blanks).

2.6.4.5 Accuracy Corrective Action

If LCS %Rs are outside of control limits, the laboratory will qualify the data and provide supplemental information regarding the nature of the deficiency. The SA will be responsible for assessing the effect of the deficiency on the usability of the data considering PQOs during the analytical verification process.

2.6.4.6 Bias Corrective Action

High or low bias can be caused by many factors. Indeterminate or non-directional bias means that the analytical results exhibit a poor degree of precision or that there are cumulative conflicting biases in the data set (e.g. surrogate recoveries for a sample are low but LCS recoveries are high). Indeterminate bias may occur when heterogeneous matrices, such as contaminated soil or soil containing wastes, are sampled (NJDEP, 2014). The heterogeneity of the matrix can cause the analytical results to vary and may cause a large RPD between the sample results, known as "matrix effect".

The SA will have responsibility for determining the usability of data in the presence of bias during the analytical verification process based on professional judgement. Bias will not be evaluated until sources of possible bias in a sample have been evaluated (i.e. surrogates, LCS recoveries, blank contribution, and MS/MSD results). Although bias may be present, it may have little effect on the usability of the data.

- If the detected concentrations are substantially above or below the applicable screening level, the bias may have little impact on the usability of the data.
- If the detected concentrations approximate the applicable screening level, the SA will evaluate potential bias sources before determining the usability of the data for its intended PQO.

For organics, the results of the MS/MSD evaluation will only impact the sample used for spike analysis, while for metals, the results of the MS/MSD evaluation will affect the entire associated batch (NJDEP, 2014).

2.6.4.7 Accuracy/Bias Reporting

Each analytical laboratory will report accuracy data with its analytical results. The SA or designee may prepare a narrative statement of data bias if bias is observed to affect data usability during data verification, to be included with the original laboratory report.

2.6.5 Representativeness

Representativeness is a measure of the degree to which data accurately and precisely represent a characteristic of a population parameter at a sampling point or for a process condition or environmental condition. Representativeness is a qualitative term that should be evaluated to determine whether in-situ or other

measurements are made, and physical samples collected in such a manner that the resulting data appropriately reflect the media measured or studied.

2.6.5.1 Representativeness Control Measures

Sample handling protocols such as storage, preservation, and transportation described in both sampling and analytical SOPs have been developed to preserve the representativeness of collected samples. Likewise, selection of analytical methods in response to the parameter being tested may affect representativeness. Since special or unusual sample conditions might affect the accuracy of an analysis, it is helpful to have information about the sample matrix. Results of such matrix tests may give additional insight into the representativeness of the analyses. Tests describing the sample matrix may be requested on a task-specific basis.

Field and laboratory documentation will be used to confirm that proper sampling and analytical protocols have been followed. Trip blanks, rinsate or field blanks, and equipment blanks will be used to assess whether field and transport activities may have impacted the representativeness of the sample. Laboratory QC will also be evaluated to ascertain if the analytical results are representative.

2.6.5.2 Representativeness Corrective Action

If evaluation of sample documentation indicates that sample representativeness may be compromised, corrective action measures will be instituted, which may include field or analytical data review, laboratory follow-up, or a QA narrative be issued regarding the usability of the data.

2.6.5.3 Representativeness Reporting

The Project Manager will review field notes, analytical summaries, and data to ensure that representativeness is maintained. Conclusions on data usability will be included in the final report associated with the project phase.

2.6.6 Comparability

Comparability is the qualitative term that expresses the confidence that two data sets can contribute to a common analysis and interpretation. Comparability must be carefully evaluated to establish whether two data sets can be considered equivalent in regard to the measurement of a specific variable or groups of variables.

2.6.6.1 Comparability Control Measures

Comparability is determined by reviewing sampling collection and handling methods, sample preparation and analytical procedures, holding times, stability issues, and QA protocols. The development of new field or laboratory methods requires validation against accepted reference methods before being adopted. If two different analytical methods are employed to measure the same parameter, an assessment of the comparability of the methods will be performed prior to determining data usability.

The usability assessment will compare overall comparability between multiple data sets collected for the project for each matrix, analytical parameter, and concentration level. It will describe the limitation on the use of project data when project-required data comparability is not achieved for the overall project or when it is limited to a specific sampling or laboratory/analytical group, data set, matrix, analytical parameter, or concentration level.

For long-term monitoring projects, data comparability is extremely important. Project data will be compared to previously generated data to determine the possibility of false positives and/or false negatives. Variations detected in the data may reflect a changing environment or indicate sampling and/or analytical error. Comparability criteria will be established to evaluate these data sets to identify statistical outliers to trigger resampling as verified.

If it is determined that long-term monitoring data are not comparable, the usability assessment will address whether the data indicate a changing environment or the anomalies are a result of sampling and/or analytical error. If data are not usable to adequately address environmental questions and/or support project decision making, then the final report will address how this problem will be resolved.

Overall comparability of data from split samples (samples that are collected at the same time from the same location and split equally between two parties using sample containers from the same source or vendor) will be evaluated by determining the RPD of detected analytes in both samples following data verification/validation. Analytes that are detected in only one of the two samples will be assessed by reviewing the data verification/validation reports for both data sets and determining the cause of the discrepancy. Overall comparability of split sample data will be considered acceptable if the RPD for detected analytes with concentrations greater than or equal to five times their respective quantitation limits does not exceed RPD acceptance criteria for field duplicate samples.

If screen/confirmatory comparability criteria are not met, then this will be documented in the usability assessment and the effect on data usability will be discussed. If oversight split- sampling comparability criteria are not met, then this will be documented in the assessment and the effect on data usability will be discussed. If data are not usable to adequately address environmental questions and/or support project decision making, then the assessment will address how this problem will be resolved and discuss potential need for resampling.

Overall comparability of data from the groundwater monitoring program will be assessed by evaluating analyte concentrations over time. The data from monitoring events will be evaluated for trends, if necessary, using the Mann-Kendall test described in Section 4.3.4.1 of EPA QA/G-9. Suspected outliers will be assessed using the Extreme Value Test described in Section 4.4.3 of EPA QA/G-9. As the groundwater database becomes larger, it may be necessary to use different statistical methods to determine trends and outliers. Any changes to the statistical methods used for this project will be communicated to the U.S. EPA prior to initiating the change.

2.6.6.2 Comparability Reporting

If data is determined to not be comparable, an assessment of the merits of the individual data sets will be performed prior to determining data reliance. Assessment results will be presented in project documents which rely on the origin data sets.

2.6.7 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system, expressed as a percentage of the number of valid measurements that should have been obtained (i.e. measurements that were planned to be collected).

2.6.7.1 Completeness Calculation

Completeness is defined as the total number of samples taken for which valid analytical data are obtained, divided by the total number of samples collected, multiplied by 100.

$$C = \frac{N_v}{N_p}\ x\ 100$$

Where:

C = Completeness DQI
N_v = Number of valid observations
N_p = Number of planned observations

2.6.7.2 Completeness Criteria
At least 90% of samples tested (for each analyte per media) must yield valid data.

2.6.7.3 Completeness Control Measures
Several factors may result in lack of completeness: (1) the DQOs may have been based on poor assumptions, (2) the survey design may have been poorly implemented, or (3) the design may have proven impossible to carry out given resource limitations. Lack of completeness will be investigated, and the lessons learned from conducting the study must be incorporated into the planning of future studies.

2.6.8 Sensitivity
Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of variables of interest. Sensitivity is determined from the value of the standard deviation at the concentration level of interest. It represents the minimum difference in concentration that can be distinguished between two samples with a high degree of confidence. Sensitivity will be expressed by the analytical laboratory for each analyte-matrix-method combination of interest as the MDL and the RL. The decision levels (required RLs and MDLs) for a project are based on concentrations in the risk-based concentration tables for the specific pathways of concern. The task-specific SAP will identify these decision levels for each analyte-matrix that will be sampled. Sensitivity will also be assessed by the analysis and reporting of LCS at or below the decision level.

2.6.8.1 Sensitivity Frequency
MDLs and RLs will be determined by the laboratory initially with the development of any new analytical methods or whenever any major changes in procedure or equipment occur. A LCS must be analyzed at a concentration generally at a concentration that is the mid-point of the calibrated range with every analytical batch. The calibration range must encapsulate concentrations equal to or less than the concentration of interest for each analyte.

2.6.8.2 Sensitivity Control Measures

Percent recovery of the LCS must be within established laboratory acceptance criteria, unless specified otherwise in task-specific field instructions. Each analytical laboratory must have an acceptable MDL study on file prior to the analysis of any project samples submitted for analysis.

2.6.8.3 Sensitivity Reporting

The analytical report submitted by the analyzing laboratory must include its RLs and the results of the LCS analyses and percent recovery.

2.7 Secondary Data Evaluation

Secondary data may include data generated for or by external, independent parties which are then transmitted to the current user. Secondary data may also include data collected in other investigations designed to answer different questions than those posed in the current investigation.

2.7.1 Secondary Data Sources

Historical data associated with this project will be used to describe the Site history and chronology as well as define the environmental problem being addressed by the QAPP. Historic data will be presented "as-is" in project databases; no further verification or validation of historic data will be necessary to satisfy the PQOs established in the QAPP.

Other secondary data sources may include Global Positioning System survey equipment or traditional survey equipment employed by a licensed surveyor to spatially document investigative points of interest.

2.8 Project Overview and Proposed Schedule

The next phase of work will include the submittal of the RFI Workplan and project QAPP, followed by implementation of the proposed workplan. An estimated timeline of foreseeable project milestones based on the current understanding of the project is presented below.

Date	Milestone
May 2025	Submittal of RFI Workplan
August 2025	Corrective Action Framework Submittal
August 2025	Response to OEPA Comments and Submittal of revised RFI Workplan, with CSM and QAPP

September/October 2025	Implement RFI WP
Winter 2025-2026	Submit RFI Implementation Report

3. MEASUREMENT AND DATA ACQUISITION ELEMENTS

3.1 Sampling Tasks

The QAPP was developed to guide decisions on remedial efficiency and determine if the remedial objectives have been satisfied. The goal of future data collection will be to obtain data in support of remedial actions.

3.1.1 Sampling Process Design

The rationale for the design collection of data was derived from the outputs of the DQO process.

Sampling activities will primarily involve the following:

- Groundwater and soil samples will be analyzed for the Site-specific COC list, unless otherwise specified.
- Soils will be field screened via a PID and/or a field pH meter.
- Groundwater turbidity, dissolved oxygen, temperature, oxidation-reduction potential, and pH will be monitored in the field with a multi-parameter meter.
- Waste characterization samples for soil and/or groundwater waste streams will be analyzed for constituents in accordance with landfill acceptance criteria.

3.1.2 Sampling Event Preparation

Project managers with assistance from administrative staff will make arrangements with the laboratory for proper sample containers, sampling request forms, and sampling equipment before field work begins.

Equipment will be assembled based on the type of samples to be collected. Preparation and assembly of required equipment and materials must be calibrated, assembled, and operating before use. Sampling equipment will be transported in such a manner as to maintain its cleanliness.

Task-specific[1] field instructions and/or SAPs shall be prepared in advance of each sampling event and must contain at minimum the following elements:

- A description of the project with relevant background information;
- A list of project members, their responsibilities and contact information;
- A description of the sampling plan, including the location, number and type of samples to be collected;
- Sample collection procedures;
- Field documentation procedures;

[1] An event that takes place during the Site study which may include, but is not limited to, an investigation, confirmatory analysis and/or remediation design.

- Management procedures for IDW;
- The number, type, and collection rate of QC samples;
- The analytical methods that laboratories analyzing the samples must use;
- Special safety and cautionary information; and
- Any additional sampling, analytical, or QA/QC requirements that deviate from those established in this QAPP.

3.1.3 Sample Collection

Sample collection and measurement activities must be traceable through field records to the person collecting the sample and making the measurement. Maintenance and calibration records for sampling and measurement equipment (where appropriate) will be kept so that they are similarly traceable. Deviations from the sampling collection design will not be tolerated without approval from the Project Manager. Changes should be documented by the responsible personnel on-Site during the field activities.

3.1.4 Sample Handling

Samples should be handled in a manner which prevents cross-contamination during sample collection. Sample collection precautions should be taken during field collection. The responsible personnel on-Site during the field activities should document events that occur during sample handling that may affect the integrity of the samples. Sample containers and preservation methods used will be evaluated to ensure that they are appropriate to the nature of the sample and the type of data generated from the sample. Checks on the identity of the sample (e.g., proper labeling and chain-of-custody records) as well as proper physical/chemical storage conditions (e.g., chain-of-custody and storage records) will be made to ensure that the sample continues to be representative of its native environment as it moves through the analytical process.

3.1.5 Sample Preservation

Samples for some analyses must be preserved to maintain their integrity. Chemical preservations used will be supplied by the laboratory. Samples requiring preservation should be preserved immediately upon collection in the field. If samples normally requiring preservation were not preserved, field records should clearly specify the reason. The chain-of-custody will be reviewed to determine if the correct sample preservation methods were followed.

3.1.6 Training

Field personnel are trained in acceptable sampling techniques, preservation, and handling procedures. Field personnel are also trained in field instrument operation, calibration, and documentation procedures.

3.1.7 Parameter-Specific Sampling Requirements

Parameter-specific sampling requirements, including container type, preservation requirements, and holding times, will be documented in task-specific field instructions.

Samples must be collected in a manner consistent with the media being sampled and the analytes of interest. Collection methods must follow an August Mack approved sampling procedure. Additional methods may be used with the approval of the Project Manager.

3.1.8 Sample Containers, Volume, and Preservation

It is important to use the proper sample containers and appropriate preservation techniques when collecting samples. Samples should be collected in containers supplied by the analyzing laboratory. This ensures that the container has been properly cleaned and that the analyzing laboratory will have sufficient sample material to do the requested test. Samples submitted to the laboratory that are not in a laboratory-supplied container are likely to be rejected, or otherwise qualified. In addition, samples must also be properly preserved, or they may be rejected.

Tables 1 through 3 summarizes required sample containers, preservation techniques, and holding times for the most commonly requested analytes within the project's scope. For information about analytes not listed in **Tables 1 through 3**, check with the analyzing laboratory. If a required sampling or field method is not documented in either of the documents referenced above, the appropriate SOP must be identified or developed and then approved before initiating field activities.

3.1.8.1 Thermal Preservation

When analytical methodology specifies refrigeration as a preservation method, samples will be refrigerated at the appropriate temperature (≤6^{o} C) and preserved as required until shipment to the laboratory. The samples will be handled as follows:

- Samples will be collected in appropriate containers with complete sample identification on the label.
- Samples will be placed in a container and packed in such a manner to facilitate stability during transport.
- Ice will be utilized to maintain cooler at the appropriate temperature.
- The chain-of-custody form will be sealed in a plastic bag and included with the samples in the cooler.
- If sampling events are in proximity to AME offices, samples may be transferred from field coolers and temporarily stored in a sample refrigerator pending courier pickup from the receiving laboratory.

3.1.8.2 pH Adjustment Preservation

Preservation by pH adjustment will be accomplished by adding the aqueous sample directly to a sample bottle containing a measured amount of the pH-adjusting chemical. Pre-cleaned sample bottles containing pH-adjusting chemicals will be supplied by the subcontracted laboratory. The specification of the pH preservatives is addressed in the analytical laboratory QAM provided in **Attachment C.**

Two methods for determining that the proper final pH preservative is achieved will be utilized during field activities, one for TCE (and breakdown) samples, and one for other samples needing pH adjustment.

3.1.8.2.1 TCE (and breakdown) Samples:

The measured amount of preservative (approximately four drops of concentrated hydrochloric acid) delivered in VOA vials is sufficient to adjust an unbuffered sample. The preservative is also sufficient to bring any sample containing typical amounts of calcium carbonate buffer to the appropriate final pH. In typical implementation, the pH, conductivity, and temperature of groundwater samples sources are measured before sampling.

3.1.8.2.2 Other Samples Requiring pH Adjustment:

The pH of other pH-adjusted samples (non-VOA) will be determined directly by the receiving laboratory, if necessary, based on method requirements. A small quantity of preserved sample is poured from sample bottle into a clean cup or retrieved via disposable syringe. The pH of sample is measured with pH meter or narrow range pH paper. The final pH is recorded in the sample condition upon receipt forms. For metals samples, if the pH is not within the acceptable range, the

laboratory will add approximately one milliliter of additional preservative and recheck pH as above. Final pH will be determined and recorded by the laboratory. Only those sample bottles identified as not meeting preservation requirements will be documented by the receiving laboratory.

3.1.9 Media-Specific Sampling Techniques

The QA goals for the program are to eliminate or minimize the potential for inconsistencies in protocols, including the field protocols that can introduce error into the data collection process. To achieve this goal, SOPs will be followed as consistently as possible by field personnel given the variability of natural conditions encountered in the field. Any deviation from SOPs necessitated by unanticipated field conditions should be documented as they occur and reported to the Project Manager. Sampling events will be performed on a task-specific frequency in accordance with the August Mack SOP. Task-specific field instructions should include reference to the SOP or provide sufficient instruction to perform the task.

3.1.10 Holding Times

Holding times for planned samples will be predetermined during the sample planning and design phases. All reasonable effort will be made to analyze samples within established holding times as designated by the analytical method.

Data generated from samples analyzed outside method recommended holding times will follow the following decision logic:

- If the analysis was performed between the holding time and 1 ½ time the holding time: The result will be considered estimated (i.e., J-flag).
- If the analysis was performed outside the 1 ½ times the holding time window: The result will be considered rejected (i.e., R-flag).

3.1.11 Handling of Investigation-Derived Wastes

IDW generated during the remedial activities may include PPE and sample collection debris and contaminated media. PPE and sample collection debris may be decontaminated and cleaned with water per the August Mack decontamination SOP. If the PPE and debris are cleaned, they may be disposed of with general refuse. Otherwise, the PPE and debris will be containerized and placed into drums and/or roll-offs pending proper transportation and disposal.

To the greatest extent possible, disposable and/or dedicated PPE shall be used to avoid cross-contamination. Non-disposable sampling equipment shall be cleaned between sampling locations. Decontamination shall be conducted in a central location, away from suspected contaminant sources. Decontamination IDW will be containerized prior to disposal. Decontamination procedures as outlined in the August Mack Decontamination SOP will be used to decontaminate equipment. Common methods of disposing of IDW are provided in **Attachment D.**

3.1.11.1 Management of Non-hazardous IDW

If the waste is from an active facility, permission should be sought from the operator of the facility to place the non-hazardous PPE, disposable equipment, and/or paper/cardboard into the facility's dumpsters. If necessary, these materials may be placed into municipal dumpsters, with the permission of the owner. These materials may also be taken to a nearby permitted landfill. On larger studies, waste hauling services may be obtained, and a dumpster located at the Site.

Disposal of non-hazardous IDW such as drill cuttings, drilling mud, purge or development water, decontamination wash water, etc., will be placed into an environmentally permitted destination, such as a landfill (for solids). Liquids may also be solidified and disposed of as solids in an environmentally permitted destination.

The minimum requirements are:

- Non-hazardous liquid and soil IDW may be returned to the origin boring if doing so does not endanger human health or the environment or violate federal or state regulations. Under no circumstances, however, should monitoring well purge water be placed back into the well from which it came from.
- Soap and water decontamination fluids and rinsates of such cannot be placed in any water bodies and must be collected and disposed of properly.
- The collection, handling, and proposed disposal method must be specified in the approved Field Instructions.

3.1.11.2 Management of Hazardous Wastes

Management of hazardous waste shall be in compliance with state and federal regulations. Hazardous waste generation and disposal shall be documented. Hazardous waste shall be disposed of at an appropriately permitted facility.

3.1.12 Equipment Decontamination

Disposable sampling equipment will not require decontamination. The water level indicator and/or product/water interface probe will be decontaminated between locations utilizing the following procedure:

- Wash with non-phosphate detergent and potable water
- Rinse with potable water
- Rinse with deionized/distilled water

Drilling casings, rods, and hydraulic-driven sampling probe will be decontaminated in compliance with AME decontamination SOP between borings.

3.2 Analytical Tasks

Analytical methods used on samples from investigations shall comply with the relevant requirements of applicable federal or state programs for which they were collected. Any specific analytical methods required by the project must be explicitly identified in the task-specific field instructions. Laboratories must use any methods specifically identified in the field instructions unless an exception is given to the laboratory by the Project Manager. A list of methods proposed to govern Site investigations is included on **Tables 1 through 3**.

3.2.1 Analytical SOPs

Analytical methods for performing measurements on project samples are outlined in the laboratory QAM (**Attachment C**). In general, laboratory methods will comply with U.S. EPA Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, also known as SW-846. Deviations from standard analytical methods will be documented in the laboratory specific SOPs.

Routine laboratory QA activities are documented in the analyzing laboratory's Quality Manual. Laboratory quality manuals must adhere to consensus standards adopted by the NELAP, which include at a minimum the following elements:

- Daily instrument calibration or calibration verification prior to analysis of any samples.
- Method blank analysis daily or at a frequency of 1/20 samples, whichever is greater.
- Analysis of an independent reference standard daily to assess the accuracy of the calibration. This reference standard check should cover low, mid-level, and high ranges when appropriate.
- Analysis of laboratory MS/MSD on a frequency of 1/20 samples to assess the precision of analysis.

- Determination of the minimum reporting limit based on detection limit studies and the concentration range of calibration standards.

Analytical procedures are documented in writing as SOPs and each SOP includes a QC section which addresses the minimum QC requirements for the procedure. All data obtained will be properly recorded. The internal data package will include information capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. Samples analyzed in nonconformance with the QC criteria will be reanalyzed by the laboratory, if sufficient volume is available. It is expected that sufficient volumes or weights of samples will be collected to allow for reanalysis when necessary.

3.2.2 Analytical Instrument Calibration Procedures

Instruments and equipment used to gather, generate, and/or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturers' specifications.

Laboratory analytical calibration procedures will be in general conformance with U.S. EPA SW-846 guidelines as appropriate to the chosen method. Deviations from conformance are documented in the laboratory QAM.

Calibration of field instruments is governed by the specific SOP for the applicable field analysis method. These instruments and equipment should be calibrated in accordance with the manufacturer's recommendation. Field forms used to document appropriate equipment calibration are provided in **Attachment E**.

3.2.2.1 Method Detection Limits

The method detection limit (MDL) is the lowest concentration at which an analyte can be measured and reported with a 99 percent confidence the concentration is greater than zero. The MDL should be determined by the analyzing laboratory by multiplying the appropriate one-sided 99 percent T-statistic by the standard deviation obtained from at least seven analyses of a spike containing the analyte of interest at a concentration of three to five times the anticipated MDL.

MDLs for each target analyte will be determined by the analytical laboratory using the applicable SW-846 protocols or the specified analytical method (e.g., Standard

Methods or ASTM methods). Laboratory MDLs for project specific analytical methods are included in **Tables 1 through 3.**

3.2.2.2 Reporting Limits

As specified in SW-846, practical quantitation limits, or reporting limits (RLs), are defined as the lowest level of quantitation that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The RLs are generally five to 10 times the MDL but may be individually selected within these guidelines to simplify and streamline data reporting. During instrument calibration, the laboratories shall demonstrate that the RLs are routinely and reliably achieved by analyzing a calibration standard that is below the RL for each analyte. Laboratory reporting limits for project specific analytical methods are included in **Tables 1 through 3**.

3.2.3 Instrument/Equipment Testing, Inspection and Preventative Maintenance Requirements

Field and laboratory analytical instruments and equipment will be tested, inspected, and maintained according to the manufacturer's guidelines and recommendations. Data collected from improperly functioning equipment will not be used to evaluate decision rules but will be maintained for reference only. The equipment testing, inspection, and maintenance logs for contractor equipment will be made available upon request.

3.2.3.1 Laboratory Instrument Maintenance

To minimize downtime, preventative maintenance is routinely performed on each analytical instrument. Analytical instruments will be maintained and serviced in accordance with the manufacturers' specifications and according to the Laboratory QAM. When repairs are necessary, they will be performed by either in-house trained personnel or by the instrument manufacturer. An instrument-specific log will be kept for each analytical instrument and will contain a record of routine maintenance and repairs.

3.2.3.2 Field Instrument Maintenance

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. The measurement devices will be operated by trained personnel and in accordance with the appropriate user's manuals. In addition to the field QC, field measurements (e.g., conductivity, pH, dissolved oxygen, etc.) shall be made following accepted field protocols using documented and calibrated

equipment. Instrument calibration information and field QC measurements shall be documented in the field notebook and/or on the appropriate field forms. The instrumentation under the "generic" heading below is commonly used during environmental investigations and is presented to allow flexibility in instrumentation under the QAPP guidance. The instrument in the "specialized" section below are proposed to be used to facilitate investigative work.

3.2.3.3 Specialized Field Instruments

3.2.3.3.1 Hach DR900 Colorimeter

This instrument may be used during soil and surface water screening for cyanide and/or metals. A calibration check will be performed daily prior to usage and on as-needed basis. The DR900 Colorimeter is calibrated annually with the DR/Check Absorbance Standard Kit.

- The battery will be checked daily before use.
- The battery will be recharged when the instrument fails the battery check.
- The instrument will be calibrated annually.
- A diluted standard will be run to ensure accurate readings.
- A clean blank will be run before each sample.

3.2.3.3.2 HI98128 pH Probe

- The probe will be calibrated daily before use, using a 3-point calibration system (target pH of 4, 7, and 10) per manufacturers specifications.
- The electrode will be replaced as needed.

3.2.3.3.3 Oakton pH150

- The probe will be calibrated daily before use, using a 3-point calibration system (target pH of 4, 7, and 10) per manufacturers specifications.
- The electrode will be replaced as needed.

3.2.3.3.4 Hach pHC101

- The probe will be calibrated daily before use, using a 3-point calibration system (target pH of 4, 7, and 10) per manufacturers specifications.
- The electrode will be replaced as needed.

3.2.3.4 Generic Field Instruments

3.2.3.4.1 Photoionization Detector

This instrument may be utilized during soil screening. It will be calibrated daily prior to usage and on an as needed basis (i.e., if the fresh air readings do not remain

consistent). The PID is calibrated with reference gas mixture suitable to meet project objectives, typically isobutylene.

- The battery will be checked routinely, using the battery check function.
- The battery will be recharged when the instrument fails the battery check.
- The instrument will be routinely calibrated.
- The pre-filter will be changed when visibly dirty or when the signal is lower than expected during calibration.
- Critical spare parts for this equipment will be maintained by AME and will include appropriate pre-filters.

If a problem with the pump or lamp is encountered, the instrument will be replaced with a properly functioning instrument.

3.2.3.4.2 Flame Ionization Detector

This instrument may be utilized during field soil screening. It will be calibrated by the rental facility prior to use in accordance with manufacturer's specifications, typically to a methane standard reference.

- The battery will be checked routinely, using the battery check function.
- The battery will be recharged or replaced when the instrument fails the battery check.
- The instrument will be routinely zeroed using fresh air calibration.
- The pre-filter will be changed when visibly dirty or when the signal is lower than expected during calibration.

If a problem with the pump or flame is encountered, the instrument will be replaced with a properly functioning instrument.

3.2.3.4.3 Portable Variable Pressure Submersible Bladder Pump (or equivalent)

- The submersible pump assembly will be cleaned daily at a minimum with de-ionized water as well as between each sampling location.
- Dedicated tubing will be utilized at each sampling location.

3.2.3.4.4 Multi-parameter Meter and Flow-Through Cell

- The instrument and accompanying flow cell will be cleaned with laboratory-supplied de-ionized water daily.
- The batteries will be checked routinely, using the battery check function.
- The batteries will be changed when the instrument fails the battery check.
- The instrument will be routinely calibrated to preserve sensor condition.

- If sensors are not properly functioning, a new instrument will be delivered to the Site.
- Critical spare parts for this equipment supplied by the rental agency typically include electrolyte solution and membrane material for sensors, O-rings, and auto-calibration solution.

Calibration of the meter will be performed prior to initiating sampling, and on an as needed basis (i.e., if the parameters do not remain consistent), in accordance with the manufacturer's specifications. During each calibration, the "initial meter readings" and "final meter readings" are recorded on the calibration record provided in **Attachment E**. The instrument will be recalibrated as necessary if drift is observed during use.

3.2.3.4.5 Multiparameter Portable Meter (i.e. 4-Gas Meter)

- The batteries will be checked daily before use, using the battery check function.
- The batteries will be changed when the instrument fails the battery check.
- The instrument will be routinely calibrated to preserve sensor condition.
- If sensors are not properly functioning, a new instrument will be delivered to the Site.

If a problem with the battery or plug is encountered, the instrument will be replaced with a properly functioning instrument.

3.2.4 Analytical Supply Inspection and Acceptance Procedures

Supplies in support of analytical data acquisition will be obtained from qualified vendors. Field measurement supplies (e.g., calibration standards or field test kits) will be obtained from specialty vendors complete with maintenance and calibration records or standard traceability documentation.

3.3 Sample Handling and Custody Documentation

Sample quality must be maintained throughout the collection, transport, storage, and analysis process. Consequently, field activities must be fully documented, the samples must be clearly identified, and custody procedures followed in both field and laboratory operations. The primary objective of chain-of-custody procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from collection through completion of required laboratory analyses.

3.3.1 Field Logbooks/Documentation

Field logbooks provide the means of recording the data collecting activities performed. As such, entries will be described in as much detail as possible so that people going to the Site can reconstruct a particular situation without reliance on memory. Field logbooks or notebooks will be bound and maintained by Field Personnel. Each logbook will contain the name of the project, project number/identification, and project start and end dates. Entries into the logbook may include the date, start time, weather, and name of sampling team members present.

Logs, records, and/or field forms will include entries in every blank, with appropriate use of the abbreviations NA (not available or not applicable) and NR (not recorded). If subsequent identical entries are present, an arrow from the initial entry to the ending identical field is also appropriate.

Entries shall be recorded in waterproof ink and signed and dated by the person making the entry. No erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark, initialed, and dated.

Measurements made, samples collected, and a detailed description of the sampling location will be recorded. Equipment used to make measurements will be identified, along with the time and date of calibration. The equipment used to collect samples will also be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers.

3.3.2 Custody

In general, chain-of-custody protocols will follow those outlined in the U.S. EPA Region 4 *Sample and Evidence Management* (U.S. EPA, 2013a) SOP. A chain-of-custody record will accompany samples that are collected. Chain-of-custody documentation will include the sample location, date and time of collection, type, amount, preservation method, type of analyses requested, sampler's name, date and time of custody transfers, and the signatures of the persons relinquishing and accepting the samples and the temperature of the samples upon arrival at the laboratory. A chain-of-custody will be initiated in the field and will accompany each group of samples for shipment to the laboratory. An example chain-of-custody form is provided in **Attachment F**. For routine sampling events, the

laboratory electronic chain of custody may be populated by the project team and included in the field instructions.

A sample or evidence file is considered to be in a person's custody if:

- It is in the possession of an authorized person;
- It is in the view of an authorized person, after being in his/her possession;
- It was in the possession of an authorized person and then he/she placed them in a secure location; or
- It is in a designated secure area.

The field sampler will be personally responsible for the care and custody of the samples until they are transferred or dispatched properly. As few people as possible will handle the samples. The Project Manager or designee will be briefed by Field Personnel for field activities and will determine whether proper custody procedures were followed during the field work.

3.3.3 Sample Dispatch

Two objectives of the procedures described in this section include: 1) compliance with DOT regulations for safe transportation of potentially hazardous materials; and 2) the maintenance of sample integrity during shipment. The following paragraphs describe sample segregation, shipping containers, sample cooling, and shipping methods.

The field personnel will decide how the samples will be separated for shipping, if necessary. The following are some general guidelines for the separation of sample for shipping:

- Reduce the number of trip blanks required by packing volatiles samples together in one cooler (reduces number of trip blanks required);
- To the extent possible, pack relatively "clean" and relatively "dirty" samples in separate coolers (reduces risk of cross contamination);
- Samples that are classified as similar "hazardous materials" should be packed together;
- It is not necessary to separate "hazardous materials" from non-hazardous materials; however, a cooler with a single hazardous material sample must comply with hazardous materials regulations as appropriate for laboratory samples.

Specifics of sample packing materials and procedures will vary slightly depending on which subcontract laboratory supplied the sample containers. The following is a typical procedure:

- Except for volatile samples, allow sufficient headspace in sample bottles (10 percent) to accommodate any temperature changes.
- Ensure that caps on containers are secure (will not leak); mark liquid level where appropriate.
- Place sample bottles inside plastic bag.
- Pack spaces with ice around sealed plastic bags.
- Place a thermometer or temperature blank in each sample cooler.
- Place chain-of-custody in a sealed plastic bag inside the cooler.
- If the cooler must be shipped via carrier (i.e., United Parcel Service [UPS]), the lid of the cooler must be closed and sealed with tape.

Environmental samples packaged as described above may be shipped by land transport, overnight air express, or delivered directly to the subcontractor laboratory by the sampling team or courier. Samples will be delivered to the laboratory within 24-hours following completion of the sampling event, unless otherwise specified or coordinated with the performing laboratory.

3.3.4 Sample Identification and Labeling

Each sample container will be labeled with a minimum of the project number, site location, sample identification, date/time of collection, initials of sampler, and analyses to be conducted and the type of preservation. Sample containers will be labeled with a unique sample identifier. Sample labels will be completed for each sample using waterproof ink. Samples will be named in compliance with the AME Standard Naming Convention (**Attachment G**) or as prescribed in the field instructions.

3.3.5 Transfer of Custody and Shipment Procedures

Samples will be accompanied by a properly completed chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to the permanent laboratory, or to/from a secure storage location.

At a minimum, the following information will be recorded on the chain-of-custody record along with the signatures and dates of custodians:

- Sampling Site identification,
- Sampling date and time,
- Identification of sample collector,
- Sample identification,
- Sample description (type and quantity),
- Sample container type, and
- Analyses to be performed.

Samples will be packaged properly for shipment and dispatched to the laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be secured prior to transport.

Samples will be either shipped daily from the field to the laboratory using a reputable courier, delivered directly to the laboratory by AME personnel, or picked up from AME by the laboratory. To ensure that holding time requirements are met, the carrier selected will be one providing dependable overnight delivery. The consultant will do everything possible to ensure overnight delivery of samples but will be held responsible only to the extent of the stated maximum sample holding times. Samples not shipped overnight but otherwise properly preserved will be valid for that maximum holding time.

Shipments will be accompanied by the chain-of-custody record identifying the contents. The original record and remaining copies will accompany the shipment.

3.3.6 Laboratory Chain-of-Custody Procedures

Upon arrival at the laboratory, samples will be inspected thoroughly to confirm that the integrity of the samples and containers has not been compromised. The cooler custody seals (when applicable) will be inspected to verify that they are still intact and were properly signed and dated by the field sampling team. The individual sample containers will be inspected to verify that each has a sample tag or label. The condition of the samples will be noted on the chain-of-custody form, the sample condition upon receipt form, or an equivalent documentation method. The sample containers will be checked against the accompanying chain-of-custody to verify that the cooler contents are identical to the samples described on the chain-of-custody documents. In addition, the temperature of the samples will be noted by the laboratory at the time of receipt. If discrepancies exist, the laboratory will immediately notify the SA and/or Project Manager. The problem will be resolved, in writing, before the samples are taken for preparation or analysis.

After the receiving laboratory has determined that the samples are in satisfactory condition and the documents are in order, a sample login sheet will be initiated and will serve as documentation as to the condition of the samples upon receipt and their assigned laboratory numbers.

Once samples have been entered into the laboratory information management systems, copies of the log-in forms and chain-of-custody records will be sent to the SA, who will verify that the specified samples and parameters correspond to the samples and parameters identified in the QAPP. The samples will be placed in a secure storage area, under the conditions called for by the analytical method, until taken for analysis.

3.4 Quality Control Samples

QC is the set of activities that are performed for the purposes of monitoring, measuring, and controlling the performance of a measurement process (IDQTF, 2005). Various types of QC samples are described within this section, along with information regarding their frequency, effect on data usability, and potential corrective action.

3.4.1 Duplicates

Sample Duplicates are used to measure variability and are taken to assess and evaluate variation in concentrations of compounds or analytes across a Site, a specific area of investigation, across time, or across waste streams. Information regarding frequency, control measures, and corrective action regarding duplicates are presented in the discussion on analytical precision in **Section 2.6.3**.

3.4.2 Blanks

The primary purpose of blanks is to trace sources of artificially introduced contamination. Blanks are a critical component of the QA program to assess potential bias throughout the sample life cycle. Multiple blank types will be utilized to evaluate bias.

3.4.2.1 Blank Collection Frequency

Blank collection frequency is unique to the type of blank be collected and the type of bias being evaluated. Blank collection frequency is described in the following sections based on blank type.

3.4.2.1.1 Equipment Blanks [EBs]

An equipment blank is a sample of laboratory de-ionized provided de-ionized water poured over or through decontaminated field sampling equipment prior to collection for environmental analysis. The equipment blank assesses the adequacy of the decontamination process. Equipment blanks will be collected at least once per sampling event per matrix per sampling procedure that uses non-dedicated, non-disposable equipment.

3.4.2.1.2 Trip Blanks [TBs]

A trip blank is a sample of a laboratory provided de-ionized water that remains with the sample containers through the life cycle of the sampling event. Field transport (trip) blanks must be submitted for each investigation that involves sampling for TCE (and breakdown products). These blanks are prepared by analyzing laboratory used distilled, de-ionized water, shipped with the other sample bottles to the field, and then returned to the analyzing laboratory with the samples for analysis. Field transport blanks are packaged with the environmental samples collected during the sampling event.

The trip blank assesses the potential for introduction of TCE (and breakdown products) during sample container transport. Trip blanks will be collected at a minimum of one per cooler containing samples scheduled for the analysis. Care will be taken during sample packaging and shipping to group samples together to minimize the number of necessary blanks.

3.4.2.1.3 Rinsate Blanks [RBs]

Rinsate blanks are aliquots of the water used to create equipment blanks. Analysis of the source water will be used to verify the water is analyte free prior to decontaminating equipment. Rinsate blanks will be collected once per batch delivery of laboratory supplied rinsate water and analyzed for the Site PC list. Based on the level of data quality necessary to satisfy PQOs, rinsate blanks may not be collected during this project phase. Introduction of potential systemic bias will be evaluated via the rinsate blank results.

3.4.2.1.4 Temperature Blanks

A temperature blank is a small sample bottle usually filled with water that is placed in each cooler. Upon arrival at the laboratory, the temperature of this vial is recorded. The temperature blank will not be analyzed and does not measure

contamination introduced during sampling. At least one temperature blank per cooler should be submitted with samples.

3.4.2.1.5 Method Blanks [MBs]

Method blanks are used to evaluate bias introduced at the laboratory extraction and/or analysis level. Method blanks will be analyzed by the laboratory at a minimum of one per analytical batch per matrix.

3.4.2.2 Blank Control Limits

Blanks are created from reagent grade de-ionized water, received directly from the analyzing laboratory. Blanks are assumed to be free of COCs of interest, confirmed via laboratory method blank analysis. Blank control limits will be set at the laboratory RL for each PC.

3.4.2.3 Blank Corrective Action

If contamination is identified in a QC blank type listed above, associated samples will be evaluated for presence and magnitude of the contaminant identified. Known CLCs (i.e. methylene chloride, 2-butanone, acetone, and bis(2-ethylhexyl)phthalate) have been identified by the U.S. EPA (U.S. EPA, 2016) and may have special considerations when identified in project blanks. The following decision tree details the relationships between corrective action, data qualification, SR, BR, and RLs, which generally follows the *National Functional Guidelines for Organic Data Review* (U.S. EPA, 2016).

- If SR < RL, and BR > RL:
  - No qualification is necessary.
- If BR > RL, and SR > RL and SR < BR:
  - B-flag SR and report SR as undetected at the BR concentration.
- If MDL < SR < RL, and SR > RL or SR > 2xRL for CLCs:
  - B-flag SR and use professional judgement regarding data usability.
- If BR > RL and SR > RL or SR > 2xRL for CLCs:
  - B-flag SR and use professional judgement regarding data usability.
- If BR > 5x RL and SR > RL:
  - Report sample results and qualify as unusable (R-flag).
- If EB/TB/RB > RL, and SR ≤ 3x EB/TB/RB:
  - B-flag SR and report SR as undetected at the EB/TB/RB concentration.
- If EB/TB/RB > RL, and 3x EB/TB/RB < SR < 10x EB/TB/RB:

- Report SR with both a B-flag and a J-flag denoting an estimated result due to blank contamination.

- If EB/TB/RB > RL, and SR > 10x EB/TB/RB:
  - Report SR with no qualifier as blank contribution is negligible.

3.4.2.4 Blank Reporting

Analytical results for project and laboratory blanks (i.e. MBs, EBs, RBs, and TBs) will be reported by the analyzing laboratory. Data qualifiers generated by data usability assessments on project blanks associated with individual samples will be presented on project tables.

3.4.3 Spikes

Spike samples are used to measure accuracy and bias and are taken to assess replicability in both the field sampling protocols and analytical methods. Spikes are used to evaluate the performance of the laboratory, as well as estimate the influence of the sample matrix on the retention of target compounds. MS/MSDs should be collected from locations expected to be relatively free from contamination, since the sample will be used for laboratory QC procedures.

Information regarding frequency, control measures, and corrective action regarding spike samples are presented in the discussion on accuracy and bias in **Section 2.6.4**.

3.4.4 Poorly Performing Compounds

Corrective actions will be initiated due to results outside control criteria, as needed (not expected).

3.5 Data Management Tasks

The primary goal of data management is to ensure that decisions are supported by data of the type and quality needed and expected for their intended use. Accomplishment of this goal involves a set of activities conducted during the planning, implementation, and assessment of data collection. Data processing, verification, and validation are the quality-management tools used to determine if project data meet the planned DQOs and requirements defined in this QAPP and in task-specific field instructions. During data processing and validation, project data will be evaluated for completeness, correctness, and compliance against the method, and procedural or contractual requirements of the project.

After each sampling event, calculations, and determinations for precision, completeness, and accuracy should be made and corrective action implemented if needed. If DQIs do not meet the project's specifications, data may be discarded and re-sampling may occur. The cause of the failure will be evaluated. If the cause is found to be equipment failure, calibration and/or maintenance techniques will be reassessed and improved. If the problem is found to be sampling team error, team members will be retrained. Any limitations on data use should be detailed in both interim and final reports, and other documentation as needed. If failure to meet project specifications is found to be unrelated to equipment, methods, or sample error, specifications may be revised for the next sampling event.

Project data and information must be documented in a format that is usable by project personnel. The QAPP describes how relevant information will be documented, tracked, and managed, from generation in the field, through data reduction, to final use and storage, in a manner that ensures data integrity, defensibility, and retrieval.

3.5.1 Project Documentation and Records

Document management protects a project from losing track of its documents or losing the document itself. Document management achieves the following objectives:

- Provide safe storage of all documents in a project library.
- Provide clarity regarding which version of a document and/or deliverable is the latest version.
- Provide a record of approved deliverables over the life of the project.
- Provide measures to maintain restricted access to confidential documents.
- Provide an accurate and complete archive of project documents at the end of the project.

For purposes of this plan a "document" is any electronic and/or hard copy media designed to convey information about or on behalf of a project, including but not limited to books, deliverables, accounting records, drawings, electronic mail, faxes, letters, memorandum, organizational charts, pictures, presentations, project binders, reports, specifications, and spreadsheets.

3.5.1.1 Recordkeeping Protocols

Raw data from field measurements will be recorded directly in field notebooks or on sample logs. Field data documented in field data reports will be maintained in original, unedited form and will include logs, field measurements, and chain-of-

custody forms. If data are reduced for inclusion in summary tables, the method of reduction will be documented in the report. Post task-specific field activities field personnel will scan the required documents into the job folder. The Project Manager or designee will verify that documents are accurate. The Project Manager or designee will be responsible for ensuring documents are present and legible.

Documents associated with a specific task will be filed by the Project Coordinator within the specific job project folder. Project records will be maintained both in printed and electronic formats whenever practicable. Printed records[2] serve as the official record and will be maintained in accordance with regulatory requirements. Electronic records, wherever possible, will be maintained in write-protected formats such as the Portable Document Format (PDF). In maintaining and archiving these electronic records, Project Managers will follow guidance and procedures that the regulating agency has established for electronic records.

Documents and records typically produced may include, but are not limited to, those examples in the following sections.

3.5.1.2 Sample Collection and Field Measurement Records

- Task-specific field instructions;
- Preliminary assessment and/or Site inspection reports;
- Field data collection sheets;
- Purge records;
- Chain-of-custody records;
- Communication logs;
- Corrective action reports;
- Documentation of internal QA review;
- Electronic data deliverables;
- Identification of QC samples
- Sampling instrument decontamination records;
- Sampling instrument calibration logs;
- Sampling location and field sampling plans;
- Sampling notes and drilling logs

3.5.1.3 Analytical Records

- Chain of custody documentation;

[2] Printed records may be converted to electronic format and designated as the official record and maintained for three years or as according to the August Mack or Regulating Agency's Record Retention Schedule. If this is done, security protections must be in place to conform with agency records policies.

- Sample condition upon receipt forms;
- Tabulated data summary forms and raw data for field samples;
- Case narratives;
- Corrective action reports;
- Definition of laboratory qualifiers;
- Electronic data deliverables;
- Instrument calibration reports;
- Other project specific documents in the laboratory's possession, such as communication logs; MDL studies; proficiency testing results, and precision and accuracy studies, may be available upon request.

Each laboratory must make available their record-handling policies. Each laboratory must have a documented sample acceptance policy. This policy must describe the minimum data elements for samples submitted to the laboratory for analyses. Complete sample documentation, adequate quantities of properly preserved sample material must be supplied to accommodate analytical tests required by the requestor, field instructions and laboratory analytical reports are required documentation for projects.

3.5.1.4 Project Data Assessment Records

- Analytical audit checklists;
- Data verification reports;
- Data validation reports;
- Corrective action reports;
- Data usability assessment narratives;
- NELAP accreditation

3.5.1.5 Corrections to Documentation

All original data recorded in field notebooks, chain-of-custody records, and other forms will be written in water-proof ink. None of these documents will be destroyed or discarded until electronic copies have been created. If an error is made on a document assigned to one individual, that individual will make corrections by crossing a single line through the error, entering the correct information, and initialing the correction. Changes to electronic records must mirror changes to printed records.

3.5.1.6 Warehousing

Throughout the course of the project, documents generated for the project, either by August Mack or its subcontractors are scanned and maintained in either a scanned or searchable Portable Document Format (PDF) or other file format

approved by project stakeholders in the appropriate folder for a minimum of three years. Finalized versions of reports are saved as both a compiled PDF file and any originating sub-files (e.g. attachments, appendices, tables or figures). Draft copies are deleted when appropriate.

Project documents will be warehoused on August Mack servers, generally sorted to the following drives:

DRIVE LETTER	LOGICAL NAME	PURPOSE
O:	Ohio VisionDocs	Storage of Ohio Projects for years 2022-2025 (and future work)
K:	VisionArchive	Storage of historical, archived Projects
N:	Indy NAS	Storage of Shared, Accounting, and Marketing data

3.5.2 Data Package Deliverables

Data packages should be consistent within the project phase, and the contents of data deliverables necessary to meet PQOs are specified within the QAPP.

3.5.2.1 Sample Collection and Field Measurements Data Package Deliverables

As part of the project-specific field event, the AME project team will prepare a field packet, consisting of applicable components of the QAPP, a copy of the project HASP, field instructions, and appropriate field data documentation records (**Section 3.5.1**).

Upon completion of field work, the project packet is initially reviewed for accuracy and completeness by the field team. The project packet is then given to the Project Manager, who will perform a completeness review on the field records to ensure that components of the field event are properly documented. Project documentation, field notes, and raw field records will be scanned and saved electronically.

3.5.2.2 Analytical Laboratory Data Package Deliverables

There are five analytical data package types that address various data uses and the QA/QC effort and methods required to achieve the desired level of quality.

Data Quality Analytical Package Types

Data Quality Deliverable Type	Description
Level I	Includes measurements/analytical results only.
Level II	Standard analytical laboratory deliverable; includes method blank, LCS, MS/MSD, and surrogate information.
Level III	Includes Level II information and raw calibration data (initial calibration curves, continuing calibration curves, tune reports, interference check standards, etc.)
Level IV	Includes all Level III information as well as quantitation reports and chromatography for blanks, spikes, checks and original samples. Similar to the U.S. EPA CLP analytical data package.
Level V (Non-Standard)	Provided when analyses by non-standard protocols are utilized; for example, when exacting detection limits or analysis of an unusual chemical compound is required. May require documentation of method development or adaptation.

Level II deliverables will be requested for Site work associated with this QAPP. For the final groundwater sampling event and for soil delineation sampling, Level IV data packages will be requested.

3.5.3 Data Reporting Formats

Laboratories will be required to provide analytical data in both PDF report format and excel tabular format EDD. EDDs will be directly imported into analytical tables to eliminate transcription errors. Analytical data will be reduced in project tables to present results, or if an analyte is not detected, a less than followed by the reporting limit will be presented. Data presentations will be formatted in such a way that evaluative identifiers can be assessed regardless of if the table is in color or reproduced in black and white copy.

3.5.3.1 Document Standards

Project documents will be authored in a standardized format in accordance with the August Mack Style Guide internal guidance document.

3.5.3.2 Document Development and Storage Tools

Project documents will use the following standard tools to develop documents, spreadsheets, e-mail, web content, and databases.

DOCUMENT TYPE	DEVELOPMENT TOOL	STORAGE LOCATION
Document	Microsoft 365	O:\Current Active Project Number
Spreadsheet	Microsoft 365	O:\Current Active Project Number
E-mail	Microsoft 365	MS Outlook
Figures / Illustrations	AutoCAD 2023	O:\Current Active Project Number
GIS	QGIS	O:\Current Active Project Number

3.5.3.3 Document Version Control

One electronic copy of each document is saved in the project folder, initially labelled with the filename suffix "-DRAFT". Once peer review and revisions are complete, the filename will be overwritten with the suffix "-FINAL". Once new versions are created, the previous copies are deleted in the same manner. Additionally, once a finalized version of a document is created, all draft copies are deleted when appropriate..

3.5.4 Data Management and Handling

3.5.4.1 Data Recording Practices

Raw data from field measurements will be recorded directly in field notebooks or on sample logs. Transcribed data will be peer reviewed to ensure transcription accuracy and completeness**.**

3.5.4.2 Data Transformation and Data Reduction

Data reduction includes processes that change the number of data items. This process is distinct from data transformation in that it entails an irreversible reduction in the size of the data set and an associated loss of detail.

The laboratory will be responsible for data reduction at the analytical level, including calculation of dry weight dilution factors, manual integration protocols, reducing raw data to reportable data, in accordance with their QAM.

The SA will ensure that results are transformed into consistent units for data presentation, with solids in milligrams per kilogram and aqueous samples in micrograms per liter or other units based on project objectives.

3.5.4.3 Data Transfer and Transmittal

Data transmittal occurs when data are transferred from one person or location to another or when data are copied from one form to another. Raw data collected in the field will be transmitted from a notebook into field data collection forms and

entered into a field electronic database. All field forms will be scanned into the project folder and reviewed for completeness by the Project Manager. The SA or designee will then review the entries into the field electronic database for completeness. Once data, including laboratory data, is entered into the appropriate forms, at least 5% of the transmitted data will be reviewed for errors by the Project Manager or designee. Any errors in data transmission will be corrected and documented.

3.5.4.4 Data Analysis

Data analysis may involve the computation of summary statistics, standard errors, and confidence intervals, tests of hypotheses relative to model parameters, trend tests and goodness-of-fit tests. Data analysis will typically be performed in conjunction with an investigative effort. Any calculations performed and subsequent derivative data will be traceable by reference to a source or established methodology.

3.5.4.5 Data Review

Data review may include the following third-party programs for data review and analysis such as:

- Potentiometric surface map generation using Golden Software's Surfer® modeling program.
- Statistical trend analysis or Theil-Sen slope approximation using ProUCL software.

3.5.5 Data Tracking

Data is tracked using excel databases and/or web-based Structured Query Language databases. The excel database track analytical data collected within excel sheets throughout the course of the project. Data entry into the project database should only be performed by qualified personnel. Field data and other non-analytical data will be transcribed and tracked via documentation checks and peer review performed by the Project Manager or designee and random audits of at least five percent of the data transmitted throughout the project lifecycle.

3.5.6 Final Evidence Files Custody Procedures

A final evidence file will be maintained for the duration of the work performed under the QAPP and will be maintained by the Project Manager. This file will be kept within the consultant's office and contain original copies and/or electronic copies of the following documentation:

- Project correspondence,
- Historical data,
- Field data,
- Analytical data,
- Data analysis, and
- Deliverables.

Copies of pertinent documents will also be provided in complete form to the regulating agencies upon their request.

4. ASSESSMENTS AND RESPONSE ACTIONS

Project data will be assessed to determine if the data falls in line with the DQOs. Factors considered in this assessment include, but are not limited to:

- The risk assessment parameters chosen based on conditions and possible receptors involved in a project (i.e. ecological data quality levels, human health data quality levels, or risk-based screening levels).
- The contaminants known and/or suspected to be of concern to the project, as they relate to the data quality level parameters chosen.
- The choice of analytical and sample preparation methods for contaminants of concern, which MDLs will meet or exceed the data quality level concentrations for those contaminants.

Once these goals and objectives are evaluated and chosen, analytical data quality will be assessed to determine if the objectives have been met. In addition, the data will be reviewed for indications of interferences to results caused by sample matrices, cross contamination during sampling, cross contamination in the laboratory, and sample preservation and storage anomalies (i.e. samples holding time or analytical instrument problems).

4.1 Assessments Activities and Project Planning

Various types of assessment activities may be used to evaluate the effectiveness of environmental program implementation. Data assessments may be performed by the Project Manager or data management personnel. Data assessment frequency will be dependent on the projects' duration and at the discretion of the Project Manager.

4.1.1 Surveillance Assessments

Projects will be continuously monitored to ensure that specified requirements are being fulfilled.

4.1.2 Data Quality Assessment

DQAs will be performed prior to the project's final report. A DQA involves the determination of whether the data meets the assumptions under which the DQOs and data collection design were developed. As a default, data usability assessments will only be documented on data that fails to meet project criteria.

4.2 Corrective Action

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out of QC performance

which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Corrective action proposed and implemented should be documented in the regular QA reports to management. For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. Nonconformance with the established QC procedures in the QAPP or field instructions will be identified and corrected in accordance with the QAPP.

4.2.1 Field Data Corrective Actions

Field data will be reviewed by the Project Manager for compliance with the QC criteria established in the QAPP and SOPs. Precision will be evaluated on the basis of reproducibility by multiple readings of a single parameter. Accuracy will be assessed through daily instrument calibration, periodic calibration checks, and analysis of blanks. Field personnel will be responsible for reporting any suspected technical or QA deficiencies to the Project Manager. The Project Manager will be responsible for assessing the suspected deficiency and for determining the impact on the quality of the data.

Corrective action for field measurements may include the following:

- Repeat the measurement to check the error;
- Check for proper adjustment for ambient conditions such as temperature and humidity;
- Check batteries;
- Re-calibrate equipment;
- Check the calibration;
- Replace the instrument or piece of equipment; and/or
- Stop work.

If the field duplicate criteria are not met, the field sampling logbook will be examined for any physical/mechanical differences noted during sampling which would explain the discrepancy. The data not meeting the criteria will be qualified as estimated for those field duplicates only.

4.2.2 Laboratory Corrective Action

Laboratory personnel are alerted that corrective actions may be necessary for the following situations:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- Blanks contain target compounds above acceptable levels;

- Undesirable trends are detected in spike recoveries or RPD between duplicates;
- There are unusual changes in detection limits;
- Deficiencies are detected by the QA department during internal or external audits and/or from the results of performance evaluation samples; and/or
- Inquiries concerning data quality are received.

Corrective action procedures may be handled at the bench level by the analyst, who will review the preparation or extraction procedure for possible errors, check the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. If the problem persists or cannot be identified, the matter will be referred to by the laboratory supervisor, manager and/or QA department for further investigation.

4.2.2.1 Samples

If insufficient sample volume for analysis remains after shipment and storage, the Project Manager will be notified, and they will determine if another sample will be collected and shipped to the laboratory to complete the analysis within the proper holding times. The analysis report for the sample batch containing the affected sample will clearly note in the discussion section that a replacement sample was taken.

4.2.2.2 Sample Extracts

If a sample extract is broken or lost during analysis, the Project Manager will be notified. Depending upon the data completeness requirements for the specific sample type, another sample may be collected and shipped to the laboratory for analysis. The analysis report for the sample batch containing the affected sample will clearly note in the discussion section that a replacement sample was taken.

4.2.2.3 Quality Control Samples

If a QC sample is lost or broken during analysis, the Project Manager will be notified. A replacement QC sample may be sampled and analyzed depending on the type of sample. The analysis report for the sample batch associated with the QC sample will clearly note in the discussion section why the data is unavailable or if a replacement sample was analyzed.

4.2.3 Corrective Action during Data Verification, Validation, and Assessment

The need for corrective action may be identified during either the data validation or data assessment process. Potential types of corrective action may include resampling by the field team or reanalysis of samples by the laboratory.

4.3 Reports to Management

Reports on data verification/validation results and QA audit findings will be provided to the Project Manager. Problems or deficiencies that are not resolved in a timely or satisfactory manner may be brought to the attention of corporate management.

4.4 Performance and System Audits

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the QAPP. The audits of field and laboratory activities include two separate independent parts, internal and external audits.

4.4.1 Laboratory Audits

The laboratory will conduct routine audits of facilities, processes, and procedures according to written protocols established by the laboratory QA Program. These audits will be conducted by the laboratory Quality Department and the results documented in written reports. The laboratory audit will include a review of the following areas:

- Sample log-in procedures;
- Sample storage facilities;
- Analyst technique;
- Adherence to QAPP;
- Adherence to laboratory SOPs;
- Instrument calibration;
- Sample measurement; and
- Cleanliness and housekeeping.

During the audit, the analytical laboratory manager may validate representative data sets as described in 'Data Validation' of the QAPP.

External performance and systems audits of the analytical laboratory will be the responsibility of the regulating agency.

4.4.2 Field Audits

There will be at least one internal audit of field activities during the project's life if it exceeds a one-year period. Additional audits may be conducted if problems are encountered. The audit will be conducted by the Project Manager and cover the execution of sample identification, sample control, chain-of-custody procedures, field documentation, and sampling operations.

The Project Manager or designee will maintain a written record of the audit. If necessary, upon completion of the audit, the Project Manager will develop an audit report that summarizes those areas requiring corrective measures. This report will be submitted to the Senior Manager and resolution of final action as described under 'Corrective Action' of the QAPP will be subsequently implemented.

External audits of field activities will be the responsibility of the Ohio EPA.

5. DATA REVIEW AND USABILITY

5.1 Data Review Overview

Data review is the process in which data are examined and evaluated by a variety of personnel who have different responsibilities within the data management process. It includes verification, validation, and usability assessments.

5.2 Data Verification

Upon completion of data reduction and internal QA/QC processes by the external laboratory, data verification activities will be initiated. Data verification will occur on laboratory reported data. The goal of data verification is to ensure and document that the data are what they purport to be, that is, reported results reflect what was actually done. Verification is a two–step process: 1) verification of sample receipt and sample completeness criteria; and 2) verification of analytical results and quality control measures (U.S. EPA, 2009).

Verification includes a review of the QC deficiencies related to the chain-of-custody, hold time, duplicates, blanks, and laboratory control samples.

5.2.1 Completeness Verification

The Project Manager and/or SA is responsible for verifying completeness data. Completeness verification consists of a review of the proposed sampling plan against the executed sampling plan, where deviations from the proposed plan are documented and assessed for their effect on data usability. Initial verification may consist of evaluating any or all of the following:

- Review of SOPs included in the field instructions;
- Field calibration method and frequency;
- Date and time sampled;
- Field notes;
- Field records;
- Chain-of-Custody forms;
- SAFs; and
- Sample Condition upon Receipt Forms.

The Project Manager or designee will perform a QA review of data obtained from field measurements and document any deviations. The SA will review validity of data by checking calibration procedures used in the field and by comparing the data to previous measurements. Large variations (greater than 50%) and

inconsistencies will be examined for possible recollection of data or assignment to a lower level of validity. Copies of raw data and calculations used to generate final results will be retained to allow reconstruction of the data reduction process.

5.2.1.1 Data Reporting

Laboratory data shall be summarized in tabular form and included in reports. Complete laboratory reports shall be included as appendices to the report including QA/QC reports generated during the analysis of samples. Analytical results will be reported as discussed in the previous sections. Full validation reports will be generated for those samples reviewed under audit conditions.

5.2.2 Laboratory Verification

All laboratory reported data will be assessed according to the data assessment procedures outlined in this QAPP. Each sample will be verified to ensure that the procedures used to generate the data were implemented as specified. Deviations from these procedures must be documented in the final laboratory sample summary or QA narrative. Professional judgement will be used in determining the usability of the data. Laboratory verification may consist of evaluating any or all of the following:

- Chain-of-Custody forms
- Analytical Results
- Field QA/QC Samples.
- Blank Results
- Spikes

5.2.2.1 Data Qualifiers

Verification procedures may generate data qualifiers to be considered during data usability assessments. The table below summarizes the qualifiers used to identify specific samples and compounds that do not meet the quality control criteria identified in the QAPP.

Table 5.2.2 – Data Qualifier Summary

Qualifier	Description
J	The value is considered estimated.
J-	The value is considered estimated with low bias.
J+	The value is considered estimated with high bias.
R	The value is considered unusable.
B	The compound was also identified in an associated blank sample.

E	The RL exceeds the applicable closure level, SL, or action level.

5.3 Data Validation

Depending on PQOs, data validation may be necessary to satisfy quality needs for the established decision rules. During validation, laboratory data would be generally evaluated using the most current version of the procedures outlined in the *NFGs* and the QC criteria specified in the QAPP. Validation of data obtained from field measurements would be performed under the supervision of the SA. Validation would consist of an analyte and sample-specific process that extends the evaluation beyond method, procedural, or contractual compliance to determine the analytical quality of a specific data set. The goals of data validation are to evaluate whether the data quality goals established during the planning phase have been achieved, to ensure that project requirements are met, to determine the impact on data quality of those that were not met, and to document the results of the data validation and, if performed, the focused data validation.

Formal data validation is not planned for the current scope of work. However, validation procedures are outlined within the QAPP to provide flexibility as the project evolves.

5.3.1 Quality Precedence

Quality guidance may occasionally be in conflict during data validation or during the resolution of data management corrective action. When rules are in conflict between two or more quality documents associated with the project, the following guidance will take precedence, in order of highest precedence to lowest precedence:

- Project QAPP
- Laboratory QAM
- Analytical Method
- NFGs

5.3.2 Validatable Deliverables

The validatable data package generated by the laboratory will include the original laboratory report and raw and backup data needed to perform data validation. Copies of the chain-of-custody forms received at the laboratory, copies of laboratory log-in documentation, sample preparation bench sheets, and instrument run logs will be included in the data packages.

The data reports will be presented in a "CLP-like" format; CLP forms will be modified to accommodate different target analytes and quality control criteria. The laboratory will also generate electronic deliverables as determined for project needs. Analytical data will be reported by analysis and SDG, so that data review can occur in a timely manner.

5.3.3 Validation Procedure

If requested by the Project Manager, data validation will be performed with a minimum of 10 percent of the laboratory reported data. The U.S. EPA SW-846 Analytical Methods will be utilized to assist in the data review of the SDGs selected for data validation. The SA or designee will screen validatable data packages for completeness. After validatable data packages have been made available, the data will be compiled into tables to facilitate evaluation of the results. A review of the data entered into the tables will be performed for accuracy and completeness and corrections will be made as necessary.

Laboratory reported data will be accepted, rejected, or qualified based on guidance from the NFGs and/or the QC criteria specified in this QAPP. However, the data validator may use professional judgement to determine if there is any need to qualify data which were not qualified based on the QC criteria discussed in the *NFGs*. If systematic analytical problems affecting data quality are detected during the verification process, additional data packages for that analysis may be validated at higher frequency to determine root cause and corrective action.

5.3.3.1 Preliminary Validatable Data Packet Review

August Mack will obtain information pertinent to the sample collection data to be reviewed, such as field notes, sample locations, maps, number of samples, and the analyses requested to ensure that the proposed DQOs were achieved by the samples collected. A thorough understanding of the project objectives should exist to focus the data validation. In the preliminary review, the laboratory analytical data package should be checked to ensure that the requested documentation is present and in order. Any documentation that is missing should be immediately brought to the attention of the laboratory. A data summary table presenting the results of the sample analyses should also be prepared during the preliminary review.

5.3.3.2 Data Evaluation

Once the documentation pertaining to the samples is in order, a detailed data evaluation is made. This detailed evaluation will be performed on 10 percent of the laboratory reported data. The primary purpose of the validation is to ensure the qualitative and quantitative reliability of the reported results. The individual checks to be made depend upon the level of the data package obtained and the analytical methods used. A Level IV analytical data package is required to perform data validation. AME will utilize the guidance provided in the *NFGs* (U.S. EPA, 2010 and U.S. EPA, 2016) to evaluate, at a minimum, those areas listed within the NFGs including the following, at a minimum:

- Preservation
- Instrument Performance Checks
    - GC/MS Instrument Performance Checks for volatiles and semi-volatiles
    - GC/ECD Instrument Performance Checks (for pesticides)
    - ICP-AES – Interference Check Samples
- Initial Calibration
- Continuing Calibration Verification
- Blanks
- Deuterated Monitoring Compounds
- MS/MSDs
- Regional QA and QC (as applicable)
- Internal Standards (GC/MS and GC/ECD)
- Target Compound Identification (GC/MS)
- ICP Serial Dilutions (ICP-AES)
- System Performance
- Overall Assessment of Data

The laboratory should be notified promptly when calculation or transcription errors are found or if clarification concerning the data is needed. Incorrect data should be corrected by the laboratory and resubmitted.

5.3.3.3 Support Documentation

Support documentation should be prepared during the validation process and should include documentation of QC data required for the analytical methods as well as an indication of whether the analysis was performed acceptably. If unacceptable QC data are found, their impact on the results should be summarized in a report for the support documentation. The support documentation should also include photocopies of errors found, with the correct information replaced and noted.

5.3.3.4 Quality Assurance Report

The laboratory will prepare a QA report (e.g. case narrative) summarizing the findings and qualifying the data usability at the completion of their internal data validation process. The report must indicate the analyses that were performed, and the areas evaluated during the data validation. Problems that were found during the validation are expressed in terms of the impact on the data usability. The proper qualifier codes should be selected and placed next to affected data on the summary tables to express data usability. A complete list of laboratory data qualifiers is provided in the contract laboratory QAM. The QA report is presented to the project team to allow them to use the data confidently. The report should address the significance, relative to subsequent work and decisions, of any errors found during the QA review.

5.4 Data Usability/Quality Assessment

DQA is the scientific evaluation of data to determine if data obtained for environmental operations are the right type, quality, and quantity to support their intended use. The DQA involves five steps that begin with a review of the planning documentation and end with an answer to the question posed during the planning phase of the study. These five steps include reviewing the DQOs and sampling design, conducting a preliminary data review, verifying assumptions and drawing conclusions from the data.

It should be noted, that the DQA cannot absolutely prove that one has or has not achieved the DQOs set forth during the planning phase of the project. This situation occurs because a decision maker can never know the true value of the item of interest. Data collection only provides the investigators with an estimate of this, not its true value. Furthermore, because analytical methods are not perfect, they too can only provide an estimate of the true value of an environmental sample.

5.5 Data Reporting

Analytical results will be reported as discussed in the previous sections. Full validation reports will be generated for validated data (formal Level IV validation efforts). Reports generated from data generated under the purview of the QAPP will follow the guidelines presented herein.

6. REFERENCES

IDQTF, 2005. *Uniform Federal Policy for Quality Assurance Project Plans: Evaluating, Assessing and Documenting Environmental Data Collection and Use Programs: Part 1 – UFP-QAPP Manual.* Intergovernmental Data Quality Task Force. March 2005.

NJDEP, 2014. *Data Quality Assessment and Data Usability Evaluation Technical Guidance.* New Jersey Department of Environmental Protection – Site Remediation Program. April 2014.

U.S. EPA, 1998. *RCRA QAPP Instructions.* U.S. EPA Region V. April 1998.

U.S. EPA, 2000. *Data Quality Objectives Process for Hazardous Waste Site Investigations (EPA QA/G-4HW).* U.S. EPA Office of Environmental Information. January 2000.

U.S. EPA, 2001a. *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5).* U.S. EPA Office of Environmental Information. March 2001.

U.S. EPA 2002. *Guidance for Quality Assurance Project Plans.* U.S. EPA Office of Environmental Information. December 2002.

U.S. EPA, 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4)*. U.S. EPA – Office of Environmental Information. February 2006.

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U.S. EPA, 2013. *Sample and Evidence Management SOP*. U.S. EPA Region IV. January 29, 2013. http://www.epa.gov/region4/sesd/fbqstp/Sample-and-Evidence-Management.pdf.

U.S. EPA, 2014a. *Operating Procedures for Soil Sampling (SESDPROC-300-R3, 2014).* U.S. EPA Region 4 Science and Ecosystem Support Division. August 2014.

U.S. EPA 2014b. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods: SW-846 Update V – Revision 8*. U.S. EPA. July 2014.

U.S. EPA, 2020a. *National Functional Guidelines for Superfund Organic Methods Data Review: U.S. EPA 540-R-20-005*. November 2020.

U.S. EPA, 2020b. *National Functional Guidelines for Inorganic Superfund Data Review:* U.S. EPA *540-R-20-006*, November 2020.

FIGURES

Area of Concern (AOC)	Description
AOC-1	Adjacent Ditch
AOC-2	Wetland
AOC-3	Sawmill Creek (see Figure 2)
AOC-4	Site-wide Perched Water and Shallow Soil
AOC-5	Site-wide Groundwater
AOC-6	Building One Footprint

AOC-2

AOC-1

AOC-6

Weldon Ln

CANFIELD

CARDINALS

Subject Property

Area of Concern

Nearmap Aerial Imagery:
June 15, 2024

Material Sciences Corporation
Canfield

Areas of Concern

460 West Main Street
Canfield, Ohio 44406

N

0 50 100 ft

4401 Rockside Road, Suite 300
Independence, Ohio 44131
(330) 576-3229

AugustMack ENVIRONMENTAL

PROJECT NO.: JZ0412.372	DATE: 05/23/2025
	SCALE: 1:1,500
FIGURE: 1	CREATED BY: CC

TABLES

Material Sciences Corporation
Canfield, Ohio

TABLE 1

SOIL DATA QUALITY OBJECTIVES SUMMARY

August Mack Project No.:
JZ0412.372

Target Analyte	CAS Number	Matrix	Prep Method	Analysis Method	Laboratory	Container Type	Extraction Hold Time	Analysis Hold Time	Reporting Limit	Method Detection Limit	LCS Recovery Criteria	MS/MSD Recovery Criteria	MS/MSD RPD Criteria	Comparative Criteria					
														2025_04 Residential Direct Contact (1E-6/0.1)	2025_04 Industrial Direct Contact (1E-5/1.0)	2025 U.S. EPA Construction Worker Criteria	2025_04 Recreator Direct Contact (1E-5/1.0)	2025_04 Soil Migration to GW (1E-5/1.0)	Maximum Leachable Contaminant (TCLP x 20)
							days	days	mg/kg	mg/kg	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Volatile Organic Compounds (VOCs)																			
1,1-Dichloroethene	75-35-4	Soil	U.S. EPA 5035	U.S. EPA 8260	Eurofins - Cleveland	5035 Sampling Kit	NA	14	0.0050	0.0018	68 - 141	44 - 160	37	23	20	TBD	127	0.0029	14
cis-1,2-Dichloroethene	156-59-2	Soil	U.S. EPA 5035	U.S. EPA 8260	Eurofins - Cleveland	5035 Sampling Kit	NA	14	0.0050	0.0015	78 - 124	48 - 132	37	6.3	369	TBD	314	0.0074	NE
trans-1,2-Dichloroethene	156-60-5	Soil	U.S. EPA 5035	U.S. EPA 8260	Eurofins - Cleveland	5035 Sampling Kit	NA	14	0.0050	0.0014	76 - 130	41 - 145	37	7.0	302	TBD	1,270	0.021	NE
Trichlorofluoromethane	75-69-4	Soil	U.S. EPA 5035	U.S. EPA 8260	Eurofins - Cleveland	5035 Sampling Kit	NA	14	0.0050	0.0027	50 - 154	36 - 161	40	2,300	350,000	TBD	53,000	3.3	NE
Vinyl chloride	75-01-4	Soil	U.S. EPA 5035	U.S. EPA 8260	Eurofins - Cleveland	5035 Sampling Kit	NA	14	0.0050	0.0018	49 - 146	32 - 163	38	0.059	17	TBD	0.68	0.000065	4.0
Metals																			
Zinc	7440-66-6	Soil	U.S. EPA 3050	U.S. EPA 6010	Eurofins - Cleveland	4 or 8 oz Glass Jar	NA	180	5.0	3.62	80 - 120	75 - 125	20	2,300	350,000	TBD	53,000	373	NE
Miscellaneous Wet Chemistries																			
Cyanide, Free	57-12-5	Soil	U.S. EPA 9013	U.S. EPA 9016	Eurofins - South Bend	4oz Amber Glass Jar	14	14	1.10	0.89	57 - 133	57 - 133	40	2.3	159	TBD	98	0.015	NE
Cyanide, Total	57-12-5	Soil	U.S. EPA 9013	EPA 9012	Eurofins - Cleveland	4oz Amber Glass Jar	14	14	0.50	0.40	65 - 128	24 - 140	40	2.3	NE	TBD	NE	NE	NE
Cyanide, Weak Acid Dissociable	57-12-5	Soil	U.S. EPA 9013	SM 4500 CN-I	Eurofins - Cedar Falls	4oz Amber Glass Jar	14	14	1.00	0.16	57 - 133	57 - 133	40	2.3	159	TBD	98	0.015	NE
Chromium, Hexavalent	18540-29-9	Soil	U.S. EPA 3060	U.S. EPA 7196	Eurofins - Cleveland	4 or 8 oz Glass Jar	1	7	0.4200	0.14	80 - 120	75 - 125	11	0.30	202	TBD	22	0.021	100
Corrosivity	NE	Soil	NE	U.S. EPA 9045	Eurofins - Cleveland	4 or 8 oz Glass Jar	NA	ASAP	NA	NA	NE	NE	NE	NE	NE	TBD	NE	NE	NE
Percent Moisture	NE	Soil	NE	ASTM D2974	Eurofins - Cleveland	4 or 8 oz Glass Jar	7	7	NA	NA	NE	NE	NE	NE	NE	TBD	NE	NE	NE

Abbreviations

LCS = Laboratory Control Sample
MDL = Method Detection Limit
MS/MSD = Matrix Spike / Matrix Spike Duplicate
NE = Not Established
OH VAP = Ohio Voluntary Action Program
RSL = Regional Screening Level
TBD = To Be Determined
TCLP = Toxicity Characteristic Leaching Procedure
U.S. EPA = United States Environmental Protection Agency

Notes

= Associated comparative criteria is less than the MDL.
= MDL used to meet associated comparative criteria

Maximum Leachable Contaminant obtained by multiplying TCLP levels from 40CFR 261 x 20.
U.S. EPA Residential (1E-6/0.1) and Industrial RSLs (1E-5/1.0) updated as of April 2025.
Recreator exposure assumes 155 days (early April to late Oct.), with 2-hr daily duration.
Soil Migration to Groundwater criteria obtained from U.S. EPA RSL Calculator, April 2025.
Construction Worker criteria to be determined via the U.S. EPA RSL Calculator.

TABLE 2
GROUNDWATER DATA QUALITY OBJECTIVES SUMMARY

Target Analyte	CAS Number	Matrix	Prep Method	Analysis Method	Laboratory	Container Type	Extraction Hold Time	Analysis Hold Time	Reporting Limit	Method Detection Limit	LCS Recovery Criteria	MS/MSD Recovery Criteria	MS/MSD RPD Criteria	Comparative Criteria					
														U.S. EPA Hazardous Waste Limits (TCLP)	2025 Maximum Contaminant Limit	2025 U.S.EPA Tap Water RSLs (1E-6/0.1)	2025 U.S.EPA Residential GW VISL (1E-5/1.0)	2025 U.S.EPA Industrial GW VISL (1E-5/1.0)	VURAM Construction Worker GW DC SLs
							days	days	µg/L	µg/L	%	%	%	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Volatile Organic Compounds (VOCs)																			
1,1-Dichloroethene	75-35-4	Water	NA	U.S. EPA 8260	Eurofins - Cleveland	3x40ml HCl Vial	NA	14	1.0	0.49	63 - 134	56 - 135	26	700	7.0	0.82	3.9	16	0.79
cis-1,2-Dichloroethene	156-59-2	Water	NA	U.S. EPA 8260	Eurofins - Cleveland	3x40ml HCl Vial	NA	14	1.0	0.46	77 - 123	66 - 128	14	NE	70	2.5	250	1,050	78
trans-1,2-Dichloroethene	156-60-5	Water	NA	U.S. EPA 8260	Eurofins - Cleveland	3x40ml HCl Vial	NA	14	1.0	0.51	75 - 124	56 - 136	15	NE	100	6.8	109	457	158
Trichloroethene	79-01-6	Water	NA	U.S. EPA 8260	Eurofins - Cleveland	3x40ml HCl Vial	NA	14	1.0	0.44	70 - 122	61 - 124	15	500	5.0	0.28	5.2	22	0.50
Vinyl chloride	75-01-4	Water	NA	U.S. EPA 8260	Eurofins - Cleveland	3x40ml HCl Vial	NA	14	1.0	0.45	60 - 144	43 - 157	24	200	2.0	0.019	1.5	25	13
Metals																			
Zinc	7440-66-6	Water	U.S. EPA 3050	U.S. EPA 6010	Eurofins - Cleveland	1x250ml Plastic; HNO3	NA	180	50	23	80 - 120	75 - 125	20	NE	NE	600	NE	NE	NE
Miscellaneous Wet Chemistries																			
Cyanide, Free	57-12-5	Water	U.S. EPA 9013	OIA-1677	Eurofins - Lancaster	1x250ml Plastic; NaOH	14	14	0.010	0.01	85 - 115	22 - 135	40	NE	200	0.15	201	844	0.14
Cyanide, Total	57-12-5	Water	U.S. EPA 9013	U.S. EPA 9012	Eurofins - Cleveland	1x250ml Plastic; NaOH	14	14	0.010	0.01	85 - 115	22 - 135	40	NE	NE	NE	NE	NE	NE
Cyanide, Weak Acid Dissociable	57-12-5	Water	U.S. EPA 9013	SM 4500 CN-I	Eurofins - Cedar Falls	1x250ml Plastic; NaOH	14	14	0.010	0.003	85 - 115	22 - 135	40	NE	NE	NE	NE	NE	NE
Chromium, Hexavalent	18540-29-9	Water	U.S. EPA 3060	U.S. EPA 7196	Eurofins - Cleveland	1x250ml Plastic	1	7	0.020	0.01	85 - 115	85 - 115	20	NE	NE	0.11	NE	NE	1,640

Abbreviations

GW DC SLs = Groundwater Direct Contact Screening Levels
LCS = Laboratory Control Sample
MCL = Maximum Contaminant Level
MDL = Method Detection Limit
MS/MSD = Matrix Spike / Matrix Spike Duplicate
NE = Not Established
RSL = Regional Screening Level
TCLP = Toxicity Characteristic Leaching Procedure
U.S. EPA = United States Environmental Protection Agency
VISL = Vapor Intrusion Screening Level

Notes

= Associated comparative criteria is less than the MDL.
= MDL used to meet associated comparative criteria

Characteristically hazardous waste criteria obtained from 40CFR 261.
U.S. EPA MCLs and Tapwater RSLs (1E-6/0.1) updated as of April 2025 and August 2025 respectively.
VISLs obtained from U.S. EPA VISL calculator assuming cancer risk of
1E-05 and hazard quotient of 1.0 in April 2025.

TABLE 3

VAPOR DATA QUALITY OBJECTIVES SUMMARY

Target Analytes	CAS Number	Matrix	Prep Method	Attenuation Factor	Analysis Method	Laboratory	Container Type	Extraction Hold Time (Days)	Analysis Hold Time (Days)	Laboratory Control Sample (LCS) Recovery Criteria	Reporting Limit* µg/m³	Method Detection Limit* µg/m³	U.S. EPA Residential VISLs (1E-5/1.0) µg/m³	U.S. EPA Industrial VISLs (1E-5/1.0) µg/m³	OSHA (Permissible Exposure Limits) PELs ppm / µg/m³
cis-1,2-Dichloroethene (cDCE)	156-59-2	Soil Vapor	NA	0.03	U.S. EPA TO-15	Eurofins - Folsom, CA	1L Summa Canister	NA	30	70% - 130%	3.7	1.3	1,390	5,840	NA
trans-1,2-Dichloroethene (tDCE)	156-60-5	Soil Vapor	NA	0.03	U.S. EPA TO-15	Eurofins - Folsom, CA	1L Summa Canister	NA	30	70% - 130%	3.7	1.6	1,390	5,840	NA
Tetrachloroethene (PCE)	127-18-4	Soil Vapor	NA	0.03	U.S. EPA TO-15	Eurofins - Folsom, CA	1L Summa Canister	NA	30	70% - 130%	6.4	2.4	1,390	5,840	NA
Trichloroethene (TCE)	79-01-6	Soil Vapor	NA	0.03	U.S. EPA TO-15	Eurofins - Folsom, CA	1L Summa Canister	NA	30	70% - 130%	5.1	0.83	69.5	292	NA
Vinyl Chloride (VC)	75-01-4	Soil Vapor	NA	0.03	U.S. EPA TO-15	Eurofins - Folsom, CA	1L Summa Canister	NA	30	70% - 130%	2.4	1.2	55.9	929	NA
cDCE	156-59-2	Sub-Slab Vapor	NA	0.03	U.S. EPA TO-15	Eurofins - Folsom, CA	6L Summa Canister	NA	30	70% - 130%	3.0	1.0	1,390	5,840	NA
tDCE	156-60-5	Sub-Slab Vapor	NA	0.03	U.S. EPA TO-15	Eurofins - Folsom, CA	6L Summa Canister	NA	30	70% - 130%	3.0	1.3	1,390	5,840	NA
PCE	127-18-4	Sub-Slab Vapor	NA	0.03	U.S. EPA TO-15	Eurofins - Folsom, CA	6L Summa Canister	NA	30	70% - 130%	5.2	1.9	1,390	5,840	NA
TCE	79-01-6	Sub-Slab Vapor	NA	0.03	U.S. EPA TO-15	Eurofins - Folsom, CA	6L Summa Canister	NA	30	70% - 130%	4.1	0.67	69.5	292	NA
VC	75-01-4	Sub-Slab Vapor	NA	0.03	U.S. EPA TO-15	Eurofins - Folsom, CA	6L Summa Canister	NA	30	70% - 130%	2.0	1.0	55.9	929	NA
cDCE	156-59-2	Indoor Air	NA	1	U.S. EPA TO-15	Eurofins - Folsom, CA	6L Summa Canister	NA	30	70% - 130%	3.0	1.0	41.7	175	200 / 790,000
tDCE	156-60-5	Indoor Air	NA	1	U.S. EPA TO-15	Eurofins - Folsom, CA	6L Summa Canister	NA	30	70% - 130%	3.0	1.3	41.7	175	200 / 790,000
PCE	127-18-4	Indoor Air	NA	1	U.S. EPA TO-15	Eurofins - Folsom, CA	6L Summa Canister	NA	30	70% - 130%	5.2	1.9	41.7	175	100 / 680,000
TCE	79-01-6	Indoor Air	NA	1	U.S. EPA TO-15	Eurofins - Folsom, CA	6L Summa Canister	NA	30	70% - 130%	4.1	0.67	2.09	8.76	100 / 540,000
VC	75-01-4	Indoor Air	NA	1	U.S. EPA TO-15	Eurofins - Folsom, CA	6L Summa Canister	NA	30	70% - 130%	2.0	1.0	1.68	27.9	1 / 2,500

*** = final value varies based on sample volume**

Abbreviations

µg/m³ = micrograms per meter cubed
MDL = Method Detection Limit
TCR = Target Cancer Rate
THQ = Target Hazard Quotient
U.S. EPA = United States Environmental Protection Agency
VISLs = Vapor Intrusion Screening Levels

Notes

Compounds, reporting limits, MDLs, and/or method version may be subject to change.
= MDL used to meet minimum comparison criteria.

VISLs generated via U.S. EPA VISL Calculator assuming a TCR of 1E-5 and THQ of 1.0.

TABLE 4
SURFACE WATER DATA QUALITY OBJECTIVES SUMMARY

Target Analyte	CAS Number	Matrix	Prep Method	Analysis Method	Laboratory	Container Type	Extraction Hold Time days	Analysis Hold Time days	Reporting Limit µg/L	Method Detection Limit µg/L	LCS Recovery Criteria %	MS/MSD Recovery Criteria %	MS/MSD RPD Criteria %	Comparative Criteria: Ohio EPA Non-Drinking Surface Water Human Health Criteria µg/L	Comparative Criteria: Ohio River Basin Aquatic Life and Human Health Tier I Criteria and Tier II Values µg/L
Miscellaneous Wet Chemistries															
Cyanide, Free	57-12-5	Water	U.S. EPA 9013	OIA-1677	Eurofins - Lancaster	1x250ml Plastic; NaOH	14	14	0.010	0.01	85 - 115	22 - 135	40	400	92
Cyanide, Total	57-12-5	Water	U.S. EPA 9013	U.S. EPA 9012	Eurofins - Cleveland	1x250ml Plastic; NaOH	14	14	0.010	0.01	85 - 115	22 - 135	40	NE	NE
Chromium, Hexavalent	18540-29-9	Water	U.S. EPA 3060	U.S. EPA 7196	Eurofins - Cleveland	1x250ml Plastic	1	7	0.020	0.01	85 - 115	85 - 115	20	NE	31

Abbreviations
EPA = Environmental Protection Agency
LCS = Laboratory Control Sample
MCL = Maximum Contaminant Level
MDL = Method Detection Limit
MS/MSD = Matrix Spike / Matrix Spike Duplicate
NE = Not Established

Notes

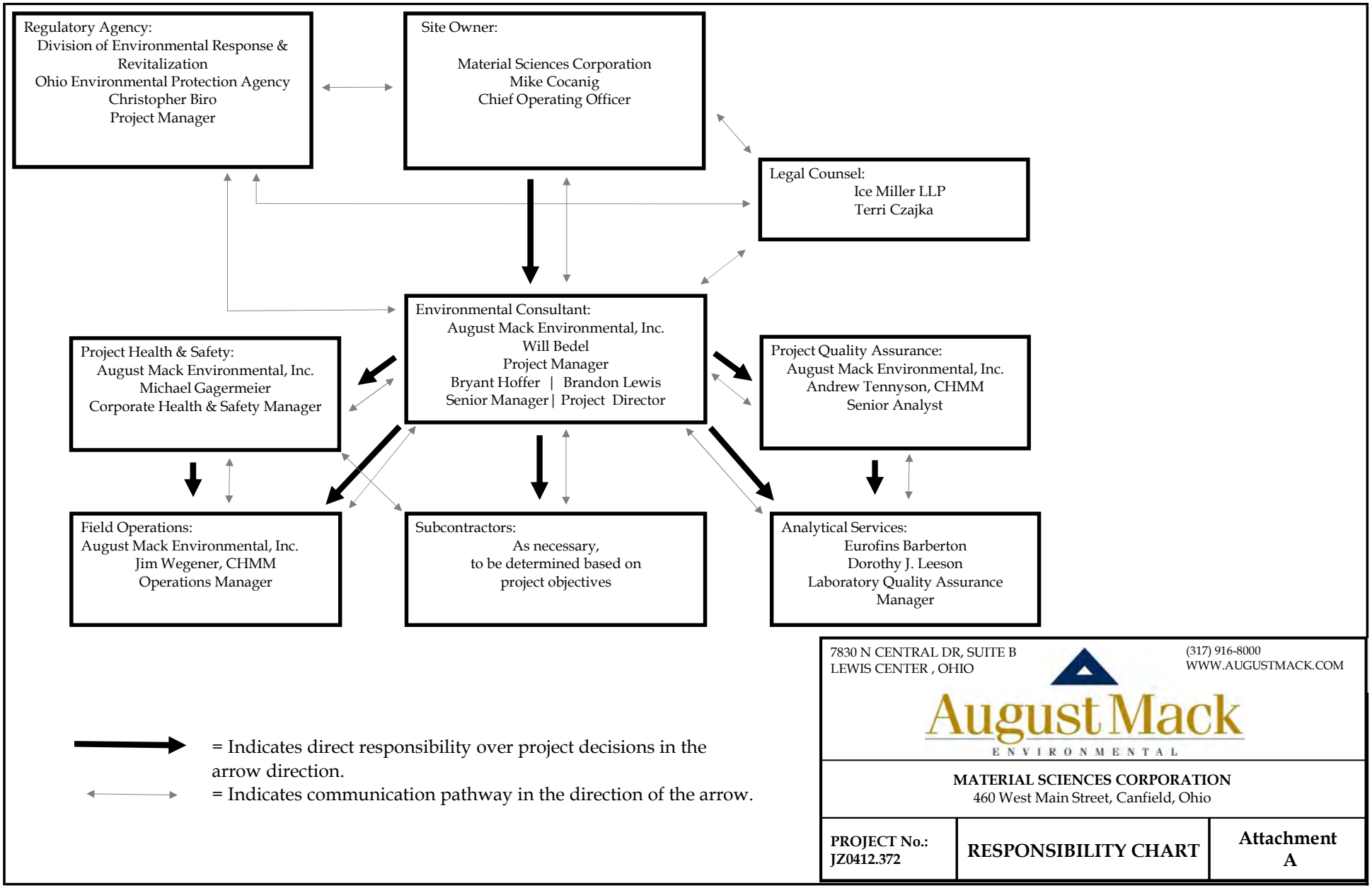
= Associated comparative criteria is less than the MDL.
= MDL used to meet associated comparative criteria

Criteria are based on Ohio Administrative Code Chapter 3745-1 for the Ohio River Basin revised December 2023.
Aquatic life criteria are based on Inside Mixing Zone Maximum values for limited warmwater habitats.

ATTACHMENTS

Attachment A

Responsibility Chart



7830 N CENTRAL DR, SUITE B
LEWIS CENTER , OHIO
(317) 916-8000
WWW.AUGUSTMACK.COM

August Mack ENVIRONMENTAL

MATERIAL SCIENCES CORPORATION
460 West Main Street, Canfield, Ohio

PROJECT No.: JZ0412.372	**RESPONSIBILITY CHART**	**Attachment A**

Attachment B

Field and Laboratory QC Elements and Assessment Criteria

Field and Laboratory QC Elements and Assessment Criteria

	QC Element	Frequency	Media[1]	Analyte Type[2]	Criteria
Field QC	Trip Blank	1 per cooler	All	Organic	Only required for VOCs
	Rinsate Blank	As necessary	All	All	< method reporting limit
	Equipment Blanks	At least once per sampling event per media per equipment set	All	All	< method reporting limit, or <10% of the lowest concentration identified in the sample
	Field Duplicate	1 per 20, but not to exceed 10% for each media sampled (at least one sample per field event)	Air, Water	Inorganic	RPD +/- 20% (Water) or +/- 20% (Air) for concentrations >5x the MRL
				Organic	
			Solids, non-aqueous liquids	Inorganic	RPD +/- 35% for concentrations > 5x the MRL
				Organic	
Laboratory QC	Method Blank	5% for each preparation	All	All	< reporting limit or < 10x the concentration of the sample result
	Laboratory Duplicates	Method dependent	All	All	Laboratory QC limits
	Lab Fortified Sample (MS)	1 per 20 or 5% for each preparation	All	All	Laboratory QC limits
	Surrogates	Each sample	All	Organic	Laboratory QC limits
	Laboratory Control Samples (LCS)	1 per analytical batch	All	All	Laboratory QC Limits

[1] Water applies to all aqueous media containing less than 15% settable solids, including drinking water, groundwater, surface water, waste effluent, etc. Solids applies to all aqueous media containing 15% or more settable solids, including soils, sediments, and sludge. Non-aqueous liquids applies to any non-water substance containing less than 15% solids, including solvents, fuels, oils, etc. Air applies to all media in the gaseous state at ambient conditions at the time of sampling.

[2] Inorganic analytes include all metals, nutrients, anions. Organic analytes include petroleum hydrocarbons, volatile/semi-volatile compounds, pesticides, herbicides, PCBs, and dioxin/furans. Not all analytes may be covered by this list.

Attachment C

Eurofins Laboratory
Quality Assurance Manual

Quality Assurance Manual Cover Page

Eurofins Cleveland
180 S Van Buren Avenue
Barberton, OH 44203
Phone: 330-497-9396

www.EurofinsUS.com/Env

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Quality Assurance Manual
Approval Signatures

Dorothy J. Leeson

Quality Assurance Manager –Date

03/10/25

Lucas Grossman

Technical Director –Date

03/13/25

SECTION 3. INTRODUCTION, SCOPE AND APPLICABILITY

3.1 Introduction and Compliance References

Eurofins Cleveland's (QA) Manual is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving the laboratory's QA Program. Governing SOPs are in place within the organization to ensure the proper execution of this QA Manual (refer to Appendix 1). This manual is required reading for all personnel. Supporting SOPs are assigned reading for relevant personnel.

The laboratory is a team of people who work together to serve the health and environmental needs of society through science and technology. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

As such, this QA Manual has been prepared to assure compliance with the applicable versions of The NELAC Institute (TNI) Standard and ISO/IEC Guide 17025, Policies and procedures referenced within this manual are compliant with the Eurofins Environment Testing (EET) National Business Line Service Center (NBLSC) procedures, Eurofins Environment Testing North Central, LLC, and the associated accreditation and certification programs held by the laboratory to support environmental work.

3.2 Terms and Definitions

A Quality Management Program is a system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the local management level through company goals, from guidance at the executive management level, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. Our program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization to better serve our clients.

Specific terms and acronyms used in the laboratory are defined in the corresponding procedures, identified in the analysis reports, and/or addressed in the referenced regulatory/method documents. An overall listing is provided in the NBLSC Document *NDSC-QA-FRM68791* - Common Terms, Definitions, and Acronyms.

3.3 .Scope / Fields of Testing

The laboratory analyzes a broad range of environmental and industrial samples. Sample matrices include, but are not limited to effluent water, groundwater, hazardous waste, sludge and soils. The QA Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work.

Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in LIMS.

Our areas of expertise include:

Eurofins Cleveland Standard Services	Eurofins Cleveland Specialty Services	Eurofins Michigan Services
Volatiles Semivolatiles Metals Pesticides/PCBs Petroleum Hydrocarbons Waste Characterization Non-Potable Water Testing Soil and Surface Water Testing Sediment and Tissue Testing Method Development Shale Oil & Gas Analysis	Organic Acids Incremental sampling and Particle Size Reduction Low Level Mercury PFAS Microbiology	Short Hold Non-Potable Water Testing Microbiology

NOTE: All current certificates and scopes of accreditation are available on the laboratory's website at **https://www.eurofinsus.com/environmenttesting/resources/certifications/**.

The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and/or the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 Quality Manual Review Process

The template on which this manual is based is reviewed annually by the NBLSC Quality Assurance leadership team. NBLSC QA will assure that the template complies with Section 3.1.

The manual itself is reviewed annually (or as required by state program) by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators. Occasionally, the manual may need to be revised in order to meet new or changing regulations and operations. The QA Department will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes in accordance with our Document Control processes.

4 MANAGEMENT REQUIREMENTS

4.1 Overview

The laboratory is an independent business unit with the Eurofins Environment Testing group of companies and includes Service Centers. Service Centers under the direct authority of Eurofins Cleveland include (but are not limited to) Cincinnati, and Columbus facilities in Ohio and Grand Rapids and Eurofins Michigan facilities in Michigan. Eurofins Michigan, located in Farmington Hills, Michigan, houses a small laboratory that performs short hold analysis as needed. The laboratory operational and support staff work under the direction of the Laboratory Director. The laboratory's quality system is managed under the oversight of the QA Manager with the Laboratory Director. The laboratory management staff includes directors, managers and group leaders.

The organizational chart of the management staff titles included in the manual is current as of the effective date of this document. Contact QA if a current version is needed or if an org change with the employee names is needed. Individual departmental staff lists are maintained in the laboratory's internal records.

4.2 Roles and Responsibilities

4.2.1 Business Unit Manager -BUMA

The Business Unit Manager is responsible for the overall quality, safety, financial, technical, human resource and service performance of the BU and reports to their Business Unit or Scope President. The BUMA is also responsible for any service centers connected with their BU that perform analytical tests, such as short holding time analyses. The BUMA provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures Eurofins human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory. Assesses laboratory capacity and workload

- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QA Manual or laboratory SOPs may be temporarily suspended by the BUMA.
- Contributes to the continuous improvement of the laboratory operations.
- Maintains an awareness of technical developments and regulatory requirements.
- Leads the management team, consisting of the QA Manager, the Technical Director, and the Laboratory Director as direct reports.

4.2.2 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system for the BU. The QA Manager is also responsible for any service centers connected with their BU that perform analytical tests.
The QA Manager reports directly to the NBLSC Quality Director and works with the BUMA and Laboratory Director at the laboratory. This position is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. The National Business Line Service Center (NBLSC) QA Team and procedures may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items.

The QA Manager directs the activities of the QA office to accomplish specific responsibilities, which include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- Have functions independent from laboratory operations for quality assurance oversight.
- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Have a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arrange for or conducting internal audits on quality systems and the technical operation
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QA Manual or laboratory SOPs shall be investigated following procedures outlined in Section 14 and if deemed necessary may be temporarily suspended during the investigation.
- Maintaining and updating the QA Manual.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- The laboratory QA Manager or designee will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.

- Objectively monitor standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Performing technical data audits and method audits to ensure consistency and compliance with regulatory requirements.
- Review of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the BUMA, Laboratory Director, clients and/or NBLSC QA
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.
- Participate in the vendor and supplier approval process, including subcontractors.
- Leads the QA team to enable communication and to distribute duties and responsibilities.
- Communication to the relevant regulatory authorities when there are management or facility changes that impact the laboratory.
- Ensuring communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.
- Evaluation of the thoroughness and effectiveness of training.
- Compliance with ISO 17025 and TNI Standard.

4.2.3 Technical Director

The Technical Director reports directly to the Laboratory Director. The Technical Director is accountable for all analyses and analysts under their experienced supervision and for compliance with the ISO 17025:2017 and TNI Standard. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and new instrumentation.

Specific responsibilities include, but are not limited to:

- Exercises day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of all test methods, i.e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. Insures that the SOPs are properly managed and adhered to at the bench. Develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Reviewing and approving client project proposals, with input from the QA Manager, and in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences

are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.

- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Coordinating sample management from “cradle to grave,” insuring that no time is lost in locating samples.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc.
- Captains department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinates audit responses with the QA Manager.
- Compliance with ISO 17025 and TNI Standard.

4.2.4 Laboratory Director

The Laboratory Director manages and directs the analytical production sections of the laboratory. The LD reports directly to the BUMA and assists the Technical Director in determining the most efficient instrument utilization.

- More specifically: Designates one or more technical managers for the appropriate fields of testing. If the Technical Director is unavailable for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another staff member meeting the qualifications of the Technical Director to temporarily perform this function. If the absence exceeds 35 calendar days, the primary accrediting body must be notified in writing.
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented. Works with Eurofins Environment Testing Human Resources for hiring of new personnel.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory. Assesses laboratory capacity and workload.

- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QA Manual or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves, or delegates the responsibility for review and approval, for all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 and TNI requirements.
- Ensures client specific reporting and quality control requirements are met.
- Contributes to the continuous improvement of the laboratory operations.
- Leads the laboratory team, consisting of the Laboratory Supervisors as direct reports.
- Evaluates the level of internal/external non-conformances for all departments.
- Ensures Eurofins human resource policies are adhered to and maintained.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.
- Develops and improves the training of all analysts in cooperation with the Technical Director and QA Manager and in compliance with regulatory requirements.
- Works with the technical departmental management and staff to ensure that scheduled instrument maintenance is completed.
- Coordinates scheduling all QA/QC-related requirements for compliance with the QA Department
- Captains department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinates audit responses with the QA Manager.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system.

4.2.5 Project Manager (PM)

The members of the laboratory Client Services/Project Management Group are responsible for organizing and managing client projects. Clients are assigned a project manager who serves as their primary contact at the laboratory. It is the PM's responsibility to act as the client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements – including all verbal communications.

With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Scheduling sample submissions, sample container orders and sample pick-up via the laboratory courier service.
- Confirming certification status

- Coordinating and communicating turnaround time (TAT) requirements for high priority samples/projects.
- Answering common technical questions, facilitating problem resolution and coordinating technical details with the laboratory staff.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample status reports or results prior to receipt of the final report.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.

4.2.6 Department Group Leaders

Department Group Leaders report to the Laboratory Director. Each one is responsible to:

- Ensure that staff in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if staff and processes are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.
- With regard to staff, participates in the selection, training (as documented in Section 5.3), development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of staff and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.
- Encourage the development of staff to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- In conjunction with the Technical Manager, Laboratory Director, and/or QA Manager, provide guidance to staff in resolving problems encountered daily during performance of their duties. Each is responsible for 100% of the data review and documentation, non-conformance, the timely and accurate completion of performance testing samples (PT) and MDLs, for the department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Director, and/or Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. Responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.

- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.7 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor.

The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- As applicable to their assigned tasks, document standard, reagent, and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the LIMS.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Director, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Technical Director, and the QA Manager. These improvements, if method compliant and approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

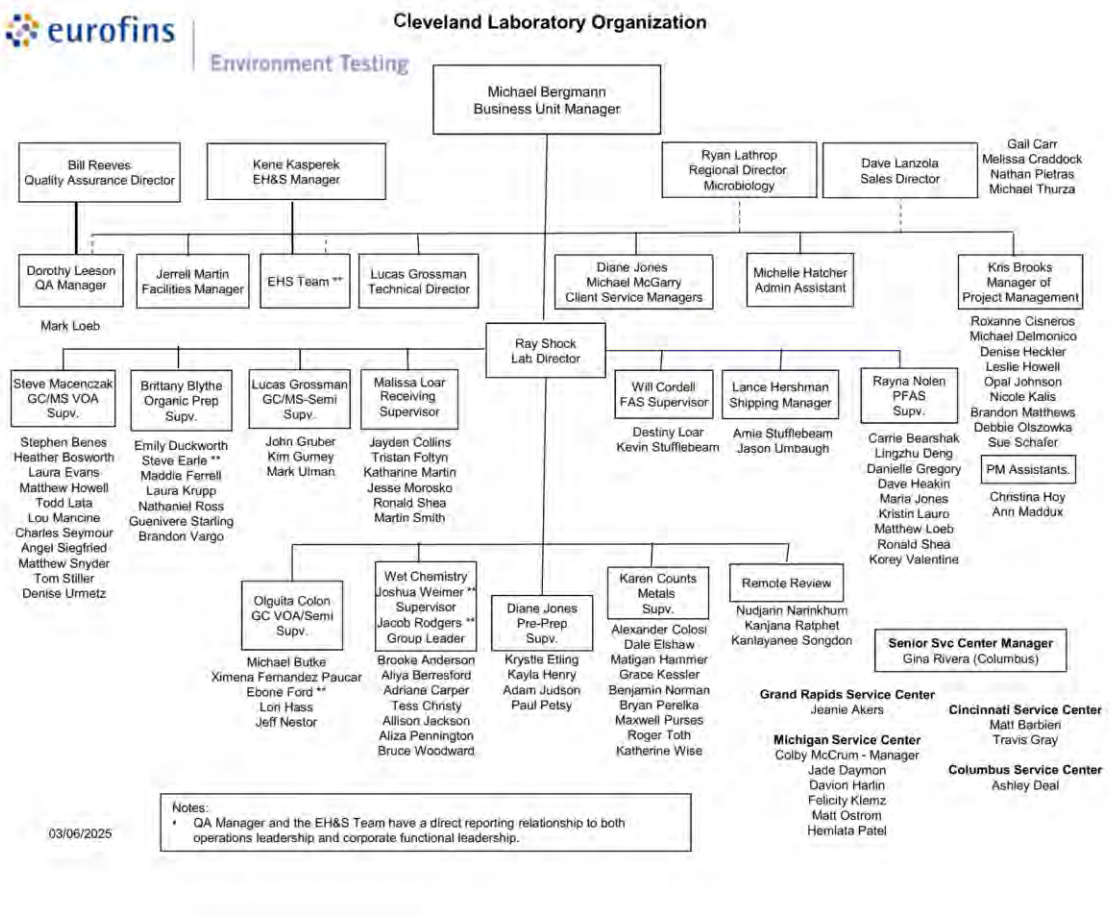
4.3 Business Continuity and Contingency Plans

Various policies and practices are in place to address continuity of business and contingency plans to ensure continued operations or minimal disruption in operations should unplanned events (natural disasters, unexpected management changes, etc.) occur. Deputies are identified for all key management personnel. Deputies would temporarily fill a role if the primary is absent for more than 15 consecutive calendar days. The deputies must meet the same qualifications as the primary person should they be required to take on the responsibilities. The QA Manager communicates to the relevant regulatory authorities when there are management or facility changes that impact the laboratory. Changes in the technical director must be communicated within a period of time and in the manner dictated by each regulatory authority.

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy
Laboratory Director	Technical Director QA Manager
Quality Assurance Manager	Quality Assurance Coordinator Laboratory Director
Technical Director	Laboratory Director Laboratory Group Leaders
EHS Team	EHS Team Members Laboratory Director

Figure 4-1. Laboratory Organization Charts



Note: ***Organization Charts are subject to change without notice.***

5.0 PERSONNEL

5.1 Overview

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel. The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of

experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

5.2 Education and Experience Requirements for Technical Personnel

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task.

Minimum education and training requirements for laboratory employees are outlined in job descriptions maintained by Eurofins Environment Testing Human Resources. https://testamerica365.sharepoint.com/sites/EETAIntranet/SitePages/Job-Descriptions.aspx.

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, colony counting, aseptic or quantitation techniques, etc., are also considered).

The TNI Standard includes specific requirements for Technical Managers (however named) as detailed in this table:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience

Specialty	Education	Experience
Technical Managers – **General**	Bachelor's Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Managers – **Wet Chem** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

5.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency.

Eurofins trainings are achieved through a combination of in-person presentations, recorded/electronic presentations/courses managed through the Eurofins Learning Centre (ELC) platform, supervised on the job training, and SOP reading. All training is documented with employee acknowledgement of completion.

New hire orientation and training begins the first week of employment. These initial sessions include overviews of the business, quality system policies and procedures, ethics and data integrity, resources, health and safety, and introduction of their job specific tasks.

Comprehensive **Environmental Health and Safety** training and review of the EHS Manual must be completed prior to performance of work in the laboratories.

Formal **Ethics and Data Integrity** and, where applicable, **Manual Integration** trainings are completed within the first 60 days of employment and include reading the associated policies and completing the assigned courses and presentations, in person and/or on-line.

Initial Demonstration of Capability (IDOC) must be completed and approved prior to independent performance of analytical method testing. See section 5.3.1.

The following occur annually:

Ethics and Data Integrity Refresher training all employees

Manual Integration Training - applicable employees

Ongoing Demonstration of Capability (ODOC)
technical staff - see section 5.3.2

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to “Demonstration of Capability” in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics.
- Documentation of proficiency.
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status and records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee’s secured personnel file.

Evidence of successful training could include such items as:

- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analyst’s knowledge to refer to QA Manual for quality issues.
- Analysts following SOPs, i.e., practice matches SOPs.
- Analysts regularly communicate to supervisors and QA if SOPs need revision, rather than waiting for auditors to find problems.

Further details of the laboratory's training program are described in the Laboratory Training SOP NC-QA-028.

5.3.1 Initial Demonstration of Capability (IDOC)

An individual must successfully perform an IDOC prior to independently analyzing and reporting client samples, and any time there is a change in instrument type, method, or any time that a method has not been performed by the analyst in a twelve (12) month period.

If the method or regulation does not specify an IDOC, it is the responsibility of the laboratory to document in their SOP what other approaches to the IDOC can be used.

The laboratory SOP NC-QA-028 details the following:

- the preparation and analysis of 4 laboratory fortified blanks (LFB or LCS).
- the evaluation criteria
- actions to be taken for IDOC failure

5.3.2 *Ongoing (Continuing) Demonstration of Capability (ODOC)*

The ODOC procedure is detailed in the laboratory SOP NC-QA-028. This process must be completed annually for each employee for the tests that they are performing. If the method has not been performed by the analyst in a twelve (12) month period, an IDOC shall be performed.

This on-going demonstration may be one of the following:

- acceptable performance of a blind sample (single blind to the analyst) or successful analysis of a blind performance sample on a similar method using the same technology (e.g., GC/MS volatiles by purge and trap for Methods 624 or 5030/8260)
- another IDOC
- at least four (4) consecutive laboratory control samples with acceptable levels of precision and accuracy
- for methods that do not lend themselves to spiking - documented process of observing the analyst performing the process and/or comparison of results between two analysts with documented evaluation of the precision

5.4 Data Integrity and Ethics Training Program

The laboratory's Ethics and Data Integrity Program is discussed in Section 7.2. Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics and Data Integrity Policy and the Eurofins Ethics Statement
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.

- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, an anonymous third party run hotline is available to all employees as a means of reporting ethics and/or data integrity issues or concerns.

- Lighthouse Services hotline at www.lighthouse-services.com/eurofinsus. via e-mail reports@lighthouse-services.com (include company name)
- or call 855-910-0005 (Spanish speaking 800-216-1288)

6.0 ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

6.1 Overview

The laboratory is a 42,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, microbiology, and administrative functions.

6.2 Environment

Laboratory accommodation, test areas, energy sources, and lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity,

voltage, temperature, and vibration levels in the laboratory. Spike/surge arrestors are installed to protect against power surge/sag and lightning strikes.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

When the laboratory performs laboratory activities at sites or facilities outside its permanent control, it shall ensure that the requirements related to facilities and environmental conditions of this document are met.

Specific requirements for facility and environmental conditions, as well as periodic monitoring of conditions, are given in the NDLSC Document NDSC-US-EHS-QP46060 Environmental Health & Safety Manual plus each laboratory's Facility Addendum.

6.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Sample incubation areas
- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory. Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory
- Sample receipt areas
- Sample storage areas
- Chemical and waste storage areas
- Data handling and storage areas
- Sample processing areas
- Sample analysis areas

6.4 Responding to Emergencies

Employees are trained in the procedures to respond to all emergencies that might occur in the workplace. Employees have been trained in the location and proper operation of all emergency equipment, evacuation routes and designated assembly areas for all areas where they work.

Refer to the NDSC EH&S Manual Document No. NDSC-US EHS-QP46060and the laboratory's local EH&S addendum for complete details. These documents provide direction for situations where normal operations of the laboratory are not possible (e.g., electrical failures, heating/air conditioning failures, fire/building evacuation, computer failures, hazardous material spills, injury to employees, pandemic flu, disruption of phone service, etc.)

In the event that the building or information technology (IT) systems would be severely challenged, a designated disaster recovery team, which includes Facility Management, Maintenance, Safety, Laboratory/Executive Management, Public Relations, IT, QA and other applicable personnel depending on the scope of the disaster, would assemble at a designated area to assess the situation and formulate a plan.

6.5 Building Security

The laboratory is considered a secure facility. All outside doors (including the main lobby entrance) are locked during normal business hours to prevent unauthorized entry. Building key fobs are distributed to employees as necessary.

Visitors to the laboratory sign in upon arrival in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the EH&S Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed. Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

7.0 QUALITY SYSTEM

7.1 Quality Policy Statement

The Quality Policy statement gives employees clear requirements for the production of analytical data. As an organization, all personnel are committed to high quality professional practice, testing and data, and service to our clients.

We strive to provide the highest quality data achievable by:

- Reading and understanding all of the quality documents applicable to each position and implementing the process in our work.
- Following all recordkeeping requirements; describing clearly and accurately all activities performed; recording "real time" as the task is carried out; understanding that it is never acceptable to "back date" entries and should additional information be required at a later date, the actual date and by whom the notation is made must be documented.
- Ensuring data integrity through the completeness, consistency, impartiality and accuracy of the data generated. Data is attributable, legible, contemporaneously recorded, original or a true copy, and accurate (ALCOA). This applies to manual paper documentation and electronic records.
- Providing accountability and traceability for each sample analyzed through proper sample handling, labeling, preparation, instrument calibration/qualification/validation, analysis, and

reporting; establishing an audit trail (the who, what, when, and why) that identifies date, time, analyst, instrument used, instrument conditions, quality control samples (where appropriate and/or required by the method), and associated standard material.

- ❖ Emphasizing a total quality management process which provides impartiality, accuracy, and strict compliance with agency regulations and client requirements, giving the highest degree of confidence; understanding that meeting the requirements of the next employee in the work flow process is just as important as meeting the needs of the external client.
- ❖ Providing thorough documentation and explanation to qualify reported data that may not meet all requirements and specifications, but is still of use to the client; understanding this occurs only after discussion with the client on the data limitations and acceptability of this approach.
- ❖ Responding immediately to indications of questionable data, out-of-specification occurrences, equipment malfunctions, and other types of laboratory problems, with investigation and applicable corrective action; documenting these activities completely, including the reasons for the decisions made.
- ❖ Providing a work environment that ensures accessibility to all levels of management and encourages questions and expression of concerns on quality issues to management. Eurofins recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff

  Continually improve systems and manage risk to support quality improvement efforts in laboratory, administrative and managerial activities

7.2 Ethics and Data Integrity

The Eurofins Environment Testing group of companies is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The laboratory operates our Ethics and Data Integrity program under the guidance of Eurofins Key Guidance Documents (KGD) and the Eurofins NBLSC Ethics and Data Integrity Policy.

The elements of our program include:

- An Ethics and Data Integrity Policy and Eurofins Ethics and Quality Policy Statements.
- Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A confidential mechanism for anonymously reporting alleged misconduct (see section 6.2 of this manual) and a process for conducting internal investigations of all alleged misconduct. Procedures and guidance for recalling data if necessary
- Effective external and internal monitoring system that includes procedures for internal audits (Section 17).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.

- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Provide procedures and guidance to ensure the impartiality and confidentiality of all data and customer information.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

7.3 Quality System Documentation

The BU's Quality System is defined and communicated through a variety of documents. There is a hierarchy of documents within Eurofins and for the local BU.

The top EET level documents are the NBLSC policies and procedures. These are written, approved, and released by the NBLSC QA team with input from NBLSC IT and EHS staff, where applicable. These documents provide procedures that can be used as guidance or a template for establishing local procedures or may be used directly as the local BU SOP by assigning the local staff to train on the NBLSC document. This level of document is written to address Environment US regulatory processes and requirements (i.e. ISO17025, TNI). Any individual state agency requirements are addressed locally.

The local BU defines its quality system through its own policies and procedures which must at a minimum meet the guidance set forth in the NBLSC SOPs. The BU documents are established using the following structure/hierarchy:

- Quality Manual
- Laboratory Operational SOPs and policies
  - those that apply to the BU as a whole
  - those that apply to specific areas of the BU
- Laboratory Analytical SOPs - define method specific processes to be followed in the laboratory tests
- Forms and Instruction Sheets - e.g., checklists, preformatted bench sheets, job aids

All of the documents described here are controlled with defined versioning, review, and approval processes. The BU management and QA staff have the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed.

7.4 Quality Control (QC) Objectives for the Measurement of Data

Quality Assurance (QA) is responsible for developing planned activities whose purpose is to provide assurance to all levels of management that a quality program is in place within the

laboratory, and that it is functioning in an effective manner that is consistent with the requirements of NELAP and any other regulatory agencies (i.e., states) in which the laboratory maintains accreditation.

Quality Control (QC) is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. The client is responsible for developing the QAPP; however, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS). See NBLSC Document *NDSC-QA-FRM68791* Common Terms, Definitions, and Acronyms for explanation. Each laboratory SOP defines the required QC indicators.

7.5 Criteria for Quality Indicators

The laboratory maintains tables, housed in LIMS that summarize the precision and accuracy acceptability limits for performed analyses. This summary includes an effective date, is updated each time new limits are generated, and are managed by the laboratory's QA department. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits are contained in NC-QA-018 Statistical Evaluation of Data and Development of Control Charts and in Section 24.

7.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846). The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts use the current limits entered into LIMS. The Quality Assurance department maintains an archive of all limits used within the laboratory. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the

sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

7.6.1 QC Charts

QC Charting is available in the LIMS for evaluation at any point by technical and/or QA staff. The laboratory's procedures for the creation of control charts are described in laboratory SOP No. NC-QA-018, "Statistical Evaluation of Data and Development of Control Charts." Control charts are created from data stored in the LIMS. The charts are reviewed by QA and/or technical staff to evaluate the statistical QC performance, to assess the need for corrective actions to improve method performance, and/or set new QC limits.

Control charts are used to develop control limits, trouble-shoot analytical problems, and, in conjunction with the non-conformance system, to monitor for trends. Program-specific data analysis requirements for control charts are followed as required for data generated under those programs. These additional requirements shall be documented in a QAPP.

7.7 Quality System Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to assess risk and to drive continuous improvement in the laboratory's Quality System. The metrics are reviewed by the BUMA and the QA Manager and shared with other management staff.

8.0 DOCUMENT CONTROL

8.1 Overview

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved current revision is in circulation and obsolete (original signed copy) and any obsolete hardcopies (other than the signed original) are destroyed. The laboratory's document control procedure is defined in SOP NC-QA-030 Document Control and in SOP NC-QA-027 Preparation and Management of SOPs.

The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- NBLSC Documents[1]

[1]Includes locally implemented documents that are document controlled within the laboratory's document control system.

The NDSC documents are only considered "controlled" when they are accessed as the electronic rile on the documents site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. .

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data, and final reports.

8.2 Document Approval and Issue

The pertinent elements of the document control system include a unique document title and number, pagination, the total number of pages of the item or an 'end of document' page, the effective date, expiration date, revision number, and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a responsible manager submits an electronic draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retains that document as the official document on file. That document is then provided to all applicable operational units. Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years and revised as appropriate. State or client programs may require a different review schedule. Changes to documents occur when a procedural change warrants.

8.3 Procedures for Document Control Policy

For creation of or changes to SOPs or the QA Manual, refer to SOP NC-QA-027.

Uncontrolled copies must not be used within the laboratory. Controlled documents are marked as such, and posted to a controlled laboratory access drive by the QA department or on D4 Controlled distribution is achieved electronically. Controlled hardcopies must be obtained through the QA Department. Previous revisions and back-up data are stored on a restricted access drive or on D4 by the QA department. Details of the numbering system, required format, and controlled distribution of documents are described in laboratory SOP No. NC-QA-027. Editable copies are stored on a restricted access drive or accessed by designated personnel in D4.

Forms, worksheets, work instructions and information are organized by the QA department. Controlled electronic versions are distributed through the intranet or on D4 and hard copies can be printed out as needed. Editable copies are stored on a restricted access drive or accessed by designated personnel in D4. All forms used in the laboratory are tracked in the controlled documents database which can be accessed by the QA department and the IT group in accordance with the procedures specified in laboratory SOP NC-QA-030.

8.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are destroyed. At least one copy of the obsolete document is archived according to SOP NC-QA-030.

[D4]

All documents reside with the D4 document management system. Only the current version of a document is accessible by the general user. Once a revision is made to a document, the prior version is automatically marked as "Invalid" and redirects the user to the current version.

If a document is no longer needed at all and is made "Obsolete" it is "deleted" from the current documents but archived within the system and automatically marked as such.

All "obsolete" and prior versions of documents can be accessed by designated personnel under the advanced search function within the program.

9.0 SERVICE TO THE CLIENT

9.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily fit into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals, and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another Eurofins business unit operating on the same LIMS or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 10 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or Eurofins Cleveland are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same review process used for the initial review of the project document is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes

9.2 Review Sequence and Key Personnel

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the Client Relationship Manager or Proposal Team, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below)

- Contract Administrator
- Laboratory Project Manager
- BUMA
- Technical Director
- Laboratory Directors and/or relevant Department Managers
- Account Executives
- Quality Managers

- Laboratory Environmental Health &Safety Manager

The QA Department performs an overall review to identify any quality systems concerns. Department Managers review the sections of the documents applicable to their assigned areas of the laboratory to identify any project specific requirements to be communicated to their staff and or any concerns with meeting the project requirements. Project specific requirements may be added as notes in the LIMS as part of the project set up. This is managed by the PM with input from the reviews.

The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The Sales Director, Contract Administrator, Account Executive or Proposal Coordinator then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

9.2.1 Project Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, a PM is assigned to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PMs are the primary client contact and they ensure resources are available to meet project requirements, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new project information to maximize production and client satisfaction, while maintaining quality. Project notes may be associated with each sample batch as requirements notifications upon sample receipt and during analytical processing.

Any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to

implementation. Documentation pertains to any document (e.g., letter, e-mail, variance, contract addendum), which has been signed by both parties.

Such changes are also communicated to the laboratory. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Technical Director. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s)..

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

9.3 Balancing Laboratory Capacity and Workload

Evaluating laboratory capacity to perform specific projects is the responsibility of the BUMA, Laboratory Director, Department Managers, and the Client Services manager. Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in case of malfunctions. This minimizes the need to evaluate small and medium size projects against capacity available to complete them. Large and complex projects are reviewed against capacity estimates before bids are submitted to ensure that the client's analysis schedule can be met. Regularly scheduled meetings are held between laboratory management, PMs, Client Services and QA personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory. Laboratory capacity and backlog is tracked on a continuous basis using information from the Laboratory Information Management System (LIMS) including turnaround time, and work in-house.

9.4 Documentation

The Contracts Department maintains copies of all signed contracts. Laboratory Project Manager Assistants and/or PMs maintain electronic copies of signed contracts as needed.

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. Records are maintained electronically.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Account Executive. A copy of the contract and formal quote will be filed with the laboratory PM and the BUMA.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client.

9.5 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all

client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients.

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assisting client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

9.6 Client Communication

PMs are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

The Technical Director is available to discuss any technical questions or concerns that the client may have.

9.7 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

9.8 Client Feedback and Surveys

The laboratory assesses both positive and negative client feedback and tracks the business's Net Promoter Score (NPS). The results are used to improve overall laboratory quality and client service. The NPS measures the customer experience from a specific business unit on a scale of 0 -10. The results of that range are put into three categories: detractors (0-6), passives (7, 8) and promoters (9, 10). To calculate the Net Promoter Score, the # of detractors is subtracted from the # of promoters to get the score which will be on a scale of -100 to 100.

Surveys are sent, using an electronic interface, every 2 weeks to only those that received a report in the 2 weeks prior. This allows us to gather more real-time data. Responses by the laboratory management and/or PM to detractors is required. It is also required to be tracked within the system

When a complaint is received, we determine, to the best of our ability, the extent of the issue and what data is in question. The person receiving the complaint documents this information and promptly forwards it to the appropriate management personnel where the work in question was performed. If a data reporting error is discovered, the final report and/or data must be regenerated with the correct value(s).

The laboratory QA staff is responsible for entering client concerns into iCAT. While an individual issue may not warrant a formal investigation, QA monitors these issues for potential

trends and will issue a CAR if a trend is evident. In other cases, based on the severity of the issue or upon client request, a formal Investigation is initiated for a single concern. Formal Investigation is used to document the situation and determine root cause(s) and corrective action(s).

9.9 Client Confidentiality

The laboratory ensures the highest standards of quality and integrity of the data and services provided to our clients

The laboratory is responsible for maintaining in confidence all client information obtained or created. In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

The laboratory will not intentionally divulge to any person (other than the client or any other person designated by the client in writing) any information regarding the services provided by the laboratory or any information disclosed to the laboratory by the client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Information about the client obtained from sources other than the client (e.g., complainant, regulators) shall be confidential between client and the laboratory. The source of this information shall be confidential to the laboratory and shall not be shared with the client, unless agreed by the source.

Note: This shall not apply to the extent that the information is required to be disclosed by the laboratory under the compulsion of legal process. The laboratory will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

10.0 SUBCONTRACTING OF TESTS

10.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the Eurofins Environment Testing laboratories. The phrase "work share" refers to internal transfers of samples between the Eurofins Environment Testing laboratories.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity, or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to the NDSC Documents on Subcontracting (NDSC-US-SUB-SOP44936).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

PMs or other responsible Client Service members, for the Export Lab (i.e., the Eurofins laboratory that transfers samples to another laboratory) are responsible for obtaining client approval prior to subcontracting any samples. The laboratory will advise the client of a subcontract arrangement in writing and when possible approval from the client shall be obtained and retained in the project folder. Standard Eurofins Terms & Conditions include the flexibility to subcontract samples within the Eurofins laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

Note: In addition to the client, some regulating agencies (e.g., USDA) or contracts require notification prior to placing such work.

10.2 Qualifying and Monitoring Subcontractors

Whenever a PM becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- Subcontractors specified by the client - In these circumstances, the client assumes responsibility for the quality of the data generated from the use of a subcontractor.
- Subcontractors reviewed by Eurofins – Firms which have been reviewed by the company and are known to meet standards for accreditations (e.g., State, TNI and DoD/DOE); technical specifications; legal and financial information.

A listing of vendors is available on the Eurofins intranet site.

All Eurofins laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations and can adhere to the project/program requirements. Client approval is not necessary unless specifically required by the contract. In these cases, the client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs.

10.2.1 When the potential sub-contract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Client Relations Manager (CRM) or Laboratory Director. The CRM or Laboratory Director requests that the QA Manager or PM begin the process of approving the subcontract laboratory. Refer to the NDSC Document No. NDSC-US-SUB-SOP44936, Subcontracting.

Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability and forwarded to the NBLSC Quality Information Manager (QIM) for review. After the NBLSC QIM reviews the documents for completeness, the information is forwarded to the BU's Scope President for formal signature and contracting with the laboratory. The approved vendor will be added to the approved subcontractor list on the intranet site, and the finance group is concurrently notified.

The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. Eurofins does not certify laboratories. The subcontractors on our approved list can only be recommended to the extent that we would use them.

10.3 Oversight and Reporting

The status and performance of qualified subcontractors will be monitored by local BUs and includes an annual evaluation survey conducted by the NBLSC-QIM. Any problems identified will be brought to the attention of the local BU management, the legal department and the finance department.
Complaints shall be investigated. Documentation of the complaint, investigation, and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the corrective action mechanism employed at each laboratory. Information shall be updated on the intranet when new information is received from the subcontracted laboratories.

- Subcontractors in good standing will be retained on the intranet listing. Client Service personnel will notify all Eurofins laboratories, NBLSC, the legal department and finance department if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all Client Service Personnel, Laboratory Directors, QA Managers, and Sales Personnel.

Prior to initially sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented within the project records.

The laboratory's certifications can be viewed on the company's website at https://www.eurofinsus.com/environment-testing/resources/certifications/

10.3.1 All subcontracted samples must be accompanied by a Eurofins Chain of Custody (COC). A copy of the original COC sent by the client must be available in LIMS for all samples workshared within Eurofins. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, to maintain client confidentiality, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

All accredited and non-accredited work must be identified in the subcontractor's report.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratory's EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a Eurofins work sharing laboratory may be transferred electronically and the results reported by the Eurofins work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

10.4 Contingency Planning

The full qualification of a subcontractor may be waived to meet emergency needs. This decision and justification must be documented in the project files, and the 'Purchase Order Terms and Conditions for Subcontracted Laboratory Services' must be sent with the samples and COC.

In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract agreement with Eurofins at this time.

The use of any emergency subcontractor will require the PM to complete a New Supplier Information Request Form in order to process payment to the subcontractor and add them to LIMS. This form requires the user to define the subcontractor's category/s of testing and the reason for testing.

11.0 PURCHASING SERVICES AND SUPPLIES

11.1 Overview

Procedures are in place to evaluate vendors who supply us with: new equipment, instrumentation, computerized systems and computer software; commercially purchased glassware, including sample bottleware, reagents, chemicals, solvents, gases, media, and standards; and contracted and subcontracted services
The laboratory strives to ensure that our suppliers continually improve their quality systems and we reserve the right to purchase from suppliers of our choice in order to best fulfill the needs of our clients and our business. When directed by a client to purchase from a specific supplier, we will do so. In this instance it is the client's responsibility to "qualify" the specified supplier. We attempt to purchase from businesses that we have an established purchase history or have previously acquired information regarding the supplier's quality programs.

An approved vendor list is maintained by the laboratory for critical consumables (reagents and standards), PT services, and metrological services

The laboratory does not evaluate every supplier. Risk assessment is taken into consideration when making this decision. The risk assessment analysis includes system, material, services, and number of samples or operations the purchase may affect or support. Evaluations are not required for computer operating systems, utilities, toolsets, or

systems software. They also are not required for any off-the- shelf configurable software package that has an extensive market performance history (e.g., Microsoft Word, Excel, Access).

Procurement

It is the responsibility of management personnel within each department to ensure that the appropriate supplies are available and/or ordered with sufficient lead-time to perform analytical testing or to provide support to the testing areas. The individual technical departments have trained personnel who enter the supply order into the company's purchasing system. The selection of these products is based on technical input at the analyst level and authorized by technical departmental management. The Purchasing Department maintains an ordering system in which purchase requisitions are managed.

Common laboratory items (e.g., beakers, flasks, reagents) are ordered directly through the purchasing system. Purchase orders over a specified dollar amount require approval from the appropriate member(s) of the Executive Management Group before an order can be placed.

Upon receipt of an order, the recipient checks the order to ensure that all items were received as specified. Products that have specific storage requirements are taken to the technical area upon receipt. It is the technical area's responsibility to ensure that the product is stored in the appropriate manner. Any checks on the quality of the materials received for use in a specific test are the responsibility of the laboratory using them. This is based upon the experience of the laboratory with the usability of the product. Generally, each test has controls in place to ensure that test results are not adversely affected by the materials.

Any problems encountered when using a material in the laboratory must be brought to the attention of the BUMA, LD, and/or Quality Assurance, as applicable, to ensure that follow-up and corrective action occur.

See NBSLC SOP US-PUR-SOP62924 - Guidance for Procurement of Environmental Laboratory Supplies for guidance.

11.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

11.3 Reagents, Standards & Supplies

Purchasing guidelines for equipment, consumables, and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with NBLSC Document No. NDSC-US-PUR-SOP46704 - Acid and Solvent Testing and Approval Program. Approval information for the solvents and acids tested under Document No. US-PUR-SOP62924 is distributed to the laboratory and kept on file on a shared network folder.

11.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The analyst may check the item out of the on-site consignment system that contains items approved for laboratory use. If the item is not in consignment, the analyst must provide the master item number, item description, package size, catalogue page number, and the quantity needed. If an item being ordered is not the exact item requested, approval must be obtained from the Operations Manager or Group Leader prior to placing the order. The purchasing manager places the order.

11.3.2 Receiving

It is the responsibility of the warehouse manager to receive the shipment. It is the responsibility of the analyst who ordered the materials to document the date materials were received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. This is documented through the addition of the received date and initials.

The laboratory group leader verifies the lot numbers of received solvents and acids against the pre-approval lists. If a received material is listed as unapproved, or is not listed, it is sequestered and returned to the vendor. Alternatively, the laboratory may test the material for the intended use, and if it is acceptable, document the approval on the approval list. Records of any testing performed locally are maintained on the shared “public” folder on the computer network.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection/verification has been documented.

Safety Data Sheets (SDSs) are available online through a link on the Eurofins EET-Net Sharepoint site: https://testamerica365.sharepoint.com/sites/EETAIntranet/SitePages/Environment,-Health-and-Safety.aspx. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

11.3.3 Specifications

Methods used in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer’s expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method.

Chemicals/solvents should not be used past the manufacturer's or SOP expiration date unless verified as outlined below

- An expiration date **cannot** be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded. In this case, the dry chemical/solvent must be discarded.
- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).
- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained on-file and available for review in the reagent module of the LIMS.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness, or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified clean by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are maintained electronically in the LIMS. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Director or QA Manager.

11.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the NBLSC Environmental Health & Safety Manual Document, No. NDSC-US EHS-QP46060, the local laboratory EH&S manual addendum, and method SOPs or manufacturer instructions.

11.4 Purchase of Equipment / Instruments / Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Technical Director and/or the Laboratory Director. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, a unique identification name is assigned and added to the laboratory's equipment list and entered into LIMS. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 20). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the bench.

11.5 Service

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 22. The need for service is determined by analysts, Group Leaders, and/or the Technical Director. The service providers that perform the services are approved by the Group Leaders, Technical Director, or Laboratory Director.

Analytical balances are serviced and calibrated annually in accordance with SOP NC-QA-015. The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. Calibration certificates are filed for reference. If the calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as thermometers, weight sets, autopipettors, etc., are obtained from vendors with current and valid ISO 17025 accreditation for calibration of the specific piece of equipment. Prior to utilizing the vendor's services, the vendor's accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the calibration certificates. The equipment is then returned to service within the laboratory

11.6 Suppliers

Eurofins adds vendors as options for use in the Purchasing program through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on the laboratory's business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls

than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Purchasing Group. The Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

Suppliers are subject to re-evaluation, as deemed appropriate, through review to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the purchasing system.

Proficiency testing providers and suppliers of certified reference materials must have appropriate ISO accreditation

11.6.1 New Vendor Procedure

Laboratory employees who wish to request the addition of a new vendor must complete a Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with laboratory employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technical Services Director are consulted with vendor and product selection that have an impact on quality.

12.0 COMPLAINTS

12.1 Overview

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures client knowledge that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly. These must also be communicated to QA for trending and/or formal investigation.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken. This may be handled by the PM following-up with the client on the resolution. If a client requires a letter detailing the investigation and actions, the letter may be written by department management and/or QA but must be approved by QA.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 14 (Corrective Actions) and is documented following SOP NC-QA-029 Nonconformance and Corrective Action System. A copy of this procedure will be made available to any interested party on request.

12.2 Complaint Processing

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to SOP NC-QA-029.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and documenting complaints
- Acknowledging receipt of complaint, whenever possible
- Complaint investigation and service recovery
- Process improvement

Complaints need to be communicated to QA to allow for initiation of investigations and for trending purposes. Full root cause investigation with corrective actions are required when requested by the client, for issues that involve a change to a reported analytical result, and where an adverse trend in the type of issue has been seen. These investigations must be documented in the corrective action database.

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

13 CONTROL OF NON-CONFORMING WORK

13.1 Overview

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 14).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for resolution. The supervisor may elect to discuss it with the Technical Director or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 14. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 21. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Technical Director and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with TNI (or the analytical method) requirements and the reason. Data being reported to a non-TNI state would need to note the change made to how the method is normally run.

13.2 Responsibilities and Authorities

Under certain circumstances, the Laboratory Director, Technical Director, or a member of the QA team may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information may also be documented in logbooks and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the Technical Director. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an ECO (e.g., the VP-QA/EHS) and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect and include full root cause investigation and corrective action(s).

The BUMA, Laboratory Director, QA Manager, ECOs, VP-QA/EHS, and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work once the investigation has been completed, root cause(s) determined and corrective action(s) implemented.

13.3 Evaluation of Significance and Actions Taken

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

The NBLSC Document *NDSC-CAR-SOP38229* – Nonconforming Work is the procedure to be followed when it is discovered that erroneous or biased data may have been reported to clients or regulatory agencies.

The NBLSC Document *NDSC-CAR-QP5341* - Investigation and Corrective Action Process Policy is the procedure to be followed for investigation and correction of situations involved alleged incidents of misconduct or violation of the company's ethics policy.

Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action processes detailed in these procedures.

13.4 Method Suspension / Restriction (Stop Work Procedures)

In some cases, it may be necessary to suspend/restrict the use of a method or target analyte which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 13.2.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line. The QA Manager will also initiate a corrective action report as described in Section 14 if one has not already been started. A copy of any meeting notes and agreed upon steps should be e-mailed by the laboratory to their Business Unit President; VP-QA & EHS. This e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for

viewing on the internet. It is the responsibility of the BUMA and Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc.). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (e.g., BUMA, Laboratory Director, Technical Director, QA Department, Group Leader) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work.

The QA Manager must approve resumption of work or elimination of any restrictions after the investigation is complete with root cause(s) determined and corrective action(s) implemented.

14 CORRECTIVE ACTION

14.1 Overview

A major component of the laboratory's (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence.

The laboratory employs two systems to manage non-conformances. Issues suspected of being systematic in nature and for which root cause analysis and a formal Corrective Action Report (CAR) are documented in the Incident Corrective Action Tracking (iCAT) database. Routine batch non-conformances, events that are understood to be isolated in nature, are documented in the LIMS non-conformance memo (NCM) system.

14.2 General Processes

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution.

14.2.1 Nonconformance Memo (NCM)

NCMs are used to document the following types of corrections/corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits
- Isolated reporting / calculation errors
- Client complaints
- Discrepancies in materials / goods received vs. manufacturer packing slips (Forms of documentation other than NCMs in LIMS are also acceptable)

14.2.2 **Investigations and Corrective Actions Documented In the ICAT Database** –

- Internal and external audit findings

- Failed or unacceptable PT results
- Identified poor process or method performance trends
- Systematic reporting / calculation errors
- Analytical Result Changes
- Data recall investigations
- Questionable trends that are found in the review of NCMs.
- Client complaints
- Excessive revised reports

The ICAT database is used to document background information, assigned tasks with the responsible staff, timelines, results of corrective action investigations and root cause analysis, details of the planned corrective action(s), and follow-up.

14.3 Corrective Action Process Steps

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

14.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An entry into the iCAT system must be initiated, someone is assigned to investigate the issue and the event is investigated for cause.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Technical Director, Laboratory Director, or QA Department is consulted.

14.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.

- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The iCAT record is used for this documentation.

14.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness. NBLSC Document No NDSC-CAR-SOP43847, Management of Root Cause Analysis provides guidance on this procedure.

Systematically analyze and document the root causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the root cause data from these incidents to identify root causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed and continue to plague the laboratory or operation.

14.3.4 Monitoring of the Corrective Actions

- The Group Leader, Laboratory Director, and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Group Leaders are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- The QA Manager or designee reviews monthly NCM and iCAT records for trends. Highlights are included in the QA monthly report (refer to Section 18). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the NBLSC Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

14.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager or designee and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 17.1.4, Special Audits.)

14.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 13). The documentation of these procedures is through the use of an NCM or record in the iCAT system.

For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs. The laboratory may also maintain controlled Work Instructions or Forms detailing these items. These procedures also detail the actions to be taken and by whom, for method and/or QC departures and nonconformances.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the method or program compliance of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis, resampling) is taken and documented.

14.5 Corrections to Data/Records

When mistakes occur in records, each mistake shall be crossed-out with a single line, [not obliterated (e.g. no white-out, erasure, write-overs, scribble out))], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated. When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented. In the case of records stored electronically, the original uncorrected file must be maintained intact and a second corrected file is created.

15 PREVENTIVE ACTION / IMPROVEMENT

15.1 Overview

The laboratory's preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA

Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Systems. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, the laboratory continually strives to improve customer service and client satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:

- review of the monthly QA Metrics Report,
- trending NCMs,
- review of control charts and QC results,
- trending proficiency testing (PT) results,
- performance of management system reviews,
- trending client complaints,
- review of processing operations, or
- staff observations.

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. The metrics report is reviewed monthly by the laboratory management, NBLSC QA Team, Local, and NBLSC Management These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lessons Learned or as management or NBLSC initiatives.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action and non-conformances provides a valuable mechanism for identifying preventive action opportunities.

15.1.1 The following elements are part of a preventive action/process improvement system:

- Identification of an opportunity for preventive action or process improvement
- Process for the preventive action or improvement
- Define the measurements of the effectiveness of the process once undertaken
- Execution of the preventive action or improvement
- Evaluation of the plan using the defined measurements
- Verification of the effectiveness of the preventive action or improvement

- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action or Process Improvement.

Documentation of Preventive Action/process Improvement is incorporated into the monthly QA reports, corrective action process and management review.

15.1.2 Any preventive actions/process improvement undertaken or attempted shall be taken into account during the annual Management Systems Review (Section 16). A highly detailed report is not required; however, a summary of successes and failures within the preventive action program is sufficient to provide management with a measurement for evaluation.

15.2 Management of Change

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these procedures, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures.

The types of changes covered under this system include (but is not limited to): Laboratory Relocation, Facility Changes, Major Accreditation Changes, Implementation of Method Updates or Program Changes (e.g., MUR, client QAPPs, Regulatory Updates), Addition or Deletion to Laboratory Capabilities or Instrumentation, Key Personnel Changes, Laboratory Information Management System (LIMS) changes.

16. CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. Exceptions for programs with longer retention requirements are discussed in Section 16.2.

16.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. Detailed information on retention of specific records is provided in NBLSC Document No. NDSC-US-LEG-QP54927, Records Retention Policy and NDSC-US-LEG-FRM58366 - Records Retention / Storage Schedule. . Quality records are maintained by the QA department electronically. Electronic files are backed up as part of the regular laboratory backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by the individual analysts under the direct supervision of their group leader.

16.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an offsite location that provides a suitable environment to prevent damage or deterioration and to prevent loss. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees and shall be documented with an access log**.** Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Whether on-site or off-site storage is used, logs are maintained in each storage box to note removal and return of records. Retention of records are maintained on-site at the laboratory for approximately one month after their generation and moved offsite for the remainder of the required storage time. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as NBLSC Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired.

1. The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format.
2. The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (Records stored off site should be accessible within 2 days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.
   - The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved**.** The laboratory's copy of the COC is stored with the invoice and the work order sheet generated by LIMS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.
   - All information relating to the laboratory facilities' equipment**,** analytical test methods**,** and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.
   - The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set. Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day's run log or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into LIMS for each method as required.
   - Changes to electronic records in LIMS or instrument data are recorded in audit trails.
   - The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "analyzed by"**.**

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned.

16.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in the table below with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 16-2. Example: Special Record Retention Requirements

Program	[1]Retention Requirement
Michigan Department of Environmental Quality – all environmental data	10 years 12 years for Lead and Copper results
Ohio VAP	10 years and State contacted prior to disposal
OSHA	30 years

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

16.3 Technical and Analytical Records

16.3.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the sampling, performance of each analysis and reviewing results.

16.3.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

16.3.3 . Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code**;**
- Date of analysis; time of analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part

of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook or on a benchsheet.

- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available.
- analysis type;
- all manual calculations and manual integrations;
- analyst's or operator's initials/signature;
- sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;
- test results;
- standard and reagent origin, receipt, preparation, and use;
- calibration criteria, frequency and acceptance criteria;
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
- quality control protocols and assessment;
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries
- Method performance criteria including expected quality control requirements. These are indicated both in LIMS and on specific analytical report formats.

16.3.4 All logbooks used during receipt, preparation, storage, analysis, and reporting of samples or monitoring of support equipment shall undergo a periodic, documented supervisory or peer review.

16.4 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;
- archived SOPs;
- correspondence relating to laboratory activities for a specific project;

- all corrective action reports, audits and audit responses**;**
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement
- sample identification, receipt, acceptance or rejection and login
- sample storage and tracking including shipping receipts, sample transmittal / COC forms
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples

16.5 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard copy form in accordance with the *NDSC-US-LEG-FRM58366 - Records Retention / Storage Schedule*.

16.6 Records Management, Storage and Disposal

All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval. Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

The laboratory has a record management system (a.k.a., document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. All data are recorded sequentially within a series of sequential notebooks. Bench sheets, if used, are filed sequentially. Standards are maintained in LIMS – no logbooks are required to be used to record that data**.** Records are considered archived when noted as such in the records management system (a.k.a., document control.)

16.6.1 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of NBLSC. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during

the previous 5 years of such action.

16.6.2 Records Disposal

Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration.

Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

If a third party records Management Company is hired to dispose of records, a “Certificate of Destruction” is required.

17. AUDITS

17.1 Internal Audits

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab’s quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and, when requested, to NBLSC management.

Audits are conducted and documented as described in NBLSC Document No. NDSC-IA-SOP5260 - Internal Auditing Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

17.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, Eurofins Data Integrity and Ethics Policies (see Sec. 7.2), TNI quality systems client, regulatory, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness & sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

17.1.2 QA Technical Audits

QA technical audits assess data authenticity and analyst integrity. These audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit miner programs (e.g., Chrom AuditMiner) are used to

identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period.

17.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Director or qualified designee at least every two years.

17.1.4 Special Audits

Focused audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

17.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: non-potable water and soil

It is Eurofins policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Full root cause investigations for unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

17.2 External Audits

External audits are performed when certifying agencies or clients conduct inspections (either on-site or remote) or submit performance testing samples for analysis. It is Eurofins policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response. Audit responses are due in the time allotted by the client or agency performing the audit.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be

clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the TNI standards.

17.3 Audit Findings

Audit findings are documented using the corrective action process and database (see Section 14). The laboratory's corrective action documentation must include the investigation, root cause(s), actions(s) with timelines and supporting documentation of proof of completion. . The responses to the agency or client may include action plans that could not be completed prior to the response due date**.** In these instances, a targeted completion date must be set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Group Leader of the department where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the monthly quality metrics report.
If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24 hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

18. MANAGEMENT REVIEWS

18.1 Quality Assurance Report

The QA Department is responsible for preparing a comprehensive monthly metrics report to Management to keep them apprised of current quality issues. This report fosters communication, review, and refinement of the QA system to evaluate the suitability of policies and procedures to meet both regulatory and laboratory quality objectives.

The NBLSC QA team compiles information from all of the Eurofins Environment Testing laboratories monthly quality metrics reports for the Executive Management team. This report includes, but is not limited to, notable information and concerns regarding the laboratories quality system programs, overall concerns across the laboratories, information regarding new regulations that may affect the Eurofins businesses.

18.2 Annual Management Review

The Laboratory Management team (BUMA, Laboratory Director, Technical Director, QA Manager, and Group Leaders) conducts a review annually of its quality and management systems to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a

platform for defining goals, objectives and action items that feed into the laboratory planning system. NBLSC personnel may be included in this meeting at the discretion of the Laboratory Director.
Details on the review process and agenda topics to be addressed are covered in SOP IA-QP38702 Management Systems Review. Checklists/templates that are used are available under document [NDSC-IA-FRM43453 - Annual Management Systems Review Checklists This uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation.

Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review
- Prior Monthly QA Reports issues
- Laboratory QA Metrics
- Review of report reissue requests
- Review of client feedback and complaints
- Issues arising from any prior management or staff meetings
- Minutes from prior senior lab management meetings - Issues that may be raised from these meetings include:
    - Adequacy of staff, equipment and facility resources
    - Adequacy of policies and procedures
    - Future plans for resources and testing capability and capacity

- Compliance to the Ethics and Data Integrity Policy - Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity
- Evaluation of overall risk, including risks to impartiality, confidentiality, reporting statements of conformity, and nonconforming work

A report is generated by the QA Manager and management. The report is distributed to the President of the Business Unit, BUMA, LD, and Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants
- A reference to the existing data quality related documents and topics that were reviewed
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)]

19. TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPS)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference the laboratory's SOP NC-QA-027 Preparation and Management of Standard Operating Procedures.
- SOPs are reviewed at a minimum of every 2 years (annually for the state of Kentucky), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the PM. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special

matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

Refer to the laboratory certifications for the currently accepted referenced methods in use by the laboratory.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data. Refer to Appendix 6 for a list of the currently accepted U.S. EPA analytical method references used by the laboratory.

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.1.1 Client Supplied, Laboratory Developed, and/or Non-Standard Methods

Most of the client-supplied method requirements involve achieving specific quality control criteria, limits of quantitation (LOQ), and/or method detection limits (MDL) using standard EPA methods. These requirements are communicated to the appropriate technical groups prior to the project start up. Each technical group evaluates the scope of work and the requirements to ensure the criteria can be met using the standard EPA method. The data is monitored to ensure the criteria are met throughout the project. The PM notifies the client if there is a more appropriate method available or if the client's criteria cannot be achieved on a certain sample matrix (i.e., due to matrix or dilutions).

The laboratory may be asked by a client to perform testing using a non-standard method or to develop a client/project specific method. When consensus is reached on the method procedure, the laboratory determines linearity, specificity, precision, accuracy, MDL, and LOQ by performing calibrations, analyzing method blanks, and carrying out method detection limit

and IDOC studies, as applicable. The standard operating procedure is written and submitted to the client with the results of the validation. These steps are completed prior to analysis of field samples.

19.4.1.2 Procedural Deviations

Analysts are required to follow a documented method for all tests performed; and any deviations from analytical methods must be documented, approved, and justified in an appropriate and consistent manner. We classify method deviations as either being a planned deviation or an unplanned deviation. In general, the following information is captured to document both types of situations:

- Description of the situation
- Reason or justification for the deviation
- Impact the deviation had on the testing
- Signature/date of analyst performing the test
- Signature/date of QA and Laboratory management approving the deviation
- Signature/date of client approval, if necessary

Deviations to written procedures are documented in raw data records, ICAT or through the NCM system. Both types of documentation require management and QA review and approval.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

A demonstration of capability (DOC), SOP NC-QA-028, Employee Orientation and Training) is performed whenever there is a change in instrument type (e.g., new instrumentation), matrix, method or personnel (e.g., analyst has not performed the test within the last 12 months).

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

The initial demonstration of capability must be thoroughly documented and reviewed by the by the Group Leader prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratory's archiving procedures.

The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (e.g., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

- At least four aliquots must be prepared (including any applicable clean-up procedures) in the same fashion, and following all of the same procedures, as client samples, and analyzed according to the test method (either concurrently or over a period of days).

- Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest. Refer to SOP NC-QA-028, Employee Orientation and Training, for details on this procedure.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

Methods on line prior to the effective date of this Section shall be updated to the procedures outlined above as new analysts perform their demonstration of capability. A copy of the new record will replace that which was used for documentation in the past. At a minimum, the precision and accuracy of four mid-level laboratory control samples must have been compared to the laboratory's quality control acceptance limits.

19.5 Laboratory Developed Methods and Non-Standard Methods

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 Validation of Methods

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

When changes are made to any validated methods, the influence of such changes shall be documented and, if appropriate, a new validation shall be performed.

Determination of Accuracy and Precision –

19.7 Method Detection Limits (MDL) / Limits of Detection (LOD)

Details of the laboratory's procedure for conducting MDL studies are given in NBLSC SOP NDSC-TS-SOP42091 - Detection and Quantitation Limits.

The MDL is the minimum measured quantity of a substance that can be reported with 99% confidence that the concentration is distinguishable from method blank results, consistent with 40CFR Part 136 Appendix B, August, 2017. The MDL is equivalent to the TNI LOD. The working or final MDL is the higher of the MDL value determined from spikes (MDLs) and the MDL value determined from blanks (MDLb).

An initial MDL study shall be performed during the method validation process and when the method is altered in a way that can reasonably be expected to change its sensitivity. Ongoing data are collected during each quarter in which samples are being analyzed. If it is found during the reevaluation of detection limit results that more than 5% of the spiked samples do not return positive numeric results that meet all method qualitative identification criteria, then then spiking level shall be increased and the initial MDL study will be repeated at the new spiking concentration.

At least once every 13 months the MDLs and MDLb are re-calculated and re-evaluated using data collected during the preceding period.

19.8 Instrument Detection Limits (IDL)

The IDL is sometimes used to assess the reasonableness of the MDL or in some cases required by the analytical method or program requirements. IDLs are most commonly used in metals analyses but may be useful in demonstration of instrument performance in other areas.

IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

19.9 Limit of Quantitation

The LOQ shall be at a concentration equivalent to the lowest calibration standard concentration, with the exception of methods using a single-point calibration, and shall be greater than the MDL. The LOQ is verified by preparing and analyzing spikes at concentrations at or below the selected LOQ, employing the complete analytical process.

When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waived for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

19.10 Retention Time Windows

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specified in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept on-file and available for review. Complete details are available in the laboratory SOPs.

19.11 Evaluation of Selectivity

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, atomic absorption or fluorescence profiles, and specific electrode response factors.

19.12 Estimation of Uncertainty of Measurement

Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurement" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty" defined as the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.1 Uncertainty is not error. Error is a single value (i.e., the difference between the true result and the measured result). On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.2 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte.

The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.3 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 99% confidence level with a coverage factor of k = 3. As an example, for a reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 +/- 0.5 mg/L.

19.12.4 In the case where a well-recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 524.2, 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as 'reanalysis') may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. Client specific *Contractual Terms & Conditions* for reanalysis protocols may supersede the following items.

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, and Methanol preserved samples. See the Department Group Leader *or* Laboratory Director if unsure.

19.14 Control of Data

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. The laboratory is currently using the Eurofins Laboratory Information Management System LIMS system, which has been highly customized to meet the needs of the laboratory.

19.14.1.1 **Maintain the Database Integrity** – Assurance that data is reliable and accurate from acquisition through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, documentation of system failures and corrective actions taken, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.2 **Ensure Information Availability** – Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, and maintaining older versions of software as revisions are implemented.

19.14.1.3 **Maintain Confidentiality** – Ensure data confidentiality through physical access controls such as password protection or website access approval when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, the data is reduced by the analyst and then verified by the Group Leader or alternate analyst once the data is uploaded or entered into LIMS. The spreadsheets, or any other type of applicable documents, are initialed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged using NBLSC Document No. NDSC-ETHC-SOP43862 - Manual Integrations.
Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the worklist folder, computer file (if appropriate), and/or run log. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or

initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1**%.** Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a formatter for significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 14.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of worksheet pages must be "Z"'d out, signed and dated. Logbooks with unused pages: The first unused page will be Z'd out, signed, and dated. A note will be added to this page stating that the logbook has been closed and no further pages are to be used.
- Worksheets are created with the approval of the QA Manager or designee at the facility. The QA Manager or designee controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Review procedures are outlined in several SOPs to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also has an SOP discussing Manual Integrations to ensure the authenticity of the data. The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 Log-In Review - The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff.

19.14.4.2 First Level Data Review - The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for continuous analyzers, chromatograms, spectra, and manual integrations), evaluation of calibration/calibration verification data in the day's analytical run, evaluation of QC data, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. A Data Review Checker (DRC) is utilized as a tool to automate review of select method requirements. All first level reviews are documented.

19.14.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial calibration/calibration verification data in the day's analytical run, evaluation of QC data, reliability of sample results, verification of units vs matrix, qualifiers and NCM narratives. Manual calculations are checked in second level review. A Data Review Checker (DRC) is utilized as a tool to automate review of select method requirements. All second level reviews are documented.

Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.4 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Manager, Technical Director, or Group Leader for further investigation. Corrective action is initiated whenever necessary.

19.14.4.5 The results are transferred into LIMS and a pdf is generated for the client.

19.14.4.6 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The

process includes, but is not limited to, verifying that the COC is followed, cover letters / narratives are present, flags are appropriate, reported units are appropriate for the sample matrix, and project specific requirements are met. The Project Manager may also evaluate the validity of results for different test methods given expected chemical relationships.

19.14.4.7 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then electronically signs the final report which is sent out to the client.

19.14.4.8 A brief overview of sample flows and information through the laboratory, as well as data review and validation, is presented in Figure 19-1.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using NBLSC Document No. NDSC-ETHC-SOP43862 - Manual Integrations.

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principles and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on expanded scale “before” and “after” chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale “before” chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1. Example: Work Flow

Action	Personnel Involved
Bottle orders generated upon request - Bottles packed and shipped to the client under COC	Client Service Personnel / PM - Bottle Preparation Personnel
Samples received at laboratory - Unpacked and reconciled against client paperwork or COC - Samples acceptance documented against completed (COC)[1]	Sample Login Personnel/PM
Samples are entered into LIMS - Job # assigned - Methods/Analytes linked from project - Sample labels generated - LIMS backlogs updated immediately	Sample Login Personnel/PM
Sample Storage - Short TATs and hold-time samples are delivered directly to the laboratory for analysis - Samples stored in assigned locations (refrigerated walk-in coolers, freezers, VOA refrigerators; etc.)	Sample Login Personnel/Analysts
Sample Receipt Acknowledgement sent to client (when requested)	Sample Login Personnel/PM
Sample Acquisition/Testing - Analysts collect samples from assigned storage. - Legal COC samples are signed in-and-out of storage - Remaining sample returned to storage.	Analysts / Login Personnel
Preparation and analysis is performed according to selected analytical method and applicable Project notes - Raw data recorded/reviewed[2] - Data imported to LIMS	Analysts
LIMS performs calculations: - Data reviewed by primary/secondary analyst - Data approved as final	Data Process (LIMS / Analyst)
Generation/review/release of reports (automated through LIMS) - Electronic copy saved in LIMS	Project Management
Electronic Data Deliverables (EDDs) generated (as applicable)	Project Management
Hard copy and electronic batch raw data is archived according to data archiving procedures.	Analysts / IT

[1]Refer to Sec. 23.3.
[2]Analyses requiring the analyst's interpretation may involve manual data reduction before entry.

SECTION 20. Instruments, Equipment and Calibrations

20.1 Overview

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs.

Equipment is only operated by authorized and trained personnel. Manufacturer's instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 Instrument/Equipment Maintenance

The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

Scheduled routine maintenance is defined in each method SOP. It is the responsibility of each Group Leader to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures are also outlined in analytical SOPs and/or instrument manuals. (**Note:** for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

- Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.
- Each entry in the instrument log includes the analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or

instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

- When maintenance or repair is performed by an outside agency, service receipts detailing the service performed must be kept on file and may be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

If an instrument requires repair (subjected to overloading or mishandling), gives suspect results, or otherwise has shown to be defective or outside of specified limits it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back-up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

At a minimum, if an instrument is sent out for service or transferred to another facility, it must be recalibrated and the laboratory MDL verified (using an MDLV) prior to return to lab operations.

20.3 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains "calibration only" ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. Further details on balance calibrations and verifications can be found in SOP NC-QA-015 Support Equipment Calibration and Verification.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters used in the laboratory are capable of measuring conductivity with an error not exceeding 1% or one umhos/cm, whichever is greater. The meters are also calibrated before each use with a known standard.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH, Conductivity, and Turbidity SOPs for further information.

20.3.3 Temperature Measuring Devices

All liquid in glass thermometers are calibrated on an annual basis with a NIST-traceable thermometer.

- If the temperature measuring device is used over a range of 10°C or less, then a single point verification within the range of use is acceptable;
- If the temperature measuring device is used over a range of greater than 10°C, then the verification must bracket the range of use.

IR thermometers, digital probes and thermocouples are calibrated quarterly. IR Thermometers should be calibrated over the full range of use, including ambient, iced (4°C) and frozen (0°C to -5°C), per the Drinking Water Manual.

The digital NIST thermometer is recalibrated every year (unless thermometer has been exposed to temperature extremes) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 0.01 degree, and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in spreadsheets, logsheets, and/or electronically. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented on unit specific logsheets or in LIMS. More information on this subject can be found in SOP No. NC-QA-015 Support Equipment Calibration and Verification.

20.3.4 Refrigerators/Freezer Units, Water baths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day.

Ovens, water baths and incubators are monitored on days of use.

All of this equipment has a unique identification number. Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens, water baths, and incubators can be found in method specific SOPs.

All of this information is documented on Daily Temperature Logsheets and/or electronically via LIMS and discussed in SOP No. NC-QA-015 Support Equipment Calibration and Verification.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware) and syringes are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis.

For those dispensers that are not used for analytical measurements, a label shall be applied to the device stating that it is not calibrated. Any device not regularly verified cannot be used for any quantitative measurements.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy and considers the statement valid for the first six months. After six months, syringes that dispense volumes greater than 20 uL must be verified or replaced.

20.3.6 Field Sampling Devices (ISCO Auto Samplers)

Each Auto Sampler (ISCO) is assigned a unique identification number in order to keep track of the calibration. This number is also recorded on the sampling documentation.

The Auto Sampler is calibrated semiannually or as needed by setting the sample volume to 100ml and recording the volume received. The results are filed in a logbook/binder. The Auto Sampler is programmed to run three (3) cycles and each of the three cycles is measured into a graduated cylinder to verify 100ml are received.

If the RSD (Relative Standard Deviation) between the 3 cycles is greater than 20%, the procedure is repeated and if the result is still greater than 20%, then the Auto Sampler is taken out of service until it is repaired and calibration verification criteria can be met. The results of this check are kept in a logbook/binder.

20.4 Instrument Calibrations

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to

determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, and type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually.

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum number of calibration points as defined by the type of calibration curve will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exceptions to these rules. ICP and ICPMS methods which define the working range with periodic linear dynamic range studies, rather than through the range of concentrations of daily calibration standards.

All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, where no other source or lot is available, a standard made by a different analyst at a different time or a different preparation would be considered a second

source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.1.1 Calibration Verification

The calibration relationship established during the initial calibration must be verified initially and at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the TNI Standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification (ICV) is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications (CCV) may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to here is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i.e., RPD, per 2009 and 2016 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used then bracketing calibration verification standards may not be required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

Generally, the calibrations must be verified by an ICV analyzed immediately following initial calibration and before sample analysis. The ICV may be used as the first bracketing CCV, if criteria for both are met.

A continuing instrument calibration verification (CCV) is generally analyzed at the beginning of each 12-hour analytical shift during which samples are analyzed. The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12-hours of the beginning of the shift. For methods that have quantitation by external calibration models, a CCV is analyzed at the end of each analytical sequence. Some methods have more frequent CCV requirements. See specific SOPs. Most inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (e.g., GCMS) then bracketing standards are not required, only daily verifications are needed, except as specified by program or method requirements.

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed and documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

  - When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.
  -

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable reported based upon discussion and approval of the client under the following special conditions:

a). when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a case narrative comment explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b). when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

Samples reported by the 2 conditions identified above will be appropriately flagged.

Tentatively Identified Compounds (TICs) – GC/MS Analysis

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.
Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

SECTION 21. MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards.

With the exception of Class A Glassware, quarterly accuracy checks are performed for all mechanical volumetric devices. Micro syringes used to dispense volumes greater than 20 uL are verified at least semi-annually or disposed of after 6 months of use. Class A Glassware should be routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-Traceable Weights and Thermometers

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For reference weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited under ISO/IEC 17025. A calibration certificate and scope of accreditation is kept on file at the laboratory.

21.3 Reference Standards, Materials, and Reagents

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared reference standards, to the extent available, are purchased from vendors that are accredited under ISO 17034. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- Purity

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique standard identification number and expiration date. All documentation received with the reference standard is retained as a QC record and references the standard identification number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the true value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs.

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Identification number
- Date opened

Label with the following when container size allows, if not ensure the information is in the associated LIMS/logbook record:

- Description (if different from manufacturer's label or if it was prepared in the
- laboratory)

  Storage Conditions

- Concentration (if applicable)
- Preparer name/ID

Special Health/Safety warnings must also be available to the analyst. This information is maintained. For safety requirements, please refer to method SOPs and the laboratory's Environmental Health and Safety Manual.

21.3.1 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID from LIMS
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained in the analytical SOPs.

21.3.2 In addition, the following information may be helpful:

- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended Storage Conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and preparation/analytical batch records.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

SECTION 22. SAMPLING

22.1 Overview

The laboratory provides sampling services. Sampling procedures are described in SOP NC-SC-006, Sample Procurement Protocol.

22.2 Sampling Containers

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Certificates of cleanliness for bottles and preservatives are provided by the supplier and are maintained at the laboratory. Alternatively, the certificates may be maintained by the supplier and available to the laboratory on-line.

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

23 HANDLING OF SAMPLES

It is the responsibility of the client to send us representative and/or homogeneous and properly preserved samples of the system from which they are drawn. The laboratory assumes that all multiple sample containers with the same designator/description and bottle type contain a homogeneous, representative sample.

The laboratory provides the appropriate sample containers, required preservative, chain-of-custody (COC) forms, shipping containers, labels, and custody seals. The laboratory also provides trip blanks and analyte-free water for field blanks. Preparation of methanol containers for field preservation of volatile soil samples is available.

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 Chain of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC

form acts as a purchase order for analytical services when no other contractual agreement is in effect.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label includes:

- Sample identification
- Date and time of collection
- Preservative

During the sampling process, the COC form is completed and must be legible. This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to the laboratory personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory personnel. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a laboratory courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the COC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by the laboratory when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The COC is stored with project information and the report.

23.1.2 Legal / Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes on the COC, login will complete the custody seal retain the shipping record with the COC, and initiate an internal COC for laboratory use by analysts and a sample disposal record.

23.2 Sampling Containers, Preservation Requirements, Holding Times

The sampling container type, preservation and holding time criteria specified in the laboratory SOPs are derived from the source documents for the methods. If method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative.

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in days (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in hours (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. Holding times for analysis include any necessary reanalysis. However, there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how the holding time is expressed

Tests designated in the method or regulation as to be performed "As soon as possible" or “ASAP” is indicative of a parameter that should be analyzed within 15 minutes of collection. Therefore, these are typically tests that are performed in the field. When the analysis is performed in the laboratory, the data will be qualified as outside the holding time.

23.3 Sample Receipt

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are detailed in SOPNC-SC-005, Sample Receiving.

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on a Cooler Receipt Form (CRF) and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

Sample Receiving personnel check and document preservation of non-volatile liquid samples in LIMS and before they are released to the laboratory for testing or placed into storage. Any checks of volatile samples and samples for oil and grease are performed and documented at the time of analysis.

23.4 Sample Acceptance Policy

Per State and/or Federal Regulation, the client is responsible to ensure that samples are shipped in accordance with DOT/IATA requirements, and that radioactive materials may only be

delivered to licensed facilities. Any samples containing (or suspected to contain) Source, Byproduct, or Special Nuclear Material as defined by 10 CFR should be delivered directly to facilities licensed to handle such radioactive material. Natural material or ores containing naturally occurring radionuclides may be delivered to any Eurofins facility or courier as long as the activity concentration of the material does not exceed 270 pCi/g alpha or 2700 pCi/g beta (49 CFR Part 173).

The laboratory has a written sample acceptance policy outlined in SOP NC-SC-005 Sample Receiving that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method;
- sample holding times must be adhered to (Sampling Guide);
- the project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.4.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.4.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS.

23.5 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers or protected locations suitable for the sample matrix. Metals samples may be unrefrigerated. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All unused portions of samples, including empty sample containers, are returned to the secure sample control area. All samples are kept in cold storage for 30 days after report generation, which meets or exceeds most sample holding times. After this time period, the samples are removed from the refrigerator shelves and prepared for disposal. Special arrangements may be made to store samples for longer periods of time.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of Eurofins.

23.6 Hazardous Samples and Foreign Soils

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in an isolated area designated for hazardous waste only. For any sample that is known to be hazardous at the time of receipt or, if after completion of analysis the result exceeds the acceptable regulatory levels, a Hazardous Sample Notice must be completed by the analyst. This form may be completed by Sample Control, Project Managers, or analysts and must be attached to the report.

The sample itself is clearly marked with a red stamp, stamped on the sample label reading “HAZARDOUS” or “FOREIGN SOIL” and placed in a colored and/or marked bag to easily identify the sample. The date, log number, lab sample number, and the result or brief description of the hazard are all written on the Hazardous & Foreign Soil Sample Notice. A copy of the form must be included with the original COC and Work Order and the original must be given to the Sample Control Custodian.

Analysts will notify Sample Control of any sample determined to be hazardous after completion of analysis by completing a Hazardous Sample Notice. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory. Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

See SOP NC-SC-019 Procedure of Acceptance and Handling of USDA Regulated Domestic and Foreign Soil for further information.

23.7 Sample Shipping

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring

water/solid volatile organic analyses (see Note). The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork.

Samples are generally shipped overnight express or hand-delivered by a Eurofins courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

23.8 Sample Aliquots / Subsampling

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots and subsampling are located in each analytical SOP and in Subsampling SOP NC-OP-046.

23.9 Sample Disposal

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement.

Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP NC-SC-005, Sample Receiving). All procedures in the laboratory's EH&S Manual are followed during disposal. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal.

All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

24 ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements. These quality control checks are performed as required by the method or regulations to assess precision and accuracy. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Samples are arranged into discreet manageable groups referred to as batches. Typically a batch consists of a maximum 20 field samples and the associated preparation and/or analytical quality control (QC) samples. Control samples are added to each batch to monitor method performance and are processed through the entire procedure with field samples.

24.3 Negative Controls

Table 24-1. Example – Negative Controls

Control Type	Details
Method Blank (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, unless the same analyte is not found in the associated samples, the blank concentration is less than 1/10 of the amount measured in the sample or the blank concentration is less than the amount in the associated sample and is less than 1/10 the regulatory limit..
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

Table 24-1. Example – Negative Controls

Control Type	Details
Trip Blank [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon
1 Method Performance (Laboratory Control Sample (LCS), which includes both the preparation and analysis measurement steps. The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix effects in a laboratory batch.
2 Matrix Effects (Matrix Spike (MS) or Sample Duplicate (MSD, DUP), which includes both the preparation and analysis steps. The matrix QC evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed.

Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Complete details on method control samples are as listed in each analytical SOP.

24.5 Acceptance Criteria (Control Limits)

As mandated by the test method and regulation, each individual analyte in the QC is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

Laboratory generated % Recovery acceptance (control) limits are generally established by taking $\pm$ 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

- Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV) (unless the analytical method specifies a tighter limit).

- In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

- The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

- The maximum acceptable recovery limit will be 200%.

- The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

- If either the high or low end of the control limit changes by $\leq$ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no effect on laboratory ability to meet the existing limits.

24.5.1 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. Refer to NC-QA-018, Statistical Evaluation of Data and Development of Control Charts for details.

24.5.2 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

- The analyte results are below the reporting limit and the LCS is above the upper control limit.

- If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

24.6.3 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference.

24.6.4 If a surrogate standard falls outside the acceptance limits, and if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

25 REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

25.2 Test Reports

. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g., Analytical Report)

25.2.2 The cover page shall include the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g., Eurofins Cleveland Job ID #) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

25.2.4. A copy of the chain of custody (COC), **including Subcontract and/or Workshare COCs**

25.2.5. The name and address of client and a project name/number, if applicable.

25.2.6. Client project manager or other contact

25.2.7. Description and unambiguous identification of the tested sample(s) including the client identification code

25.2.8. Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9. Release Date or date of revision, (when applicable).

25.2.10. Method used (EPA ###, Standard Methods ####, etc.)

25.2.11. Reporting limit.

25.2.12. Method detection limits (if requested)

25.2.13. Definition of Data qualifiers and reporting acronyms

25.2.14. Sample results

25.2.15. Batch QC data

25.2.16. Condition of samples at receipt including temperature.

25.2.17. A statement expressing the validity of the results, that the source methodology was followed and all results were reviewed for error.

25.2.18. A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory, except when information is provided by the client. When data is provided by the client there shall be a clear identification of it, and a disclaimer shall be put in the report when the client supplied data can affect the validity of the test.

25.2.19. A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory.

25.2.20. A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Authorized signatories are designated Project Managers.

25.2.21. A narrative to the report that explains any noncompliant data and (where applicable) action(s) taken (e.g. repreparation, reanalysis)

25.2.22. When soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.23. Laboratory certification number for the state of origin of the sample, if applicable.

25.2.24. If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., partial report, or how your lab identifies it). A complete report must be sent once all of the work has been completed.

25.2.25. Any subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All Eurofins Cleveland subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.26. A Certification Summary Report, where required, will document that, unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.

25.2.27. Reports for Ohio VAP work require a VAP affidavit be completed and submitted to the client.

Where the laboratory is responsible for the sampling stage, in addition to the requirements listed above, reports containing the results of sampling shall include the following, where necessary for the interpretation of test results:

- the date of sampling;
- unambiguous identification of the material sampled;
- the location of sampling plan and procedures, and deviations, addition to or exclusions from the sample procedures;
- a reference to the sampling plan and procedure, and deviations, additions to or exclusions from the sample procedures;
- details of any environmental conditions during sampling that affect the interpretation of test results;
- information required to evaluate measurement uncertainty for subsequent testing

25.3 Reporting Level or Report Type

The type and format of the Analysis Report is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse of

the data. The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level.

The packages provide the following information in addition to the information described above:

- Level 1 is a basic sample results report noting any data qualification but excluding QC results.
- Level 2 is a Level 1 report plus QC summary information
- Level 3 contains all the information supplied in Level 2, but presented on the CLP-like summary forms, and relevant calibration information. No raw data is provided.
- Level 4 is the same as Level 3 with the addition of all raw supporting data.

Various formatter options are available with the report types. These are designed to meet program and/or client specific requirements. The formatters define such parameters as reporting to the MDL/DL vs LOQ/RL, flags and qualifier types (e.g. DoD, state specific). The laboratory also offers reports in an electronic data deliverable (EDD) formats.

25.4 Electronic Data Deliverables (EDDs)

A variety of EDDs are available. EDD formats include, but are not limited to, Environmental Restoration Information Management System (ERPIMS), Staged Electronic Data Deliverable (SEDD) Environmental Quality Information System (EQuIS), Electronic Deliverable Format (EDF), Excel and custom files.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 Supplemental Information

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

Numeric results with values outside of the calibration range, either high or low are qualified as estimated.

Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived

from any sample that did not meet sample acceptance requirements such as improper container, holding time, or temperature.

Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

When, as requested by the client and agreed to by Eurofins Cleveland, the report includes a statement of conformity to specification or standard, the report shall clearly identify:

- to which results the statement applies,
- which specifications, standard or parts thereof are met or not, and
- the decision rule that was applied (unless the decision rule is inherent in the requested specification or standard, taking into account the level of risk (such as false accept and false reject and statistical assumptions) associated with the decision rule.

Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

12.3 Amendments to Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Investigation into any laboratory caused data change is documented using the laboratory's corrective action system.

Copies of all Final versions of a report are maintained in the LIMS. Any revisions are identified with a revision # in the file name and on the report cover page. The date that the version was generated is also identified on the cover page.

Further detail on the revision is provided in the report narrative. This detail includes the date of the original report and the reason for the revision. Example explanatory text is "*The report being provided is a revision of the original report sent on 5/4/2022. The report (revision 1) is being revised due to correction to QC data for method #####.*"

12.4

12.4.1 Policy on Data Omissions or Reporting Limit Increases

Eurofins policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions.

This policy has the following exceptions:

- Laboratory error
- Sample identification is indeterminate (discrepancy between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310); documented request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

12.4.2 Multiple Reports

The laboratory does not issue multiple reports for the same work order where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

26) Appendices

26.1 QA Manual Crosswalk with TNI and ISO/IEC 17025 Standards

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
-	QUALITY ASSURANCE MANUAL COVER PAGE	V1M2 Sec. 4.2.8.3		
-	Table of Contents	V1M2 Sec. 4.2.8.3		8.1.2., 8.2.1
1.0	Title Page			
2.0	Revision Log	V1M2 Sec. 4.2.8.5		
3.0	Introduction, Scope and Applicability	V1M2 Sec. 4.2.8.4		
3.1	Introduction and Compliance References	V1M2 Secs. 1.1; 1.2; 2.0; 3.2; 4.1.2; 4.2.4	4.1.2; 4.2.4	5.3; 5.4; 8.2.4; 8.3.1
3.2	Terms and Definitions	V1M2 Secs. 3.0; 4.2.4	4.2.4	
3.3	Scope /Field of Testing	V1M2 Secs. 1.2; 4.2.4	4.1.2; 4.2.4	5.3; 5.4; 8.2.1; 8.2.4
3.4	Quality Manual Review Process	V1M2 Secs. 4.2.1; 4.2.7; 4.3.3.2; 4.3.3.3	4.2.1; 4.2.7; 4.3.3.2; 4.3.3.3	5.3
4.0	Management and Responsibilities	V1M2 Sec. 4		8.2.4; 8.2.5
4.1	Overview	V1M2 Secs. 4.1.1, 4.1.3; 4.1.5	4.1.1; 4.1.3; 4.1.5; 4.2.6	5.1; 5.2; 5.5; 5.6 ; 6.2.1; 6.2.4
4.2	Roles and Responsibilities	V1M2 Secs. 4.1.4; 4.1.5; 4.1.6; 4.2.1; 4.2.6; 5.2.4	4.1.3; 4.1.5; 4.1.6; 4.2.1; 4.2.6; 5.2.4	4.1.1 to 4.1.3; 4.1.5; 5.5; 5.6; 6.2.1; 6.2.4; 6.2.6 8.2.2;
4.3	Business Continuity and Contingency Plan	V1M2 Secs. 4.1.5; 4.1.7.2; 4.2.7	4.1.5; 4.2.7	
5.0	Personnel	V1M2 Secs. 5.2; 5.2.1	5.2.1	6.1; 6.2.3
5.1	Overview	V1M2 Secs. 5.2.2; 5.2.3; 5.2.5	5.2.2; 5.2.3; 5.2.5	6.2.2
5.2	Education and Experience Requirements for Technical Staff	V1M2 Secs. 5.2.1; 5.2.3; 5.2.4	5.2.1; 5.2.3; 5.2.4	6.2.2 to 6.2.4
5.3	Training	V1M2 Sec. 5.2.5	5.2.5	4.2.1; 6.2.2; 6.2.4; 6.2.5
5.4	Ethics and Data Integrity Training	V1M2 Sec. 4.2.8.1; 5.2.7		4.1.1
6.0	Accommodations and Environmental Conditions	V1M2 Sec. 5.3		6.1; 6.3.1
6.1	Overview	V1M2 Secs. 5.3.1; 5.3.3; 5.3.4; 5.3.5	5.3.1; 5.3.3; 5.3.4; 5.3.5	6.3.1
6.2	Environment	V1M2 Secs. 5.3.1; 5.3.2; 5.3.3; 5.3.4; 5.3.5	5.3.1; 5.3.2; 5.3.3; 5.3.4; 5.3.5	6.3.1 to 6.3.5
6.3	Work Area	V1M2 Secs. 5.3.3; 5.3.4; 5.3.5	5.3.3; 5.3.4; 5.3.5	6.3.1
6.4	Responding to Emergencies			
6.5	Building Security	V1M2 Sec. 5.3.4	5.3.4	6.3.4
7.0	Quality System			6.1; 8.2.4

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
7.1	Quality Policy	V1M2 Secs. 4.1.5; 4.2.2; 4.2.3; 4.2.8.3	4.1.5; 4.2.2; 4.2.3	8.2.3; 8.6.1
7.2	Ethics and Data Integrity	V1M2 Secs. 4.1.5; 4.16; 4.2.2; 4.2.8.1; 5.2.7	4.1.5; 4.2.2	4.1.1 to 4.1.3; 4.2.1; 6.2.1; 8.2.2; 8.2.3
7.3	Quality System Documentation	V1M2 Secs. 4.1.5; 4.2.2; 4.2.5	4.2.2; 4.2.5	8.2.4
7.4	QA/QC Objectives for the Measurement of Data	V1M2 Sec. 4.2.2	4.1.5; 4.2.2	6.2.4
7.5	Criteria for Quality Indicators			
7.6	Statistical Quality Control			
7.7	Quality System Metrics			
7.8	Management of Change			
8.0	Document Control	V1M2 Secs. 4.2.7; 4.3.1; 4.3.2.2 ; 4.3.3.3; 4.3.3.4	4.2.7; 4.3.1; 4.3.2.2; 4.3.3.3; 4.3.3.4	8.2.4; 8.3.1
8.1	Overview			8.2.5; 8.3.1; 8.3.2
8.2	Document Approval and Issue	V1M2 Secs. 4.3.2; 4.3.2.1-4.3.2.3; 4.3.3.1	4.3.2.1; 4.3.2.2; 4.3.2.3; 4.3.3.1	8.2.5; 8.3.2
8.3	Procedures for Document Control	V1M2 Secs. 4.3.2.1–4.3.2.2; 4.3.3.1	4.3.2.1; 4.3.2.2; 4.3.3.1	8.2.5; 8.3.2
8.4	Obsolete Documents	V1M2 Secs. 4.3.2.1–4.3.2.2	4.3.2.1; 4.3.2.2	8.2.5; 8.3.2
9.0	Service to the Client	V1M2 Secs. 4.4.1 - 4.4.4	4.4.1; 4.4.2; 4.4.3; 4.4.4	7.1.1; 7.1.1.4; 7.1.1.5; 7.1.1.8; 7.1.2.1
9.1	Overview	V1M2 Secs. 4.4.5; 4.5.5; 5.7.1	4.4.5; 5.7.1	
9.2	Project Review	V1M2 Sec. 4.4.5	4.4.5	7.1.1.6
9.3	Balancing Laboratory Work Load and Capacity			
9.4	Project Contracts/Records	V1M2 Sec. 5.7.1	5.7.1	
9.5	Special Services	V1M2 Secs. 4.7.1-4.7.2	4.7.1; 4.7.2	7.1.1.3; 7.1.1.7
9.6	Client Communication	V1M2 Secs. 4.7.1-4.7.2	4.7.1; 4.7.2	7.1.1.7
9.7	Reporting	V1M2 Secs. 4.7.1-4.7.2	4.7.1; 4.7.2	7.1.1.7
9.8	Client Feedback and Surveys	V1M2 Secs. 4.7.1-4.7.2	4.7.1; 4.7.2	7.1.1.7; 8.6.2
9.9	Client Confidentiality	V1M2 Secs. 4.1.5; 5.10.7	4.1.5; 5.10.7	4.2.1 to 4.2.4
10.0	Subcontracting	V1M2 Secs. 4.4.3; 4.5.4	4.4.3; 4.5.4	
10.1	Overview	V1M2 Secs. 4.5.1 - 4.5.3; 4.5.5; 5.3.1	4.5.1; 4.5.2; 4.5.3; 5.3.1	6.6.1; 7.1.2.1; 7.1.2.2
10.2	Qualifying and Monitoring Subcontractors	V1M2 Secs. 4.5.1; 4.5.2; 4.5.3; 4.5.5	4.5.1; 4.5.2; 4.5.3	6.6.1; 7.1.2.1; 7.1.2.2
10.3	Oversight and Reporting	V1M2 Sec. 4.5.5		
10.4	Contingency Planning			
11.0	Purchasing Services and Supplies	V1M2 Sec. 4.6.1	4.6.1	

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
11.1	Overview	V1M2 Secs. 4.6.2; 4.6.3; 4.6.4	4.6.2; 4.6.3; 4.6.4	6.6.1; 6.6.2
11.2	Glassware	V1M2 Sec. 5.5.13.1		
11.3	Reagents, Standards & Supplies	V1M2 Secs. 4.6.2; 4.6.3; 4.6.4 2016 V1M4 1.7.2.5	4.6.2; 4.6.3; 4.6.4	6.6.1 to 6.6.3
11.4	Purchase of Equipment / Instruments / Software			
11.5	Services			
11.6	Suppliers			
12.0	Complaints	V1M2 Sec. 4.8	4.8	8.6.1; 8.6.2
12.1	Overview			7.9.1 to 7.9.3 8.6.1; 8.6.2;
12.2	Complaint Processing			7.9.2 to 7.9.7 8.6.1; 8.6.2;
13.0	Control of Nonconforming Work	V1M2 Secs. 4.9.1; 5.10.5	4.9.1; 5.10.5	7.10.1
13.1	Overview	V1M2 Secs. 4.9.1; 4.11.3; 4.11.5	4.9.1; 4.11.3; 4.11.5	7.10.1
13.2	Responsibilities and Authorities	V1M2 Secs. 4.9.1; 4.11.3; 4.11.5; 5.2.7	4.9.1; 4.11.3; 4.11.5	7.10.1
13.3	Evaluation of Significance and Action Taken	V1M2 Secs. 4.9.1; 4.11.3; 4.11.5	4.9.1; 4.11.3; 4.11.5	4.1.5; 7.10.1; 7.10.2; 8.5.3
13.4	Method Suspension / Restriction (Stop Work Procedures)	V1M2 Secs. 4.9.1; 4.9.2; 4.11.5	4.9.1; 4.9.2; 4.11.5	7.10.1; 7.10.2
14.0	Corrective Action	V1M2 Sec. 4.11		4.1.4; 4.1.5
14.1	Overview	V1M2 Secs. 4.9.2; 4.11.1; 4.11.2	4.9.2; 4.11.1; 4.11.2; 8.7.1; 8.7.3	7.10.2 8.7.1; 8.7.3;
14.2	General Processes	V1M2 Sec. 4.11.2; 4.11.3	4.11.2; 4.11.3	7.7.2; 8.5.3; 8.7.1;
14.3	Correction Action Process Steps	V1M2 Sec. 4.11.2; 4.11.3; 4.11.4; 4.11.6; 4.11.7; 4.12.2	4.11.2; 4.11.3; 4.11.4; 4.12.2	8.5.3; 8.6.1; 8.7.2
14.4	Technical Data Corrective Actions	V1M2 Sec. 4.11.6		8.7.1
14.5	Corrections to Data/Records	V1M2 Secs. 4.11.1; 4.13.2.3	4.11.1; 4.13.2.3	7.5.2; 8.7.1
15.0	Preventive Action / Improvement	V1M2 Secs. 4.10; 4.12.1; 4.12.2; 4.15.1; 4.15.2	4.10; 4.12.1; 4.12.2; 4.15.1; 4.15.2	4.1.4; 8.6.2
16.0	Control of Records	V1M2 Secs. 4.2.7; 4.13.1.1; 4.13.3	4.2.7; 4.13.1.1	8.4.2
16.1	Overview	V1M2 Secs. 4.13.1.1 - 4.13.1.4; 4.13.2.1-4.13.2.3; 4.13.3	4.13.1.1 - 4.13.1.4; 4.13.2.1-4.13.2.3	8.4.1; 8.4.2
16.2	Programs with Longer Retention Requirements			
16.3	Technical and Analytical Records	V1M2 Sec. 4.13.2.2 - 4.13.2.3	4.13.2.2; 4.13.2.3	7.5.1; 8.4.2
16.4	Laboratory Support Activities			7.5.2; 8.4.2
16.5	Administrative Records			8.4.2

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
16.6	Records Management, Storage and Disposal	V1M2 Sec. 4.13.3		4.2.1; 8.4.2
17.0	Audits			
17.1	Internal Audits	V1M2 Sec. 4.2.8.1; 4.14; 4.14.1; 4.14.2 ; 4.14.3; 4.14.5; 5.9.1; 5.9.2	4.14.1; 4.14.2; 4.14.3; 5.9.1; 5.9.2	8.6.1; 8.8.1; 8.8.2
17.2	External Audits	V1M2 Secs.4.14.2; 4.14.3	4.14.2; 4.14.3; 4.14.4	4.2.1; 8.6.1
17.3	Audit Findings	V1M2 Secs. 4.14.2; 4.14.3; 4.14.5		8.6.1
18.0	Management Reviews	V1M2 Sec. 4.1.6; 4.15; 4.15.1; 4.15.2	4.1.6; 4.15.1; 4.15.2	4.1.4; 8.5.1; 8.6.1; 8.9.1; 8.9.2
18.1	Quality Metrics Report			8.5.1
18.2	Annual Management Review	V1M2 Sec. 4.2.2; 4.15.3	4.2.2	4.1.1, 4.1.4; 4.2.1; 7.1.1.3; 8.2.2; 8.5.1 to 8.5.3; 8.6.1; 8.9.3
19.0	Test Methods and Method Validation	V1M2 Sec. 5.4.1	5.4.1	7.2.1.1; 8.2.5
19.1	Overview	V1M2 Sec. 5.4.1	5.4.1; 5.4.5.1	6.2.3; 7.2.1.1 to 7.2.1.3
19.2	Standard Operating Procedures (SOPs)	V1M2 Secs. 4.2.8.5; 4.3.3.1; 5.4.2	4.3.3.1; 5.4.2	7.2.1.4
19.3	Laboratory Methods Manual	V1M2 Sec. 4.2.8.5 (2019 5.4.4.2)		6.2.3
19.4	Selection of Methods	V1M2 Secs. 4.13.3; 5.4.1; 5.4.2; 5.4.3. (2019 5.4.4) V1M4 Secs. 1.4; 1.5.1; 1.6.1; 1.6.2; 1.6.2.1; 1.6.2.2	5.4.1; 5.4.2; 5.4.3; 5.4.4; 5.4.5.1; 5.4.5.2; 5.4.5.3	7.1.1.2; 7.2; 7.2.1.2; 7.2.1.3; 7.1.2.4 to 7.2.1.7; 7.2.2.1 to 7.2.1.7; 7.2.2.1
19.5	Methods Detection Limits (MDLs) / Limit of Detection (LOD)	V1M2 Sec. 5.9.3. V1M4 Secs. 1.5.2; 1.5.2.1; 1.5.2.2	5.4.5.3	7.2.2.3
19.6	Instrument Detection Limits (IDLs)	V1M2 Sec. 5.9.3. V1M4 Sec. 1.5.2.1		
19.7	Limit of Quantitation	V1M2 Sec. 5.9.3		
19.8	Retention Windows	V1M2 Sec. 5.9.3. V1M4 Sec. 1.5.4; (2009 1.7.3.6) (2016 1.7.2.6)		
19.9	Evaluation of Selectivity	V1M2 Sec. 5.9.3. V1M4 Sec. 1.5.4; (2009 1.7.3.6) (2016 1.7.2.6)		
19.10	Estimation of Uncertainty of Measurement	V1M2 Sec. 5.1.1; 5.1.2; 5.4.6	5.1.1; 5.1.2; 5.4.6.1; 5.4.6.2; 5.4.6.3	7.6.1; 7.6.2; 7.6.3
19.11	Sample Reanalysis Guidelines	V1M2 Sec 5.9.1	5.9.1	
19.12	Control of Data	V1M2 Secs. 5.4.7.1; 5.4.7.2; 5.9.1	5.4.7.1; 5.4.7.2; 5.9.1	7.11.1 to 7.11.6

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
20.0	Instruments, Equipment, and Calibration	V1M2 Secs. 5.5.4; 5.5.5; 5.5.6	5.5.4; 5.5.5; 5.5.6; 5.6.1	6.1; 6.4.3; 6.4.6; 6.4.9
20.1	Overview	V1M2 Secs. 5.5.1; 5.5.2; 5.5.3; 5.5.5; 5.5.10	5.5.1; 5.5.2; 5.5.3; 5.5.5; 5.5.10; 5.6.1	6.4.1; 6.4.4 to 6.4.6; 6.4.9; 6.4.11
20.2	Instrument and Equipment Maintenance	V1M2 Secs. 5.5.1; 5.5.3; 5.5.7; 5.5.9	5.5.1; 5.5.3; 5.5.7; 5.5.9; 5.6.1	6.4.1 to 6.4.3; 6.4.6; 6.4.10
20.3	Support Equipment	V1M2 Secs. 5.5.10; 5.5.11; 5.5.13.1	5.5.10; 5.5.11; 5.6.2.1.2; 5.6.2.2.1; 5.6.2.2.2	6.4.11; 6.4.12; 6.5.1; 6.5.2; 6.5.3
20.4	Instrument Calibrations	V1M2 Secs. 5.5.8; 5.5.10; 5.6.3.1. V1M4 Sec. 1.7.1.1; (2009 1.7.2) (2016 1.7.1.2)	5.5.8; 5.5.9; 5.5.10; 5.6.1; 5.6.2; 5.6.3.1	6.4.2; 6.4.3; 6.4.6 to 6.4.8; 6.4.11; 6.4.13; 6.4.14; 6.5.1; 6.5.2
21.0	Measurement Traceability			
21.1	Overview	V1M2 Sec. 5.6.3.1	5.6.2.1.2; 5.6.2.2.2; 5.6.3.1	6.4.14; 6.5.1; 6.5.2; 6.5.3
21.2	Reference Weights and Thermometers	V1M2 Secs. 5.5.13.1; 5.6.3.1; 5.6.3.2	5.6.3.1; 5.6.3.2	6.4.14
21.3	Reference Standards, Materials, and Reagents	V1M2 Secs. 5.6.3.1; 5.6.3.2; 5.6.3.3; 5.6.3.4; 5.6.4.1; 5.6.4.2; 5.9.1; 5.9.3	5.6.3.1; 5.6.3.2; 5.6.3.3; 5.6.3.4; 5.9.1	6.4.14
22.0	Sampling			
22.1	Overview	V1M2 Secs. 5.7.1; 5.7.3	5.7.1; 5.7.3	7.3.1; 7.3.2; 7.3.3
22.2	Sample Containers			
23.0	Sample Handling	V1M2 Sec. 5.8.1	5.8.1	7.4.1
23.1	Chain of Custody (COC)	V1M2 Secs. 5.7.2; 5.7.4; 5.8.4; 5.8.7.5; 5.8.8; 5.9.1	5.7.2; 5.8.4; 5.9.1	7.1.1.6; 7.4.1
23.2	Sampling Containers, Preservation Requirements, Holding Times			
23.3	Sample Receipt	V1M2 Secs. 5.8.1; 5.8.2; 5.8.3; 5.8.5; 5.8.7.3; 5.8.7.4; 5.8.7.5	5.8.2; 5.8.3	7.4.3
23.4	Sample Acceptance Policy	V1M2 Secs. 5.8.6; 5.8.7.2		
23.5	Sample Storage	V1M2 Secs. 5.7.4; 5.8.4	5.8.4	7.4.1; 7.4.4
23.6	Hazardous Samples and Foreign Soils			
23.7	Sample Shipping	V1M2 Sec. 5.8.2	5.8.2	7.4.2
23.8	Sample Aliquots / Subsampling	V1M2 Sec. 5.7.1	5.7.1	7.3.1; 7.3.2
23.9	Sample Disposal			
24.0	Assuring the Quality of Test Results			
24.1	Overview	V1M2 Secs. 5.9.2; 5.9.3	5.9.2	7.7.2 to 7.7.3
24.2	Controls	V1M2 Secs. 5.9.2; 5.9.3	5.9.2	7.7.1; 7.7.3

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
24.3	Negative Controls	V1M2 Secs. 5.9.2; 5.9.3 V1M4 Secs. (2019 1.7.3; 1.7.3.1; 1.7.4.1) (2016 1.7.2, 1.7.2.1, 1.7.3.1)	5.9.2	7.7.1; 7.7.3
24.4	Positive Controls	V1M2 Secs 5.9.2; 5.9.3. V1M4 Secs.(2009 1.7.3; 1.7.3.2; 1.7.3.2.1; 1.7.3.2.2; 1.7.3.2.3) (2016 1.7.2, 1.7.2.2, 1.7.3.2)	5.9.2	7.7.1; 7.7.3
24.5	Acceptance Criteria (Control Limits)	V1M2 Sec. 5.9.3. V1M4 Secs. 1.7.4.2; 1.7.4.3		7.7.1; 7.7.3
24.6	Marginal Exceedance	V1M4 Sec. 1.7.3.2		
25.0	Reporting Results			
25.1	Overview	V1M2 Secs. 5.10.1; 5.10.2; 5.10.8	5.10.1; 5.10.2; 5.10.8	7.8.1 to 7.8.2
25.2	Test Reports	V1M2 Secs. 5.10.1; 5.10.2; 5.10.3.1; 5.10.3.2; 5.10.5; 5.10.6; 5.10.7; 5.10.8; 5.10.10; 5.10.11	5.10.1; 5.10.2; 5.10.3.1; 5.10.3.2; 5.10.5; 5.10.6; 5.10.7; 5.10.8	7.8.2.1; 7.8.2.2; 7.8.3; 7.8.5
25.3	Reporting Level or Report Type	V1M2 Secs. 5.10.1; 5.10.7; 5.10.8	5.10.1; 5.10.7; 5.10.8	
25.4	Electronic Data Deliverables (EDDs)			
25.5	Supplemental Information for Test	V1M2 Secs. 5.10.1; 5.10.3.1; 5.10.5	5.10.1; 5.10.3.1; 5.10.5	7.1.1.3; 7.8.6.1; 7.8.6.2; 7.8.7.1 to 7.8.7.3
25.6	Amendments to Test Reports	V1M2 Sec. 5.10.9	5.10.1; 5.10.9	7.8.8.1 to 7.8.8.3

26.2. References

The QAM has been prepared to be consistent with the requirements of the following documents:

- "EPA Requirements for Quality Management Programs" (QA/R-2) (EPA/240/B-01/002, May 31, 2006).
- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th, 21st, and on-line Editions.

- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Final Update IV, January 2008; Final Update V, August 2015.*
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- Toxic Substances Control Act (TSCA).

Attachment D

Investigation Derived Waste Commonly Generated During Field Investigations

Commonly Generated Investigation Derived Waste

Type	Hazardous	Non-Hazardous
PPE-Disposable	Containerize in bucket with tight-fitting lid. Identify and leave on-site with permission of site operator.	Place waste in trash bag. Place in dumpster with permission of site operator.
PPE-Reusable	Decontaminate per August Mack SOP. If the equipment cannot be decontaminated, containerize with tight-fitting lid. Identify and leave on-site with permission of site operator.	Decontaminate per August Mack SOP.
Spent Solvents	Containerize in original containers. Clearly identify contents. Leave on-site and arrange for proper disposal	NA
Soil Cuttings	Containerize in DOT-approved container with tight-fitting lid. Identify and leave on-site with permission of site operator, and arrange for testing and disposal.	Containerize in an appropriate container with tight-fitting lid or dispose of per the Site-specific disposal procedures.
Groundwater	Containerize in DOT-approved container with tight-fitting lid. Identify and leave on-site with permission of site operator, and arrange for testing and disposal.	Containerize in an appropriate container with tight-fitting lid or dispose of per the Site-specific disposal procedures.
Decontamination Water	Containerize in DOT-approved container with tight-fitting lid. Identify and leave on-site with permission of site operator, and arrange for testing and disposal.	Containerize in an appropriate container with tight-fitting lid or dispose of per the Site-specific disposal procedures.
Disposable Equipment	Containerize in DOT-approved container or 5-gallon plastic bucket with tightfitting lid. Identify and leave on-site with permission of site operator, otherwise arrange with program site manager for testing and disposal.	Containerize in an appropriate container with tight-fitting lid or dispose of per the Site-specific disposal procedures.
Trash	NA	Place waste in trash bag. Place in dumpster with permission of site operator.

Attachment E

Field Measurement Equipment Calibration Summary

August Mack
ENVIRONMENTAL

FIELD SAMPLING EQUIPMENT
CALIBRATION AND INSPECTION FIELD FORM

FACILITY: _____ DATE:_____

PURPOSE OF SAMPLING:_____

SAMPLERS:_____

MULTI-PARAMETER METER:

Manufacturer:_____ Serial Number:_____

Overall Condition: Good Fair Poor Comments:_____
Battery Charged: Yes No Comments:_____
Decon Prior to Use: Yes No Comments:_____

STANDARDS

	Manufacturer	Lot No.	Expiration Date
PH			
4.0			
7.0			
Conductivity			
7980 uS			
Turbidity			
Factory			

Before Calibration					
Time	Temperature	pH 4	pH 7	Conductivity	ORP

After Calibration					
Time	Temperature	pH 4	pH 7	Conductivity	ORP

WATER LEVEL INDICATOR:

Manufacturer:_____ Serial Number:_____

Overall Condition: Good Fair Poor Comments:_____
Battery Charged: Yes No Comments:_____
Decon Prior to Use: Yes No Comments:_____

INTERFACE PROBE:

Manufacturer:_____ Serial Number:_____

Overall Condition: Good Fair Poor Comments:_____
Battery Charged: Yes No Comments:_____
Decon Prior to Use: Yes No Comments:_____

DOC022.97.80344

DR 900

04/2022, Edition 4



User Manual
Manuel de l'utilisateur
Manual del usuario
Manual do Usuário
用户手册
取扱説明書
사용 설명서
คู่มือผู้ใช้
دليل المستخدم

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Section 1 Specifications

Specifications are subject to change without notice.

Specification	Details
Measurement mode	Transmittance (%), Absorbance (Abs) and Concentration (Conc)
Dimensions (W x D x H)	23.6 x 8.7 x 4.7 cm (9.3 x 3.4 x 1.9 in.)
Enclosure rating	IP67
Weight	0.6 kg (1.3 lb)
Power requirements (internal)	AA Alkaline batteries (4x)
Battery life	6 months (typical) at 5 readings a day/5 day week without the backlight
Interface	USB mini
Operating temperature	0 to 50 °C (32 to 122 °F), maximum 90% relative humidity non-condensing
Storage temperature	–30 to 60 °C (–22 to 140 °F), maximum 90% relative humidity non-condensing
Lamp source	Light emitting diode (LED)
Detector	Silicon photodiode
Wavelength range	420, 520, 560, 610 nm
Photometric measuring range	0–2 Abs
Wavelength accuracy	±1 nm
Photometric accuracy	±0.03 Abs
Photometric linearity	±0.002 Abs (0–1 Abs)
Wavelength selection	Automatic, based on the method selection
Photometric repeatability	±0.002 Abs (0–1 Abs)
Data readout	Graphical display, 240 x 160 pixel (backlit)
Sample cells	16 mm, 1 cm/10 mL, 1-inch (25 mm) round
Protection class	Class III
Certifications	CE certified
Warranty	1 year (EU: 2 years)

Section 2 General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

2.1 Safety information

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is soley responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

2.2 Use of hazard information

⚠ DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE
Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

2.3 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol indicates that a risk of explosion is present.
	This symbol indicates that a risk of fire is present.

	This symbol identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol indicates the need for protective eye wear.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

2.4 Compliance and certification

⚠ CAUTION

This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Canadian Radio Interference-Causing Equipment Regulation, ICES-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

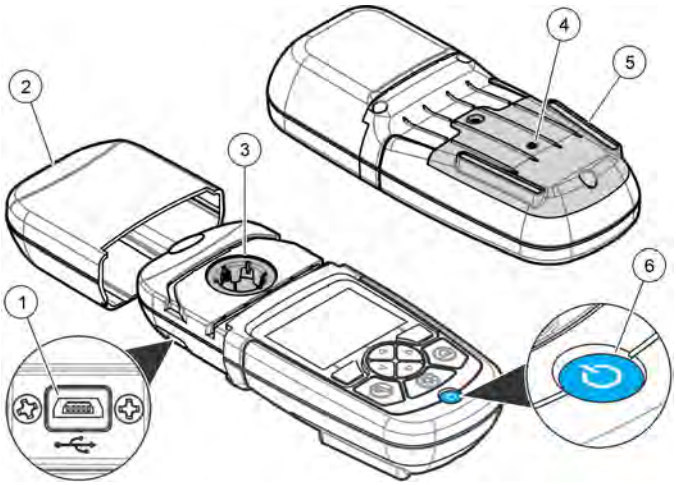
1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

2.5 Product overview

The DR 900 is a portable, LED-sourced colorimeter that measures at wavelengths of 420, 520, 560 and 610 nm. The instrument is used to measure various parameters in drinking water,

wastewater and industrial applications. The instrument comes with a complete set of stored programs (pre-installed methods) and the availability of user program storage and favorite program selection. Refer to Figure 1.

Figure 1 Instrument overview

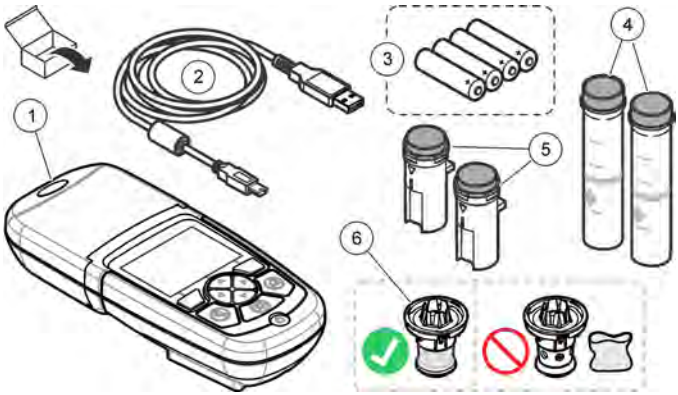


1 USB port	**4** Vent
2 Instrument cap	**5** Battery compartment
3 Cell compartment	**6** Power key

2.6 Product components

Make sure that all components have been received. Refer to Figure 2. If any items are missing or damaged, contact the instrument supplier or a sales representative immediately.

Figure 2 Product components



1 DR 900	**4** Glass sample cell, 1-inch (25 mm) round, 10, 20, 25-mL marks (2x)
2 USB cable with mini-USB connector	**5** Sample cell, 1 cm/10 mL (2x)
3 AA alkaline batteries (4x)	**6** Sample cell adapter

Section 3 Installation

⚠ WARNING

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

NOTICE

Make sure not to cause a blockage of the instrument battery vent during use or storage.

3.1 Install the batteries

⚠ WARNING

Explosion hazard. Incorrect battery installation can cause the release of explosive gases. Be sure that the batteries are of the same approved chemical type and are inserted in the correct orientation. Do not mix new and used batteries.

⚠ WARNING

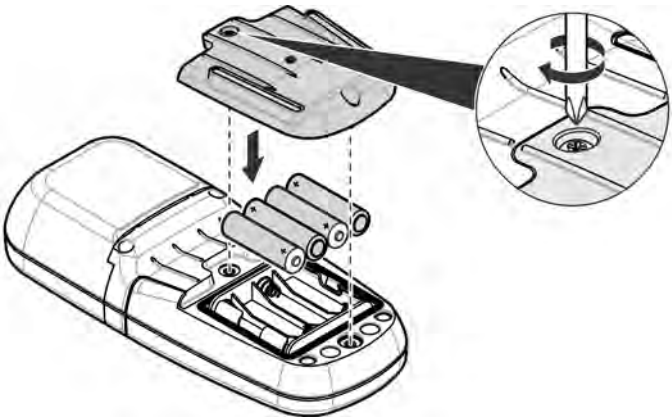
Fire hazard. Battery substitution is not permitted. Use only alkaline batteries.

NOTICE

Make sure to tighten the screws to 1–1.4 N·m (9–12 in.·lb) for a correct seal fit and to maintain the enclosure environmental rating.

The instrument is powered with four AA alkaline batteries. Make sure that the batteries are installed in the correct orientation. Refer to Figure 3 for the battery installation.

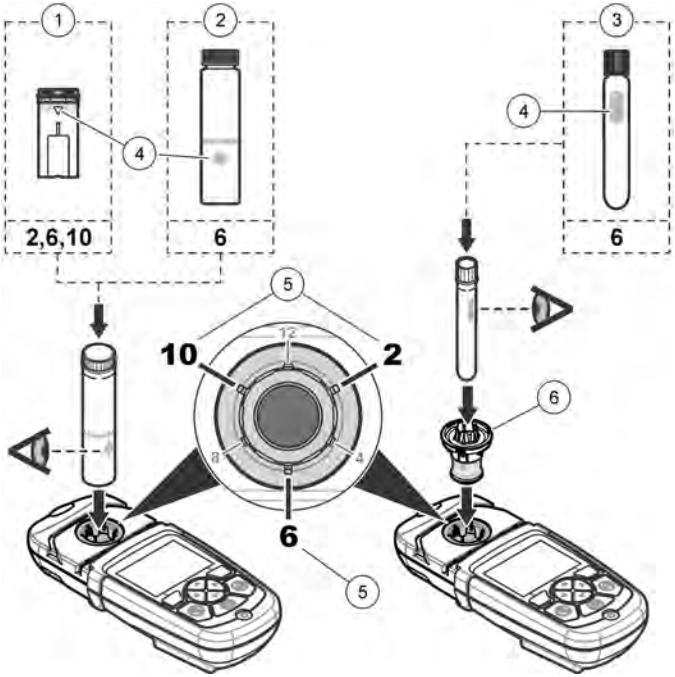
Figure 3 Battery installation



3.2 Install the sample cell and cell adapter

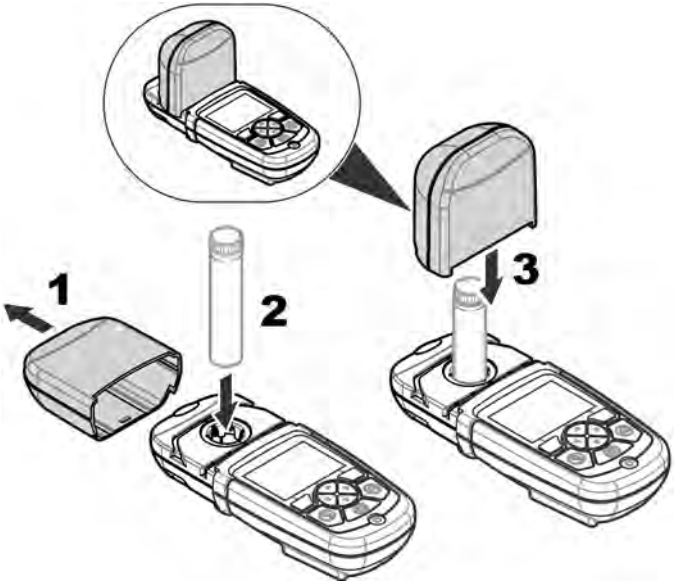
The instrument has one cell compartment which can use one adapter for different sample cell types. Make sure to install the sample cell in the correct orientation and in a consistent orientation so that the results are more repeatable and precise. Refer to Figure 4. Close the instrument cap before the instrument zero is set or a measurement is made to prevent light interferences. Refer to Figure 5.

Figure 4 Sample cell orientation



1 1-cm/10-mL plastic sample cell	**4** Orientation mark
2 1-inch (25 mm) glass sample cell	**5** Orientation position (clockwise)
3 16-mm glass test vial	**6** Sample cell adapter

Figure 5 Sample cell and instrument cap installation



Section 4 User interface and navigation

4.1 Keypad description

Refer to Figure 6 for the keypad description and navigation information.

Figure 6 Keypad description



1 BACKLIGHT: set the display illumination to on or off	**4** RIGHT selection key (contextual): read sample, selects or confirms options, opens sub-menus
2 SETTINGS: setup options[1]	**5** Navigation keys UP, DOWN, RIGHT, LEFT: scroll through menus, enter numbers and letters[2]
3 LEFT selection key (contextual): access for options, cancels or exits the current menu screen to the previous one	**6** HOME/Options: go to the main reading screen[1], select program, data management

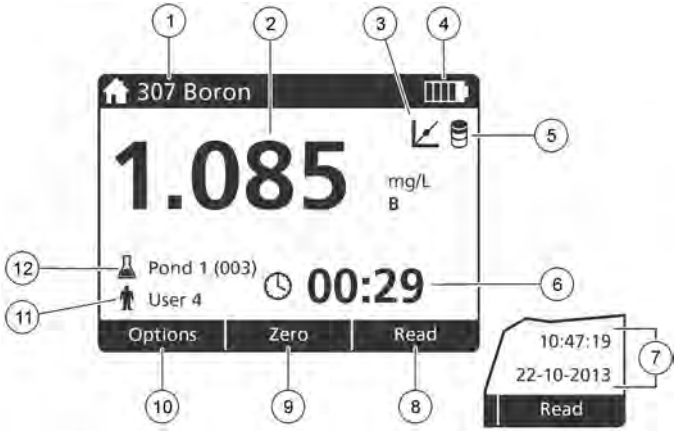
4.2 Display description

The reading screen shows the selected mode, unit, date and time, operator ID and sample ID. Refer to Figure 7.

[1] While in an edit mode, the key does not operate.

[2] When an UP or DOWN key is held, it scrolls fast. When a LEFT or RIGHT key is pushed, it scrolls by page.

Figure 7 Single screen display



1 Program name and number	**7** Time and date
2 Reading value, unit, chemical form, under "---" or over measuring range "+++"	**8** Read (contextual: done, select, start, ok)
3 Standard adjust icon	**9** Zero (contextual: navigation key UP arrow)
4 Battery status	**10** Options (contextual: back, cancel)
5 Reagent blank icon	**11** Operator identification
6 Timer	**12** Sample identification

4.3 Navigation

The instrument contains menus to change various options. Use the navigation keys (**UP**, **DOWN**, **RIGHT** and **LEFT** arrows) to highlight different options. Push the **RIGHT** selection key to select an option. Enter an option value with the navigation keys. Push the navigation keys (**UP**, **DOWN**, **RIGHT** and **LEFT** arrows) to enter or change a value. Push the **RIGHT** arrow to advance to the next space. Push the **RIGHT** selection key under **Done** to accept the value. Push the **LEFT** selection key to exit the current menu screen to the previous one.

Section 5 Startup

5.1 Set the instrument to on or off

Push the **POWER** key to set the instrument to on or off. If the instrument does not power on, make sure that the batteries are correctly installed.

5.2 Set the language

There are two options to set the language:

- Set the display language when the instrument is set to on for the first time.
- Set the language from the SETTINGS menu.

1. Push **SETTINGS>Setup>Language**.
2. Select a language from the list.

5.3 Set the date and time

There are two options to set the date and time:

- Set the date and time when the instrument is set to on for the first time.
- Set the date and time from the Date & Time menu.

1. Push **SETTINGS>Setup>Date & Time**.
2. Select **Set Date & Time Format**, then select a format for the date and time.
3. Select **Set Date & Time**.
4. Use the navigation keys to enter the current date and time, then push **OK**.

Section 6 Standard operation

6.1 Program list

The instrument is delivered with a complete series of application programs. Refer to Table 1 for the program descriptions.

Table 1 Program options

Program option	Description
Stored programs	Stored programs are factory-installed, pre-programmed methods. Refer to Select a stored program on page 13.
User programs	Methods can be developed and can be saved as a user program.[3] Refer to User programs on page 16.
Favorites	Methods which are often used can be saved in the favorite list.[1]

6.1.1 Select a stored program

1. Push **HOME>Options>All Programs**.
2. Select the applicable method and push **Start**.
3. Select **Options>Add to Favorites** to add the selected method to favorites for faster access.

6.1.2 Select basic program options

When a program is selected, additional parameter options are available.

1. Push **Options** to access the option menu.
2. Select the applicable options.

Option	Description
Start Timer	Select a pre-set timer or set a manual timer to make sure that the steps of an analysis are correctly timed (e.g., reaction times or wait times can be exactly specified). When the timer is on, the timer icon is shown on the display. The instrument makes an audible sound when the time is over. **Pre-set timer**—Select the applicable pre-set timer for one or more stored procedure steps and push **Start**. **Timer Manual**—Enter the applicable time with the navigation keys and push **Done**. Default = 00:00
Favorites/User Programs	Select from the stored favorites or user programs list. Refer to Select a favorite or a user program on page 16 for more information.
All Programs	Select a pre-programmed method from the list.
Data Log	Show all saved readings. Refer to Data log on page 15 for more information.

[3] A maximum of ten methods (user programs and/or favorites) can be saved.

Option	Description
Add to Favorites	Save stored programs and user programs methods which are often used in the favorites list. Refer to Add a program to favorites on page 16.
%T/Abs/Conc	Switch to % transmittance, absorbance or concentration readings. **Transmittance reading (%)**—Reads the percent of the original light that passes through the sample and reaches the detector. **Absorbance readings**—The light absorbed by the sample is read in absorbance units. **Concentration readings**—The measured absorbance values are converted into concentration values with the program-specific stored equation.
Advanced Options	Use the advanced options to specify more parameters. Refer to Select advanced program options on page 14.
Save	Save the last reading manually when the auto save option is set to Off.

6.1.3 Select advanced program options

Every program has various additional advanced options from which to select.

1. Push **Options** to access **Options>Advanced Options**.
2. Use the advanced options to specify more parameters.

Option	Description
Auto Save	Toggle between On and Off. Every reading is automatically saved when the option is set to On. The reading can be saved manually when the option is set to Off.
Chemical Form	Select the alternate chemical form and the associated measuring range on some factory-installed methods.
Reagent Blank	The Reagent Blank correction can be used with some of the factory-installed methods. Enter the result of a completed test using deionized water as the sample. The blank value is subtracted from every result to correct for any background color due to reagents. Enter the blank correction before the Standard Adjust option is used. Complete this correction for each new lot of test reagents.
Standard Adjust	Change stored calibration. Complete a test on a known standard at a concentration near the top of the test range. Use this function to adjust the result to align the standard concentration.
Sort Program	Select an alphabetical or numerical program order for the stored program list.

6.2 Use an operator ID

The operator ID tag associates readings with an individual operator. All stored data will include this ID.

1. Push **SETTINGS>Operator ID** in the reading screen.
2. Select, create or delete an operator ID:

Option	Description
Current ID	Select an ID from a list. The current ID will be associated with the sample data until a different ID is selected.
Create New ID	Enter a name for a new operator ID. A maximum of 10 names can be entered.
Delete ID	Erase an existing operator ID.

6.3 Use a sample ID

The sample ID tag is used to associate readings with a particular sample or with a location. If assigned, stored data will include this ID.

1. Push **SETTINGS>Sample ID** in the reading screen.
2. Select, create or delete an operator ID:

Option	Description
Current ID	Select an ID from a list. The current ID will be associated with the sample data until a different ID is selected.
Create New ID	Enter a name for a new sample ID. A maximum of 10 names can be entered. The samples are numbered in sequence for each measurement until a different ID is selected (e.g., Pond 1, Pond 2).
Delete ID	Erase an existing sample ID.

6.4 How to do a measurement

Basic measurement steps are necessary to complete a measurement. Every method has a step-by-step procedure. Refer to the applicable method to run a specific test. The example that follows is a basic procedure to complete a measurement.

1. Select the applicable program from the programs menu (e.g., Stored Programs, User Programs, Favorites).
2. Install the cell adapter, if necessary.
3. Push **Start** to start the program.
4. Prepare the blank according to the method document. Close the sample cell and clean the optical faces of the sample cell with a lint-free cloth.
5. Insert the blank sample cell into the cell compartment. Make sure to install the blank sample cell in the correct and in a consistent orientation so that the results are more repeatable and precise. Refer to Figure 4 on page 9.
6. Close the instrument cap to prevent light interferences. Refer to Figure 5 on page 10.
7. Push **Zero**. The display shows a concentration of zero (e.g., mg/L, ABS, µg/L).
8. Prepare the sample. Add reagents as specified by the method document.
9. Select **Options>Start Timer** to use the stored timers within the program.
10. Close the sample cell and clean the optical surfaces of the cell with a lint-free cloth
11. Insert the sample into the cell compartment. Make sure to install the sample cell in the correct and in a consistent orientation so that the results are more repeatable and precise. Refer to Figure 4 on page 9.
12. Close the instrument cap to prevent light interferences. Refer to Figure 5 on page 10.
13. Push **Read**. The display shows the results in the selected units.
    Note: *The display shows "+++" or "---" if the measured absorbance is less or more than the calibration range of the test.*

6.5 Data log

The data log shows all saved readings. Push **HOME>Options>Data Log** to see the readings. Refer to Export the data log on page 19 for information about the data log export.

Section 7 Advanced operation

7.1 Select a favorite or a user program

The favorite and user programs database is empty when the instrument is started for the first time. A method can be saved in the favorites for faster access. A user program can be programmed for specific needs.

1. Push **HOME>Options>Favorites/User Programs>Select**.
2. Push **New Program** to make a new user program. Refer to User programs on page 16.

7.2 Add a program to favorites

Stored programs and user programs methods which are often used can be saved in the favorites list.

1. Select **HOME>Options>All Programs**.
2. Select the applicable method and push **Start**.
3. Select **Options>Add to Favorites** to add the selected method to favorites.

7.3 User programs

The user programs database is empty when the instrument is started for the first time. Use **New Program** to make new programs for specific needs. To make a new user program, do the steps that follow.

1. Push **HOME>Options>Favorites/User Programs>Select>New Program**.
2. Select an available program number from 1001 to 1010.
   Note: *A maximum of ten programs (user programs and/or favorites) can be saved.*
3. Enter a method name (up to 12 characters).
4. Select the wavelength: 420, 520, 560 or 610 nm.
5. Select the unit: None, µg/L, mg/L or g/L.
6. Select the resolution: 0000, 000.0, 00.00 or 0.000.
7. Add the calibration points: a minimum of 2 and a maximum of 12 calibration points.[4] Select Edit Std 1 and enter the first standard concentration value. Push **Done**.
   Note: *A beep means that the concentration is a duplicate of a previously entered standard or the concentration is too high for the selected resolution. Enter a different value and continue.*
8. Enter the absorbance value:

Option	Description
Edit ABS Manual	Use the navigation keys to enter the absorbance value manually.
Edit ABS Auto	1. Put the blank into the cell holder and push **Zero**. 2. Put the prepared sample into the cell holder and push **Read**. 3. Push **Done**.

   Note: *A beep means that the absorbance is a duplicate of a previously entered standard or that it falls between two previous standards. Enter a different value and continue.*
9. Push **Done**.
10. Select Add Cal Point.

[4] If the curve is known to be linear, only two concentration data points (e.g., a standard with zero absorbance and another known standard) are necessary. Use additional data points to confirm linearity or define a nonlinear curve.

11. Enter additional calibration points as described in steps 7–9.
12. Select **Save User Program**.

7.3.1 Edit a user program

To edit a stored user program:

1. Select **HOME>Favorites/User Programs.**
2. Select the applicable program and push **Options**.
3. Push **Edit**.
4. Obey the screen prompts to edit the procedure.

7.3.2 Delete a user or a favorite program

Delete a stored user or favorite program if the program is not used anymore.

1. Select **HOME>Options>Favorites/User Programs**.
2. Highlight the applicable program and push **Options>Delete** and obey the screen prompts.

7.4 Instrument information

The instrument information menu shows specific information such as the instrument name, serial number, software version, database version, memory used and program availability. Push **SETTINGS>Instrument Information**.

7.5 Set the password

The password settings options are used to prevent access to restricted menus.
Note: *If the specified password is forgotten and Security Options is set to on, the operator is locked out of the restricted menus. Contact technical support if the password is forgotten.*

1. Push **SETTINGS>Setup>Password Settings**.
2. Select an option.

Option	Description
Password Settings	Select On or Off to set the password protection to on or off.
Protected Items	Shows the list of protected items: edit operator ID, edit sample ID, edit user programs, date & time, upgrade firmware, upgrade methods, language and edit favorites list.

7.6 Set the display and sound

Use the display options to change the display contrast, the battery auto-shutoff options or the backlight option. Use the sound options for an audible sound when a key is pushed or a reading is complete.

1. Push **SETTINGS>Setup>Display & Sound>Display Options**.
2. Select an option.

Option	Description
Contrast	Adjust the display contrast. The lightest setting is 0 and the darkest setting is 9. Default: 5

Option	Description
Auto-Shutoff	To maximize battery life, set a time period after which the instrument will automatically set the power to off if no key is pushed (5, 10, 15, 20, 30 minutes, 1 hour, 2 hours or Disable). Default: 10 minutes
Backlight	The display backlight is set to on when **BACKLIGHT** is pushed. Set a time period after which the backlight will automatically power off if no key is pushed (10, 20, 30 seconds, 1, 2, 5, 10 minutes or Disable). Default: 1 minute

3. Push **SETTINGS>Setup>Display & Sound>Sounds**.
4. Select an option.

Option	Description
Keystroke	The instrument will make an audible sound whenever a key is pushed. Default: off
Reading Complete	The instrument will make an audible sound whenever a reading is complete. Default: on

7.7 USB main menu

When the instrument is connected with a USB cable to a computer, the USB Main Menu opens. Update the software, export or import programs or export the data log and event log from the USB Main Menu.

7.7.1 Update the firmware

Find the firmware upgrade file on the product website or contact the instrument supplier. Save the file from the website to the computer.

1. Set the instrument to on and connect the USB cable to the instrument and to the computer. The USB Main Menu prompts.
2. Select **Update DR900**.
   The instrument shows as a USB drive on the computer. Open the folder.
3. Copy the file DR900.bin to the open folder.
4. Push **Ok**.
5. When the update is done, push **Ok**.
6. Select **Disconnect USB**, push **Ok** and disconnect the USB cable.
7. Push **Ok**.
8. Restart the instrument.

7.7.2 Manage programs

With the Manage Programs function, user programs can be exported and/or imported and new factory programs can be imported.

1. Set the instrument to on and connect the USB cable to the instrument and to the computer. The USB Main Menu prompts.
2. Select **Manage Programs** and select an option:

Option	Description
Export User Programs	Export all user programs to the computer for storage or to move the user programs to another DR 900.

Option	Description
Import User Programs	Replace all user programs with the user programs from another DR 900 via computer.
Import Factory Programs	Import new factory programs from the manufacturer website.

The instrument shows as a USB drive on the computer. Open the folder.

3. Copy the export file from drive to the computer or copy the import file from the computer to the drive.
4. Push **Ok**.
5. When the transfer is done, select **Disconnect USB** and disconnect the USB cable.
6. Push **Ok**.

7.7.3 Export the data log

The event log and the data log can be exported to the computer. The event log contains the date, time, event number, parameter and the description of a configuration related action. Sample measurements are stored manually or automatically in the data log. Refer to Select advanced program options on page 14.

1. Set the instrument to on and connect the USB cable to the instrument and to the computer. The USB Main Menu prompts.
2. Select **Export Datalog**. The instrument shows as a USB drive on the computer. Open the folder.
3. Copy and save the export files (DR900_DataLog.csv and DR900_EventLog.csv) to the computer.
4. Push **Ok**.
5. When the files are copied to the computer, select **Disconnect USB** and disconnect the USB cable.
6. Push **Ok**.

Section 8 Maintenance

⚠ WARNING



Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

8.1 Clean the instrument

Clean the exterior of the instrument with a moist cloth and a mild soap solution and then wipe the instrument dry as necessary.

8.2 Clean the sample cells

⚠ CAUTION



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

⚠ CAUTION



Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

Most laboratory detergents are used at recommended concentrations. Neutral detergents, such as Liquinox, are safer to use when regular cleaning is necessary. To decrease the cleaning times, increase the temperature or use an ultrasonic bath. To complete the cleaning, rinse a few times with deionized water and then let the sample cell air dry.
Sample cells may also be cleaned with acid, followed by a thorough rinse with deionized water.

Note: *Always use acid to clean sample cells that were used for low-level metal tests.*

Special cleaning methods are necessary for individual procedures. When a brush is used to clean sample cells, take extra care to avoid scratches on the interior surfaces of the sample cells.

8.3 Replace the batteries

⚠ WARNING



Explosion hazard. Expired batteries can cause hydrogen gas buildup inside the instrument. Replace the batteries before they expire and do not store the instrument for long periods with the batteries installed.

⚠ WARNING



Fire hazard. Battery substitution is not permitted. Use only alkaline batteries.

NOTICE

Make sure to tighten the screws to 1–1.4 N·m (9–12 in.·lb) for a correct seal fit and to maintain the enclosure environmental rating.

Refer to Install the batteries on page 7 for battery replacement.

Section 9 Troubleshooting

Error code	Possible cause	Solution
1	Instrument is not configured.	Contact technical support.
2	Could not read program data	
3	Could not write program data	
4	Battery error	Replace the batteries.
5	A/D error during a measurement	Contact technical support.
6	Offset error during a measurement	Make sure that the instrument cap is correctly installed.

Error code	Possible cause	Solution
7	Low light error during a measurement	• Make sure that there is no light path blockage. • Zero is out of instrument range • Contact technical support.
8	Over range error during a measurement, a potential light blockage or the concentration is too high	• Make sure that there is no light path blockage and that the concentration is not too high for the program. • Make sure that the instrument cap is correctly installed. • Contact technical support.

Section 10 Replacement parts and accessories

⚠ WARNING



Personal injury hazard. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction. The replacement parts in this section are approved by the manufacturer.

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Replacement parts

Description	Item no.
Adapter assembly, COD	4846400
Battery set, AA alkaline batteries (4x)	1938004
Sample cell with cap, 25 x 95 mm, 10-20-25 mL (6x)	2401906
Sample cell with cap, 1 cm/10 mL (2x)	4864302
USB cable	LZV818

Accessories

Description	Item no.
Cap, sample cell, for 25 x 95 mL cell	2401812
Carrying case, hard-sided	4942500
Carrying case, soft-sided with shoulder strap	2722000
Carrying case, portable laboratory	4943000
DR/Check™ absorbance standards	2763900
Instrument cap, DR 900	9390500

Operational Guide

To turn the meter on and check the battery status

Press and hold the ⏻/MODE button until the LCD lights up. All the used segments on the LCD will be visible for 1 second (or as long as the button is pressed), followed by the percent indication of the remaining battery life (E.g. "% 100 BATT").

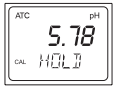
Taking measurements



Submerge the electrode in the solution to be tested while stirring it gently. The measurements should be taken when the stability symbol ⏱ on the top left of the LCD disappears.

The pH value automatically compensated for temperature is shown on the primary LCD while the secondary LCD shows the temperature of the sample.

To freeze the display



While in measurement mode, press the SET/HOLD button. "HOLD" appears on the secondary display and the reading will be frozen on the LCD (E.g. "pH 5.78 HOLD"). Press any button to return to normal mode.

To turn the meter off

While in normal mode, press the ⏻/MODE button. "OFF" will appear on the secondary display. Release the button.

Notes: Before taking any measurements make sure the meter has been calibrated ("CAL" tag present on the LCD).
If measurements are taken in different samples successively, rinse the probe thoroughly to eliminate cross-contamination and after cleaning, rinse the probe with some of the sample to be measured.

Setup

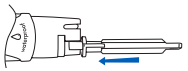
Setup mode allows the selection of temperature unit and pH buffer set. To enter the Setup mode, press the ⏻/MODE button until "CAL" on the secondary display is replaced by "TEMP" and the current temperature unit (E.g. "TEMP °C"). Then:

- for °C / °F selection: Use the SET/HOLD button. After the temperature unit has been selected, press the ⏻/MODE button to enter the buffer set selection mode; press the ⏻/MODE button twice to return to the normal measuring mode.
- to change the calibration buffer set: After setting the temperature unit, the meter will show the current buffer set: "pH 7.01 BUFF" (for pH 4.01 / 7.01 / 10.01) or "pH 6.86 BUFF"(for NIST 4.01 / 6.86 / 9.18). Change the set with the SET/HOLD button, then press ⏻/MODE to return to normal measuring mode.

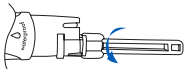
pH Electrode Maintenance

- When not in use, rinse the electrode with water to minimize contamination and store it with a few drops of HI70300 storage solution in the protective cap. DO NOT USE DISTILLED OR DEIONIZED WATER FOR STORAGE PURPOSES.
- If the electrode has been left dry, soak in storage solution for at least one hour to reactivate it.
- To prolong the life of the pH electrode, it is recommended to clean it monthly by immersing it in the HI7061 cleaning solution for half an hour. Afterwards, rinse it thoroughly with tap water and recalibrate the meter.

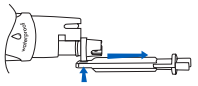
The pH electrode can be easily replaced by using the supplied tool (HI73128).



Insert the tool into the electrode cavity as shown above.



Rotate the electrode counterclockwise.



Pull the electrode out by using the other side of the tool. Insert a new pH electrode following the above instructions in reverse order.

Battery Replacement

The meter displays the remaining battery percentage every time it is switched on. When the battery level is below 5%, the ▭ symbol on the bottom left of the LCD lights up to indicate a low battery condition. The batteries should be replaced soon. If the battery level is low enough to cause erroneous readings, the meter shows "% 0 BATT" and the Battery Error Prevention System (BEPS) will automatically turn the meter off. To change the batteries, remove the 4 screws located on the top of the meter (fig. 1).

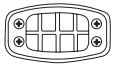
fig. 1 

fig. 2 

Once the top has been removed, carefully replace the 4 batteries located in the compartment while paying attention to their polarity (fig. 2).
Replace the top, making sure that the gasket is properly seated in place, and tighten the screws to ensure a watertight seal.

Note: Batteries should only be replaced in a safe area using the battery type specified in this instruction manual. Old batteries should be disposed in accordance with local regulations.

Accessories

Electrode

Code	Description
HI73127	Replaceable pH electrode
HI73128	Electrode removal tool

pH Buffer Solution

Code	Description
HI70004P	pH 4.01 solution, 20 mL sachet (25 pcs.)
HI70006P	pH 6.86 solution, 20 mL sachet (25 pcs.)
HI70007P	pH 7.01 solution, 20 mL sachet (25 pcs.)
HI70009P	pH 9.18 solution, 20 mL sachet (25 pcs.)
HI70010P	pH 10.01 solution, 20 mL sachet(25 pcs.)
HI770710P	pH 10.01 & 7.01 solution, 20 mL sachets (10 pcs., 5 ea.)
HI77400P	pH 4.01 & 7.01 solutions, 20 mL sachet (10 pcs., 5 ea.)

Electrode Cleaning Solution

Code	Description
HI7061M	Electrode cleaning solution, 230 mL bottle

Electrode Storage Solution

Code	Description
HI70300M	Electrode storage solution, 230 mL bottle

Other Accessories

Code	Description
HI740026P	Replacement 1.5V batteries (12 pcs.)

Warranty

HI98127 and HI98128 are warranted for a period of one year against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. The electrode is warranted for a period of six months. This warranty is limited to repair or replacement free of charge. Damage due to accidents, misuse, tampering or lack of prescribed maintenance is not covered. If service is required, contact your local Hanna office. If under warranty, report the model number, date of purchase, serial number and the nature of the problem. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization (RGA) number from the Technical Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

IST98127 02/16

US DESIGN PATENT D462, 024

INSTRUCTION MANUAL

HI98127 • HI98128

Waterproof pH Testers with Replaceable Electrode



HANNA® instruments

1.800.561.8187 www.itm.com information@itm.com

Preliminary Examination

Remove the instrument from the packing material and examine it carefully to make sure that no damage has occurred during shipment. If noticeable damage is evident, contact your local Hanna office.
Each meter is supplied with:

- HI73127 pH electrode
- HI73128 electrode removal tool
- 1.5V batteries (4 pcs.)
- Instruction manual
- Calibration card

Note: Save all packing material until you are sure that the instrument functions correctly. All defective items must be returned in the original packing together with the supplied accessories.

General Description

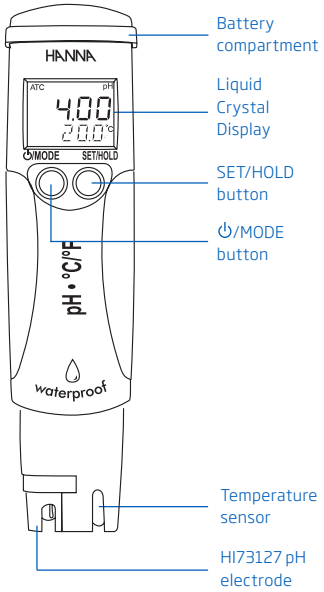
HI98127 (pHep®4) and HI98128 (pHep®5) are waterproof pH and temperature meters. The housing has been completely sealed against humidity and designed to float. All pH readings are automatically temperature compensated (ATC), and temperature values can be displayed in °C or °F units.

These meters can be calibrated at one or two points with auto-buffer recognition and against five memorized buffer values. A stability indicator is displayed on the LCD to ensure measurements are highly accurate.

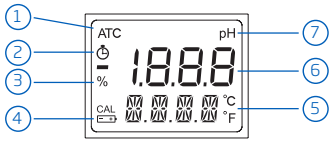
At start-up, these meters indicate battery level and will display a low battery symbol to alert the user if the batteries need to be replaced. In addition, the Battery Error Prevention System (BEPS) avoids erroneous readings by turning the meter off when battery voltage levels are too low.

The included HI73127 pH electrode can be easily replaced and the stainless steel encapsulated temperature sensor facilitates faster and more accurate temperature measurement and compensation.

Functional Description



LCD Description



1. ATC (Automatic Temperature Compensation) indicator
2. Stability indicator
3. Battery life percentage indicator
4. Low battery indicator
5. Secondary display
6. Primary display
7. Measuring unit for primary display

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Specifications

Range	-2.0 to 16.0 pH (HI98127) -2.00 to 16.00 pH (HI98128) -5.0 to 60.0 °C / 23.0 to 140.0 °F
Resolution	0.1 pH (HI98127) 0.01 pH (HI98128) 0.1 °C / 0.1 °F
Accuracy (@25 °C / 77 °F)	±0.1 pH (HI98127) ±0.05 pH (HI98128) ±0.5 °C / ±1.0 °F
Temperature Compensation	automatic
Environment	-5 to 50 °C (23 to 122 °F); RH 100%
Calibration	1 or 2 points with 2 sets of memorized buffers (pH 4.01 / 7.01 / 10.01 or pH 4.01 / 6.86 / 9.18)
Electrode	HI73127 pH electrode (included)
Battery Type	1.5V (4 pcs.)
Battery Life	with BEPS / approx. 300 hours
Auto-off	after 8 minutes of non-use
Dimensions	171 x 41 x 26 mm (6.7 x 1.6 x 1.0")
Weight	84 g (3.0 oz)

Calibration

For better accuracy, frequent calibration of the instrument is recommended. In addition, the instrument must be recalibrated whenever:

a) The pH electrode is replaced.
b) After testing aggressive chemicals.
c) Where high accuracy is required.
d) At least once a month.

Calibration procedure

From normal measuring mode, press and hold the ⏻/MODE button until "OFF" on the secondary LCD is replaced by "CAL".
Release the button. The LCD enters the calibration mode displaying "pH 7.01 USE" (or "pH 6.86 USE" if the NIST buffer set was selected).
After 1 second the meter activates the automatic buffer recognition feature. If a valid buffer is detected then its value is shown on the primary display and "REC" appears on the secondary LCD.
If no valid buffer is detected, the meter keeps the "USE" indication active for 12 seconds, and then it replaces it with "WRNG", indicating the sample being measured is not a valid buffer.

For a single-point calibration with buffers pH 4.01, 9.18 or 10.01, the meter automatically accepts the calibration when the reading is stable; the meter displays the accepted buffer, with the message "OK 1". After 1 second the meter automatically returns to the normal measuring mode.
If a single-point calibration with buffer pH 7.01 (or pH 6.86) is desired, then after the calibration point has been accepted the ⏻/MODE button must be pressed in order to return to normal mode.
After the button is pressed, the meter shows "7.01" (or "6.86") - "OK 1" and, after 1 second, it automatically returns to the normal measuring mode.

Note: A two-point calibration is recommended for better accuracy.

For a two-point calibration, place the electrode in pH 7.01 (or pH 6.86) buffer. After the first calibration point has been accepted, the "pH 4.01 USE" message appears. The message is held for 12 seconds, unless a valid buffer is recognized. If no valid buffer is recognized, then the "WRNG" message is shown.

If a valid buffer (pH 4.01, 9.18 or 10.01) is detected, then the meter completes the calibration procedure. When the buffer is accepted, the LCD shows the accepted value with the "OK 2" message, and then the meter returns to the normal measuring mode.

Note: When the calibration procedure is completed, the "CAL" tag is turned on.

To quit calibration and reset to default values

- After entering the calibration mode and before the first point is accepted, it is possible to quit the procedure and return to the last calibration data by pressing the ⏻/MODE button. The secondary LCD displays "ESC" for 1 second and the meter returns to the normal measuring mode.
- To reset to the default values and clear a previous calibration, press the SET/HOLD button after entering the calibration mode and before the first point is accepted. The secondary LCD displays "CLR" for 1 second, the meter resets to the default calibration and the "CAL" tag on the LCD disappears.

Recommendations for Users

Before using Hanna products, make sure that they are entirely suitable for your specific application and for the environment in which they are used. Operation of these instruments may cause unacceptable interferences to other electronic equipment. Take all necessary steps to correct such interferences. Avoid touching the probe at all times. Any variation introduced by the user to the supplied equipment may degrade the instrument's EMC performance. Do not put the instrument in a microwave oven to avoid burns or damage to equipment. Do not use or store the instrument in hazardous environments.

1.800.561.8187 www.itm.com information@itm.com

150 & 450 Series Waterproof Handheld Meter

pH/mV Operation Instructions

EUTECH INSTRUMENTS Technology Made Easy ...

OAKTON

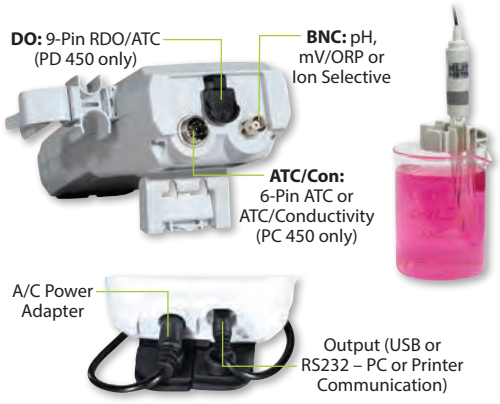
Models:



pH 150	pH 450	PC 450	PD 450
pH/mV	pH/mV/ISE	pH/mV/Con	pH/mV/DO

Getting Started/Connections

After installing (2) AA batteries and/or connecting the optional 110/220 VAC power supply, connect the desired sensors to the corresponding ports.



12 mm and 16 mm probes can utilize the **Grip-Clip™** to attach one or more sensors to a beaker and to the instrument as needed. The stand can be extended as shown above or used for wall-mounting.

Keypad Functions

ON/LIGHT	Press once to power ON in the mode that was previously used. Press again to turn backlight on for one minute or off (450 series only). Hold for 3 seconds to power OFF.
CAL / MEAS / BACK	Toggle between measurement and calibration modes. In SETUP mode, BACK serves to return to the previous menu option or setting.
ENTER / HOLD	Confirm calibration values in CAL mode. Confirm selections in SETUP mode. Freeze or release the measured reading.
SETUP	Customize instrument settings and preferences. (See also **Setup Programs**)
MODE	Toggle between available measurement types.
SAVE	Save measurement into memory. Increase value or scroll up in SETUP or manual calibration.
VIEW	Recall saved values from memory. Decrease value or scroll down in SETUP or manual calibration.
PRINT	Send output data to printer or computer. (450 series only).

Setup Programs

To access the settings below, press **SETUP**. Up/down arrows will display the available options. Press **ENTER** to accept the desired setting, or **BACK** to return to the previous option and/or exit.

Configuration Options

- Ready indicator **ON** / **OFF** / or Automatic **HOLD** when stable
- Choose **ºC**elsius or **ºF**ahrenheit

pH Buffer Options

- Select the desired pH Buffer Calibration Group:
  USA (1.68, 4.01, 7.00, 10.01, 12.45) or
  NIST (1.68, 4.01, 6.86, 9.18, 12.45) or
  DIN (1.09, 3.06, 4.65, 6.79, 9.23, 12.75) or
  MAN (manual adjustment of any custom pH values that are ≥1 pH unit apart. 450 series only)
- Select number of calibration points

Select Calibration Due Reminder

- Set number of days from **0-60** for desired parameter

View Calibration Data

- Press **ENTER** to view each point that is calibrated.

View Electrode Data

- Press **ENTER** to view mV **Offset** and **Slope %** of the measured reading.

System Settings

- Data Logging:
  MANUAL upon key press only
  TIMED interval. Choose (**SEC** / **MIN** / **HOUR**) interval.
- Automatic shut off after 10 minutes. Choose **ON** or **OFF**.
- Clock Settings:
  Date: Choose **USA** (MM/DD/YYYY) or **Euro** (DD/MM/YYYY).
  Time: Choose (**24HR or 12HR**). If 12HR, choose **AM** or **PM**.
- Set Printer Type:
  CSV (Comma Separated Values) – best format for computer
  Printer (Text) – best format for printer.
  Choose Manual (**MAN**) upon key press or **TIMED** interval.
  If timed, choose (**SEC** / **MIN** / **HOUR**).

Reset

- **NO**. Exits from reset menu options without action.
- **FACTORY RESET**. Returns all settings except date/time and ATC calibration to factory default values after **ENTER** is pressed then restarts meter.
- **DATA RESET**. Erases data stored in memory while retaining other settings after **ENTER** is pressed.
- **CALIBRATION RESET**. Erases non-ATC calibration data while retaining other settings after **ENTER** is pressed.

pH Calibration

For best results, periodic calibration with known, accurate standards is recommended. Calibrate with standards that bracket your intended measuring range while including a neutral standard (pH 7.00 or 6.86). For example, if you expect to measure samples from pH 6.2 to pH 9.5, calibration with 4.01, 7.00, and 10.01 standards will work well. Provide stirring for best results. After calibration with two or more points, the active slope segment of the measurement will be visible on the bottom display during measurement. 100 % slope will be shown if only one calibration point is performed and "- - -" if no calibration is performed. The meter will automatically return to measurement mode upon successful completion of the number of specified calibration points. To specify a different number of pH calibration points, see **pH Buffer Options**.

Using Automatic Buffer Recognition

1. While in pH measurement mode, dip the pH and ATC sensor(s) into your first standard, then press **CAL**. The primary display will search for the nearest standard value, while the secondary display will show the un-adjusted value.
2. When the "**READY**" indicator appears, press **ENTER** to accept. The primary reading will flash "**DONE**".
3. Rinse your electrode(s) then dip into the next pH standard. The primary display will search for the nearest standard value that has not yet been calibrated, while the secondary display will show the unadjusted value. When the "**READY**" indicator appears, press **ENTER** to accept.
4. To calibrate another pH standard repeat Step 3 or press **MEAS** to return to pH measurement mode.

Using Manual Recognition / Custom Buffers (450 Series Only)

1. While in pH measurement mode, dip the pH and ATC sensor(s) into your first standard then press **CAL**.
2. When the **READY** indicator appears, use up/down arrows to adjust the primary reading to match the standard value at the measured temperature, then press **ENTER**.
3. Rinse your electrode(s) then repeat Step 2 with a standard that is ≥1 pH unit from the previous standard value.
4. To calibrate another pH standard, repeat Step 3 or press **MEAS** to return to pH measurement mode.

mV Offset Adjustment

1. While in mV measurement mode, dip the ORP and ATC sensors into a solution with a known mV value (i.e. Zobel, Light's, quinhydrone, or iodide/triiodide) and stir.
2. When the "**READY**" indicator appears, use up/down arrows to adjust the primary reading to match the mV value at the measured temperature, then press **ENTER**. The meter allows an adjustable maximum value of ±200 mV from the factory default mV value. When an offset has been stored successfully, R.mV replaces mV.

Temperature Calibration/Manual ATC

1. Press **CAL** from any measurement, then press **MODE**.
2. Skip to step 3 for manual ATC, otherwise, dip the temperature sensor into a solution with a known accurate temperature. The upper display shows the active temperature while the lower display shows the factory default temperature without adjustment.
3. Use up/down arrows to adjust the upper display. Press **ENTER** to accept the calibration temperature. The maximum adjustable value is ±10 ºC (or ±18 ºF) from factory default.

Error Messages

ERR "ERR" will appear when an error condition exists or the incorrect key is pressed. Common examples include:

- Pressing **ENTER** during calibration before the "**READY**" indicator appears. Wait for the "**READY**" indicator before pressing **ENTER**.
- **UR** (Under Range) • **OR** (Over Range)

Intended Use, Maintenance & Precautions

These handheld meters use sensors to detect various parameters for water-based measurements. For routine maintenance disconnect the power cord or battery, then dust or wipe the display using a damp cloth. If necessary, warm water or a mild water based detergent can be used. Immediately remove any spilled substance from contact with the meter using the proper cleaning procedure for the type of spill.

- Do not use this equipment in potentially explosive atmospheres.
- Refer to the electrode instructions for use, storage and cleaning.
- Ensure that no liquid enters the instrument.
- Do not use any aggressive cleaning chemicals (solvents or similar agents).
- There are no user serviceable parts inside. Attempts to service internal parts may void the warranty.
- **WARNING:** No modification of this equipment is allowed.

Instrument Operating Conditions	
Operating Ambient Temp.	5 to 45 ºC
Operating Relative Humidity	5 to 85 %, non-condensing
Storage Temp.	-20 to +60 ºC
Storage Relative Humidity	5 to 85 %, non-condensing
Pollution	Degree 2
Overvoltage	Category II
Weight	500 g
Size (L x W x H)	21.15 x 9.87 x 5.85 cm
Regulatory & Safety	CE, TUV 3-1, FCC Class A
Power Rating	DC Input: 9 VDC 1 A
Battery Requirement	2 x AA (LR6) 1.5 V batteries (replace batteries when battery sign blinks)
Vibration	Shipping/handling per ISTA #1A
Shock	Drop test in packaging per ISTA #1A
Enclosure (Designed To Meet)	IP67 (using rubber covers)
Universal Power Adapter Operating Conditions	
Operating Ambient Temp.	0 to 50 ºC
Operating Relative Humidity	0 to 90 %, non-condensing
Storage Temp.	-20 to +75 ºC
Storage Relative Humidity	0 to 90 %, non-condensing
Pollution	Degree 2
Overvoltage	Category II
Power Rating	I/P: 100 - 240 V, 50/60 Hz, 0.3A O/P: 9 VDC 1 A

Eutech Instruments Pte Ltd
Blk 55, Ayer Rajah Crescent,
#04-16/24, Singapore 139949
Tel: (65) 6778-6876
Fax: (65) 6778-0086
eutech@thermofisher.com
www.eutechinst.com

Oakton Instruments
625 East Bunker Court,
Vernon Hills, IL, 60061, USA
Tel: 1-888-462-5866
Fax: 1-847-247-2984
info@4oakton.com
www.4oakton.com

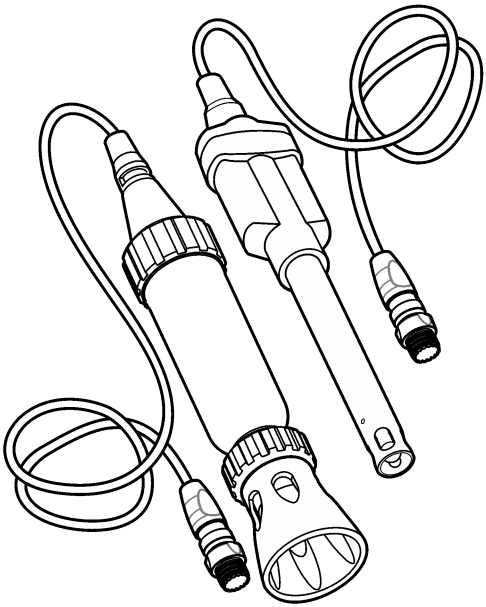
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PHC101

06/2021, Edition 5

User Manual



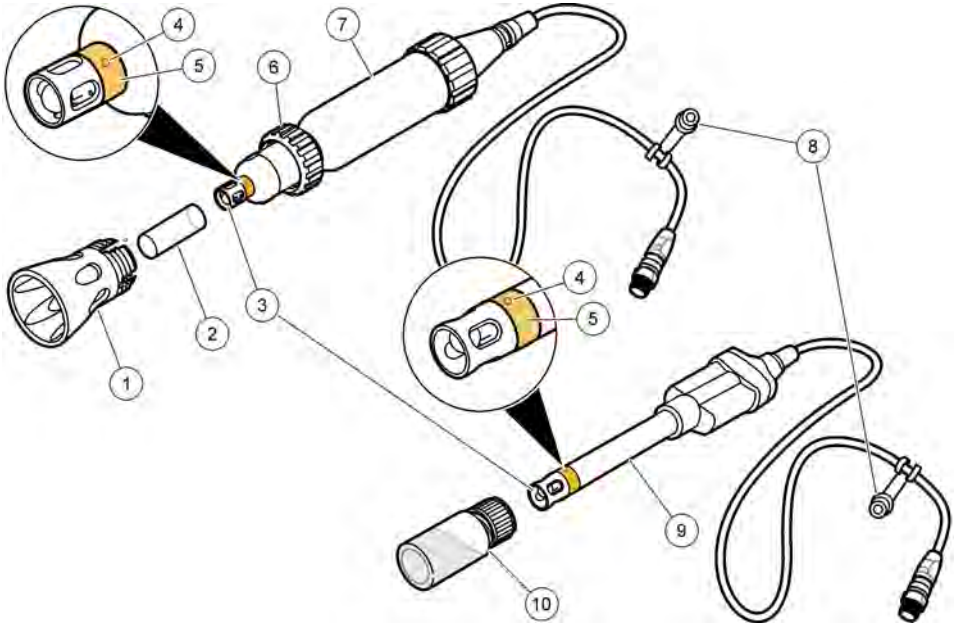
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Section 1 Product overview

The Intellical PHC101 series pH probes are digital, combination electrodes that measure the pH of wastewater, drinking water and general water samples. The probes have a non-refillable, gel-filled electrolyte and a built-in temperature sensor. The open reference junction gives an optimum electrical connection between the sample and the electrolyte and does not become clogged. The standard probes are for laboratory use. The rugged probes are for field use. Refer to Figure 1.

Note: *Do not use the probe to measure the pH of organic solvents or samples with a pH less than 2.*

Figure 1 Probe overview



1 Shroud (rugged model)	**6** Locking ring (rugged model)
2 Probe storage cap	**7** Rugged probe
3 Glass bulb and temperature sensor	**8** Probe soaker bottle holder or storage cap
4 Reference junction	**9** Standard probe
5 Protective tape	**10** Probe soaker bottle with storage solution

Section 2 Specifications

Specifications are subject to change without notice.

Specifications	Details
Probe type	Digital combination pH probe with non-refillable gel electrolyte and built-in temperature sensor
pH range	2 to 14 pH
pH accuracy	±0.02 pH
Reference type	Ag/AgCl

Specifications	Details
Reference junction	Open
Slope	–59 mV/pH (90 to 110% at 25 °C (77 °F) per Nernstian theoretical value)
Isopotential point	0 (±30) mV at 7.0 (±0.5) pH
Sodium (alkalinity) error	–0.6 pH at pH 12.6 in 1 M NaOH
Temperature accuracy	±0.3 °C (±0.54 °F)
Temperature sensor type	30 kΩ NTC thermistor
Operating temperature	0 to 50 °C (32 to 122 °F)
Storage temperature	5 to 40 °C (41 to 104 °F)
Minimum immersion depth	20 mm (0.79 in.)
Body material (standard)	Epoxy
Body material (field rugged)	Epoxy/stainless steel
Electrolyte	Non-refillable gel reference element
Storage solution	Hach pH electrode storage solution[1]
Cable connection	M12 digital output and connector
Dimensions	Diameter: 12 mm (0.47 in.) Length: 175 mm (6.9 in.) total; 103 mm (4.1 in.) below head Cable length: PHC10101: 1 m (3.3 ft); PHC10103: 3 m (9.8 ft)
Dimensions (rugged)	Diameter: 46 mm (1.8 in.) Length: 223 mm (8.7 in.) Cable length: PHC10105: 5 m (16.4 ft); PHC10110: 10 m (32.8 ft); PHC10115: 15 m (49.2 ft); PHC10130: 30 m (98.4 ft)
Weight (includes cable)	PHCxxx01: ~0.4 kg (0.9 lb); PHCxxx03: ~0.45 kg (1 lb)
Weight (rugged, includes cable)	PHCxxx05: ~1.3 kg (2.9 lb); PHCxxx10: ~1.55 kg (3.4 lb); PHCxxx15: ~1.9 kg (4.2 lb); PHCxxx30: 3.0 kg (6.6 lb)
Warranty	6 months on the probe. This warranty covers manufacturing defects, but not improper use or wear.
Certifications	CE, FCC/ISED

Section 3 Safety information

3.1 Intended use

The Intellical probes are intended for use by individuals who measure water quality parameters in the laboratory or in the field. The Intellical probes do not treat or alter water.

[1] Use of other storage solutions can cause permanent damage to the probe.

3.2 Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

3.3 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

3.4 Product hazards

⚠ CAUTION

	Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

⚠ CAUTION

	Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

⚠ CAUTION

	Personal injury hazard. Glass components can break. Handle with care to prevent cuts.

Section 4 Preparation for use

NOTICE

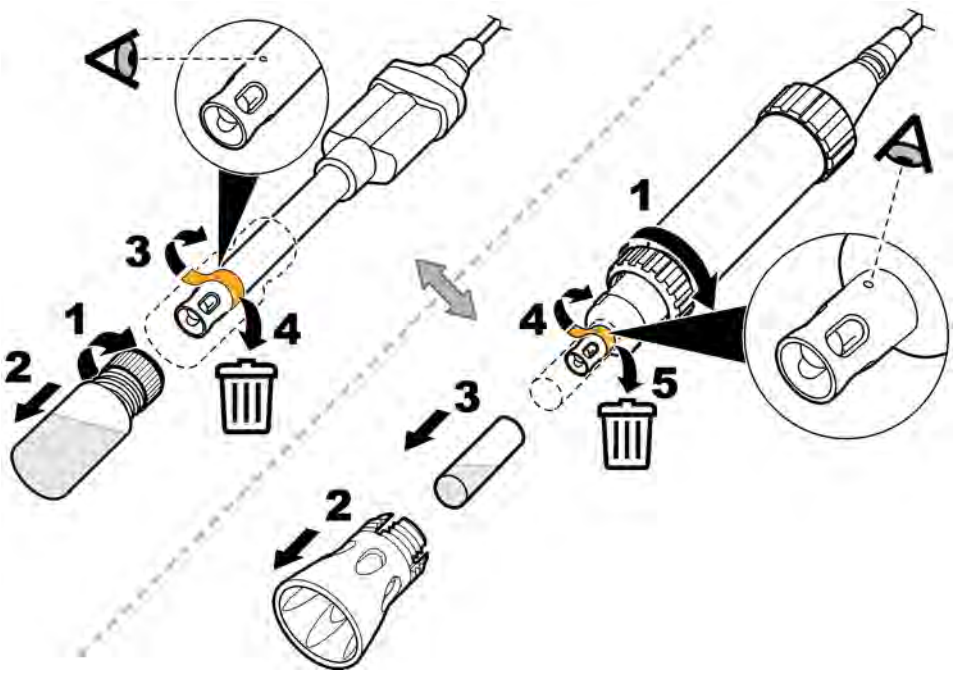
Make sure to remove the protective tape from the reference junction of new probes. A probe with a blocked reference junction will not operate correctly.

New probes come with protective tape and a soaker bottle that contains storage solution to keep the glass bulb and reference junction hydrated. Prepare the probe as follows.

1. Remove the protective tape from the reference junction. Refer to Figure 2.
2. Rinse the reference junction and glass bulb with deionized water. Blot dry with a lint-free cloth.
3. For faster stabilization, soak the probe for 3 or more minutes in the sample before use.
4. Make sure that the meter has the correct date and time settings. The service-life time stamp in the probe comes from the date and time settings in the meter.

   Note: *Some meters automatically open the date and time settings when the meter starts for the first time, or after battery replacement.*
5. Connect the probe to the meter.

Figure 2 Remove the protective tape



Section 5 Calibration

The procedure that follows is applicable to meters that can connect to Intellical pH probes. Refer to the applicable meter documentation for meter operation and probe-specific settings.

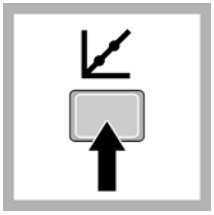
5.1 Calibration notes

Read the notes that follow before calibration:

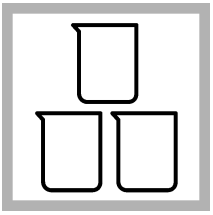
- Use prepared pH buffer solutions or mix pH buffer powder pillows with deionized water for calibration. Discard the prepared buffer solutions after each calibration.
- Use two or three buffer solutions for best results. Two buffer solutions are sufficient if the expected sample pH is between the pH of the two buffer solutions. The sequence in which the pH buffer solutions are used is not important. Use buffer solutions that are 2 or more pH units apart.
- For a one-point calibration, use a pH buffer near the expected sample pH.
- Use the default calibration options or change the options in the probe settings menu.
- Use the single display mode for calibration when more than one probe is connected to the meter (if applicable).

- Calibrate the probes and verify the calibration regularly for best results. Use the meter to set calibration reminders.
- The calibration data is stored in the probe. When a calibrated probe is connected to a different meter with the same calibration options, a new calibration is not necessary.
- Air bubbles below the sensor when in solution can cause a slow response or error in the calibration. Make sure to remove air bubbles during calibration.
- The pH buffer solutions have known pH values at different temperatures. The meter uses the mV and temperature readings of the probe in the pH buffer solutions to calculate a calibration slope. During measurements, the meter adjusts the slope for the sample temperature to determine the pH value of the sample.
- If the rugged probe does not easily go in the calibration container, remove the shroud. Refer to Remove or install the shroud on page 11.

5.2 Calibration procedure



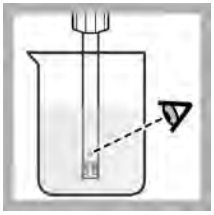
1. Go to the calibrate menu. Select the probe, if applicable. The display shows the pH buffer solutions to use for calibration.



2. Prepare or pour the pH buffer solutions in different beakers.



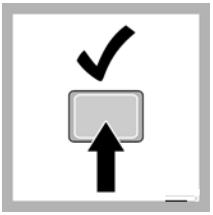
3. Rinse the probe with deionized water. Dry the probe with a lint-free cloth.



4. Put the probe in the first pH buffer solution. Make sure that the sensor and reference junction are fully in the solution. Do not put the probe on the bottom or sides of the beaker.



5. Shake the probe from side to side to refresh the reference junction and remove air bubbles.



6. Stir slowly, then read the pH value of the buffer solution. The display shows the temperature-corrected pH value when the reading is stable.



7. Continue with steps 3 through 6 for the remaining buffers or select Done.



8. Save the calibration.

Section 6 Sample measurement

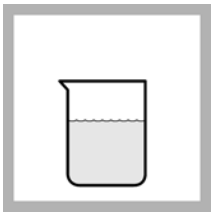
The procedure that follows is applicable to meters that can connect to Intellical pH probes. Refer to the applicable meter documentation for meter operation and probe-specific settings.

6.1 Sample measurement notes

Read the notes that follow before sample measurements.

- Rinse the probe with deionized water and dry with a lint-free cloth between measurements to prevent contamination.
- If complete traceability is necessary, enter a sample ID and operator ID before measurement. Refer to the meter manual for instructions.
- The meter automatically saves the measurement data when the user manually reads each data point and when the meter is set to read at regular intervals. The user must manually save each data point when the meter is set to read continuously.
- Air bubbles below the sensor can cause a slow response or error in the measurement. Make sure to remove air bubbles before and during measurements.
- If the probe is a rugged type, make sure to install the shroud before field use to prevent damage to the sensing elements. Refer to Remove or install the shroud on page 11. The probe warranty does not include such damage.
- To deploy a rugged probe at a distance, toss the probe body with a slow underhand throw. Do not throw the probe by the cable to prevent damage to cable, the probe or the user.

6.2 Sample measurement procedure

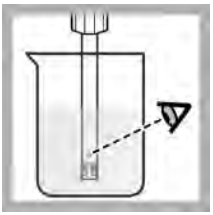


1. Collect the sample.



2. Rinse the probe with deionized water. Dry the probe with a lint-free cloth.

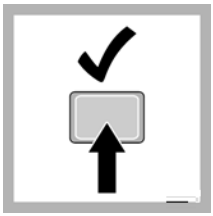
Rugged probes: install the shroud.



3. Put the probe in the sample with the sensor and reference junction fully in the sample. Do not put the probe on the bottom or sides of the beaker.



4. Shake the probe from side to side to refresh the reference junction and remove air bubbles.



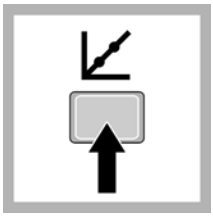
5. Stir gently, then read the pH value of the sample. The display shows the temperature-compensated pH value when the reading is stable.

Section 7 Verify the calibration

Measure the pH value of a fresh pH buffer solution to make sure the result is accurate. The meter compares the selected pH buffer value to the measured pH value and accepts or rejects the measurement. The user can change the pH buffer solution and acceptance criteria for verification in the probe-specific settings.

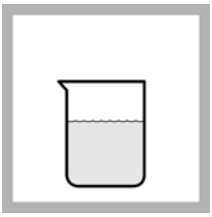
Note: *Password protection may prevent access to the acceptance criteria.*

7.1 Verification procedure

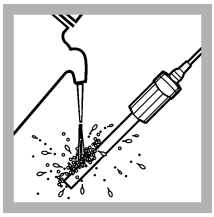


1. Go to the verification menu. The display shows the pH buffer solution to use for verification.

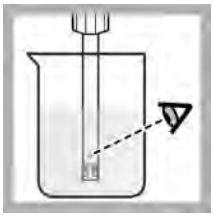
Note: *Menu name for HQd meters: Run check standard.*



2. Prepare or pour the pH buffer solution into a beaker.



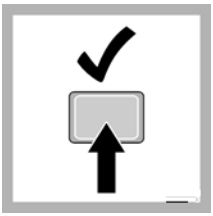
3. Rinse the probe with deionized water. Dry the probe with a lint-free cloth.



4. Put the probe in the pH buffer solution with the sensor and reference junction fully in the solution. Do not put the probe on the bottom or sides of the beaker.



5. Shake the probe from side to side to refresh the reference junction and remove air bubbles.



6. Stir gently, then read the pH value of the buffer solution. The meter accepts or rejects the result.

Section 8 Maintenance

Regular maintenance is necessary for the best accuracy, stabilization time and life of the probe. Keep the probe in the recommended storage solution between measurements.

8.1 Clean the probe

NOTICE

Probes with an open reference junction can become permanently damaged if the reference junction is soaked for a long time in a cleaning solution. Make sure to soak the probe below the reference junction only.

Clean the probe regularly to remove contamination and to keep the reference junction open. Symptoms of contamination:

- Incorrect or irregular readings
- Slow stabilization times
- Calibration errors
- Sample material stays on the probe

1. Rinse the probe with deionized water. Use warm (35–45 °C (95–113 °F)) deionized water to remove storage solution that dries on the probe. Dry the probe body with a lint-free cloth.

   Note: *Remove the shroud on a rugged probe before cleaning. Install the shroud after the probe is clean. Refer to* Remove or install the shroud *on page 11.*
2. Soak the probe below the reference junction in the applicable cleaning solution for the specified time. Do not let the reference junction soak in the cleaning solution or the probe can become permanently damaged. Refer to Figure 3, Table 1 and Consumables on page 14.
3. Rinse or soak the probe for 1 minute in deionized water. Dry the probe body with a lint-free cloth.
4. Soak the probe in pH 4 buffer for 20 minutes.
5. Rinse the probe with deionized water. Dry the probe body with a lint-free cloth.

Figure 3 Soaking depth for open junction probes

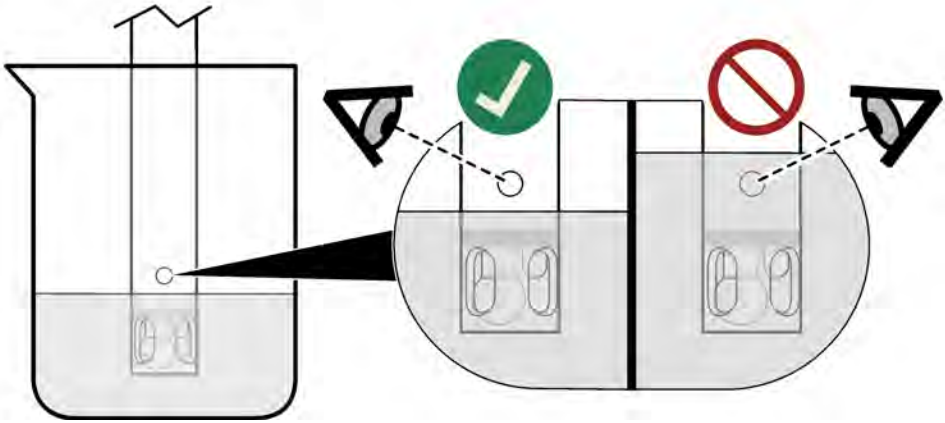


Table 1 Cleaning solution

Contamination	Cleaning solution	Active component	Soak time
General contamination	Electrode cleaning solution for regular maintenance	KATHON™ CG, DECONEX®11	12–16 hours
Minerals	Electrode cleaning solution for minerals/inorganic contamination	Phosphoric acid (~10%)	10–15 minutes
Fats, grease and oils	Electrode cleaning solution for fats, oils and grease contamination	KATHON™ CG, TRITON® X	2 hours maximum
Proteins	Electrode cleaning solution for proteins/organic contamination	Pepsin in HCl	3 hours maximum
Wastewater and organic compounds	Electrode cleaning solution, extra strong	Sodium hypochlorite	5–10 minutes

8.2 Soak procedure for dry probes

If the glass bulb becomes dry, complete the steps that follow to hydrate the probe.

1. Soak the probe tip in pH 4 and pH 7 buffer solutions for 5 minutes in each solution.
2. Rinse the probe with deionized water. Blot dry with a lint-free cloth.
3. Calibrate the probe.

8.3 Remove or install the shroud

Remove the shroud on the rugged probe during calibration and maintenance. Refer to Figure 4. Keep the shroud installed on the rugged probe during sample measurements to prevent damage to the sensor. Refer to Figure 5.

Figure 4 Remove the shroud

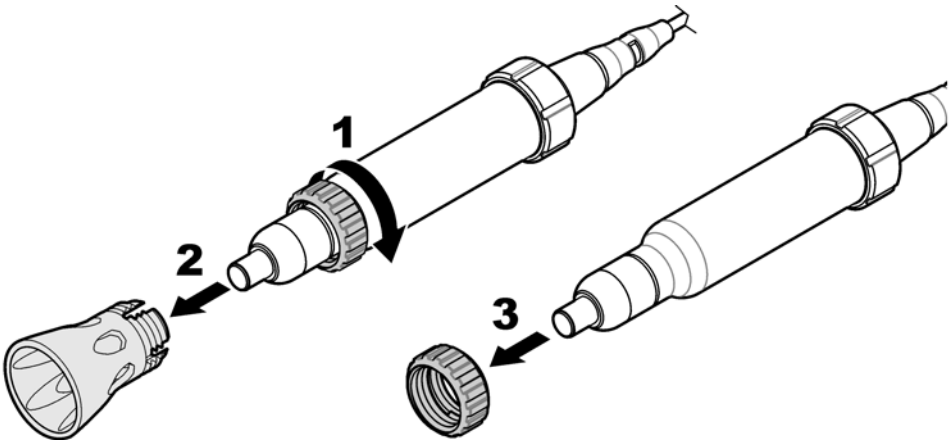
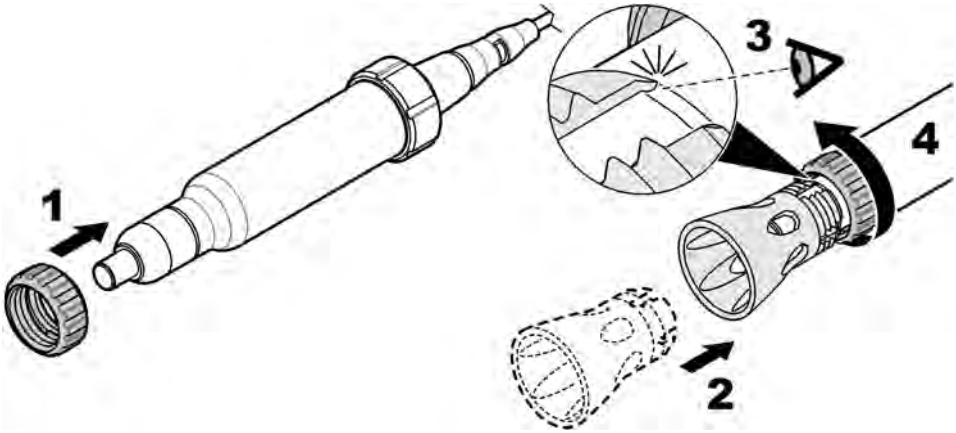


Figure 5 Install the shroud



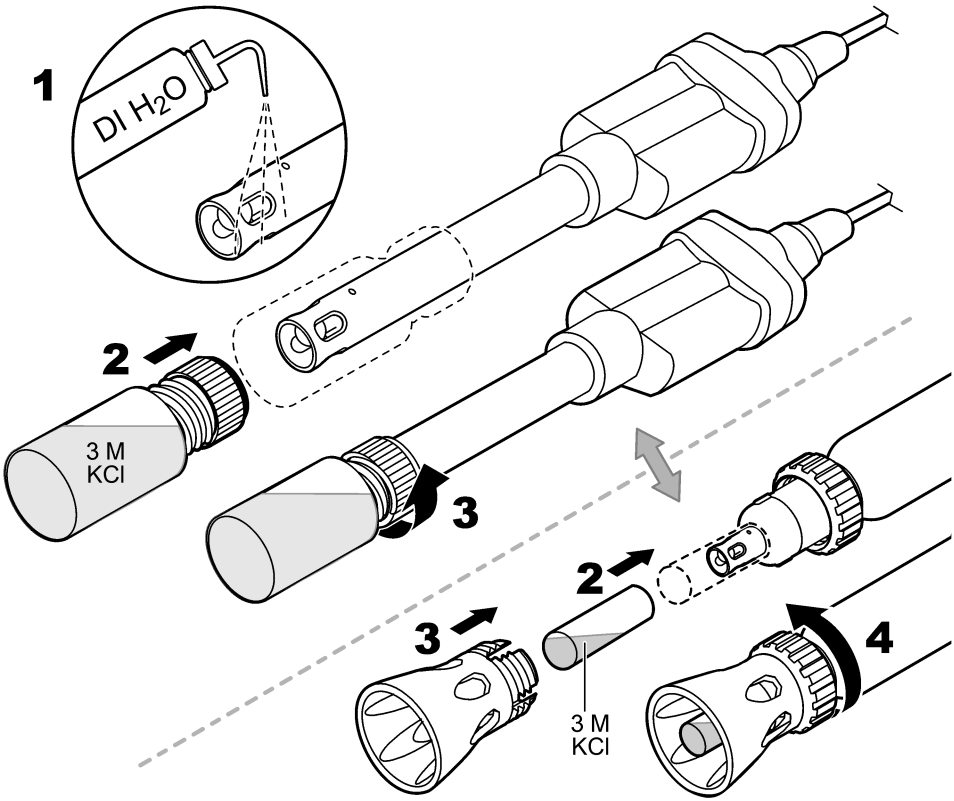
8.4 Storage

NOTICE

Probes can become permanently damaged if kept in a storage solution that is not specified by the manufacturer. Use only the specified storage solution (Hach pH electrode storage solution or 3 M KCl).

Do not store the probe in deionized water or in samples of low ionic strength. Put the soaker bottle that contains the storage solution on the probe when not in use. Make sure to only use the specified storage solution. Other solutions contaminate the non-replacement electrolyte gel through the open reference junction and the probe will not operate correctly. Refer to Figure 6. Keep the probe in a vertical position with the sensor and reference junction below the liquid level in the soaker bottle. Add storage solution to the soaker bottle if necessary.

Figure 6 Probe storage



Section 9 Troubleshooting

Keep the probe clean and in the recommended storage solution when not in use for the best accuracy, stabilization time and life of the probe.

Problem	Possible cause	Solution
Decreased probe performance causes slow stabilization and prevents accurate calibrations or measurements.	The glass sensor is dirty.	Clean and condition the probe. Refer to Clean the probe on page 10.
	The glass sensor has become dry.	Clean and condition the probe. Refer to Maintenance on page 10.
	The calibration slope of the probe has changed.	Increase the accepted slope limit settings if possible, or contact technical support.

Problem	Possible cause	Solution
Sample properties cause slow stabilization or inaccurate measurements.	The sample absorbs carbon dioxide (CO_2) from the air, which causes the pH value to slowly decrease in low ionic strength (LIS) or high purity samples.	Use the LIS chamber for LIS/high purity samples to prevent CO_2 absorption.
	The sample temperature is low, or there is a large temperature difference between samples.	Increase the sample temperature or adjust the temperature of different samples to be the same (within 2 °C (3.6 °F)).
Procedure problem causes slow stabilization and prevents accurate calibrations or measurements.	The probe is not conditioned to the sample.	Soak the probe in the sample before sample measurements. Refer to Preparation for use on page 5.
	Air bubbles are around or below the probe tip.	Carefully tap or shake the probe to remove air bubbles.
	The electrical connection through the reference junction is not sufficient.	Shake the probe in the solution from side to side to refresh the reference junction.
	The stir speed is too slow or too fast.	Try a different stir speed.
	An incorrect buffer solution was used or the buffer solution has contamination.	Use the specified buffer solutions of good quality.

Section 10 Consumables

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Quantity	Item no.
Hach pH electrode storage solution	500 mL	2756549
Electrode cleaning solution for regular maintenance	500 mL	2965249
Electrode cleaning solution for minerals/inorganic contamination	500 mL	2975149
Electrode cleaning solution for proteins/organic contamination	250 mL	C20C370
Electrode cleaning solution for fats, oils and grease contamination	500 mL	2964449
Electrode cleaning solution, extra strong	250 mL	S16M002

10.1 Recommended standards

Description	Unit	Item no.
pH 4.01 buffer solution, Singlet one-use packets, 20 mL each	20/pkg	2770020
pH 7.00 buffer solution, Singlet one-use packets, 20 mL each	20/pkg	2770120

10.1 Recommended standards (continued)

Description	Unit	Item no.
pH 10.01 buffer solution, Singlet one-use packets, 20 mL each	20/pkg	2770220
pH 4.01 and pH 7.00 buffer solution kit, Singlet one-use packets, 20 mL each	2 x 10/pkg	2769920
pH 7.00 and 10.01 buffer solution kit, Singlet one-use packets, 20 mL each	2 x 10/pkg	2769820
pH color-coded buffer solution kit (NIST), 500 mL, includes:	1	2947600
pH 4.01 ± 0.02 pH buffer (NIST)	500 mL	2283449
pH 7.00 ± 0.02 pH buffer (NIST)	500 mL	2283549
pH 10.01 ± 0.02 pH buffer (NIST)	500 mL	2283649
Powder pillows:		
pH 4.01 ± 0.02 pH buffer powder pillow (NIST)	50/pkg	2226966
pH 7.00 ± 0.02 pH buffer powder pillow (NIST)	50/pkg	2227066
pH 10.01 ± 0.02 pH buffer powder pillow (NIST)	50/pkg	2227166
Radiometer Analytical (IUPAC Series certified pH standards):		
pH 1.679 ± 0.010 at 25 °C (77 °F)	500 mL	S11M001
pH 4.005 ± 0.010 at 25 °C (77 °F)	500 mL	S11M002
pH 6.865 ± 0.010 at 25 °C (77 °F)	500 mL	S11M003
pH 7.000 ± 0.010 at 25 °C (77 °F)	500 mL	S11M004
pH 9.180 ± 0.010 at 25 °C (77 °F)	500 mL	S11M006
pH 10.012 ± 0.010 at 25 °C (77 °F)	500 mL	S11M007
pH 12.45 ± 0.05 at 25 °C (77 °F)	500 mL	S11M008
pH buffer 1.09, technical	500 mL	S11M009
pH buffer 4.65, technical	500 mL	S11M010
pH buffer 9.23, technical	500 mL	S11M011

10.2 Accessories

Description	Quantity	Item no.
Beaker, 30 mL, plastic, colorless	80/pkg	SM5010
Beaker, 30 mL, plastic, red	80/pkg	SM5011
Beaker, 30 mL, plastic, yellow	80/pkg	SM5012
Beaker, 30 mL, plastic, blue	80/pkg	SM5013
Beaker, 30 mL, plastic, green	80/pkg	SM5014
Beaker dispenser and holder, 30 mL	1	923-656
Beaker holder, 30 mL	1	923-556

10.2 Accessories (continued)

Description	Quantity	Item no.
Beaker, 100 mL, polypropylene	1	108042
LIS (low ionic strength) chamber	1	5189900
Disposable wipes, 11 x 22 cm	280/pkg	2097000
Wash bottle, polyethylene, 500 mL	1	62011
Probe stand for standard Intellical probes	1	8508850
Soaker bottle for probe storage	1	5192900
Probe cable depth markers for rugged Intellical probes	5/pkg	5828610
Shroud kit for rugged probes	1	5825900
Storage caps for rugged PHC and MTC probes	5/pkg	5857305



HACH COMPANY World Headquarters
P.O. Box 389, Loveland, CO 80539-0389 U.S.A.
Tel. (970) 669-3050
(800) 227-4224 (U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

HACH LANGE GMBH
Willstätterstraße 11
D-40549 Düsseldorf, Germany
Tel. +49 (0) 2 11 52 88-320
Fax +49 (0) 2 11 52 88-210
info-de@hach.com
www.de.hach.com

HACH LANGE Sàrl
6, route de Compois
1222 Vésenaz
SWITZERLAND
Tel. +41 22 594 6400
Fax +41 22 594 6499

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Attachment F

Chain of Custody Form

Eurofins Cleveland
180 S. Van Buren Avenue
Barberton, OH 44203
Phone (330) 497-9396 Phone (330) 497-0772

Chain of Custody Record

eurofins | Environment Testing

Client Information	Sampler:	Lab PM: Kalis, Nicole A	Carrier Tracking No(s):	COC No: 240-124901-43556.3
Client Contact: Kain Lager-Lowe	Phone:	E-Mail: Nicole.Kalis@et.eurofinsus.com	State of Origin:	Page: Page 1 of 1
Company: August Mack Environmental, Inc.	PWSID:			Job #:

Address: 7830 North Central Drive, Suite B	Due Date Requested:
City: Lewis Center	TAT Requested (days):
State, Zip: OH, 43035	Compliance Project: Δ Yes Δ No
Phone: 740-548-1515(Tel)	PO #:
Email: klagerlowe@augustmack.com	WO #:
Project Name: MSC Canfield - Soil/Surface Water	Project #: DO NOT DELETE - 24033889
Site:	SSOW#:

Analysis Requested

Preservation Codes:
N - None
A - HCL
B - NaOH
D - HNO3
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)												Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N	N	N	N	N	N						
				Solid															
				Solid															
				Solid															
				Solid															
				Solid															
				Solid															
				Solid															
				Solid															
				Solid															
				Solid															
				Solid															

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For _____ Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Attachment G

August Mack Standard Sample Naming Convention

AUGUST MACK ENVIRONMENTAL SAMPLE NAMING CONVENTION

Soil/Sediment/Water Samples	
Soil Sample (with sub area)	**SB-#-#-#** **SB-*[identifier]*-#-#-#**
Impoundment/lagoon samples	**SED-#-#-#**
Sediment Sample	**SED-#-#-#**
Surface Water Sample Surface Soil Sample:	**SW-#** **SS-#-#-#**
Groundwater Sample	**MW-#-YYYYMMDD**
Soil boring grab groundwater	**SB-#-GW-#-#**
Temporary Well (Piezometer) Samples (blind drill)	**TW-#-#-#**
Underground Utility Exposure	**UE-"Type"-#**
Underground Utility "Type":	
Gas = G Electric = E Water = W Sewer = S Fiber = F	

Soil Excavation / Test Pit Samples	
North	**EX-#[a]-N-#[b]-#-#**
South	**EX-#[a]-S-#[b]-#-#**
East	**EX-#[a]-E-#[b]-#-#**
West	**EX-#[a]-W-#[b]-#-#**
Bottom	**EX-#[a]-B-#[b]-#-#**
Water	**EX-#[a]-GW-#[b]-#-#**
Piping Run	**EX-#[a]-P-#[b]-#-#**
Dispenser	**EX-#[a]-DI-#[b]-#-#**
Backfill	**EX-#[a]-BF-#[b]-#-#**
Test Pits	**TP-#-#-#**

#[a]= iterator for multiple excavations; #[b] = iterator for multiple samples of same sample type
 # = sample number in series; #-# = depth of sample in feet below ground surface; *[identifier]* – An indicator of subarea (SB-A-1…)

Air Samples	
Indoor Air	**IA-address-#-YYYYMMDD**
Basement Air	**BA-address-#-YYYYMMDD**
Ambient (outdoor) air	**AA-address-#-YYYYMMDD**
Sub-slab soil gas sample	**SGSS-address-#-YYYYMMDD**
Exterior soil gas sample	**SGE-#-#-#-YYYYMMDD**
Conduit Sewer Vapor	**MH-#-#-#-YYYYMMDD**
Crawlspace Sample	**CSA-address-#-YYYYMMDD**

QA/QC Samples	
Duplicate Samples	**Prefix (SB/MW/etc.)-DUP-#-YYYYMMDD**
MS/MSD Samples	**Same as original**
Equipment Blanks	**EB-#-YYYYMMDD**
Rinsate Blanks	**RB-#-YYYYMMDD**
Trip Blanks	**TB-#-YYYYMMDD**

Waste Characterization Samples			
Drum of waste water/soil	**WC-#-Event-DW/S-#**	**Generating Event**	
Roll-off	**WC-#-Event-R-#**	Quarterly Monitoring	**#QYY**
Tote	**WC-#-Event-#-T-#**	Site Investigation	**SIYY**
Soil stockpile	**WC-#-Event-SP-#**	Further Site Investigation	**FSI#**
Decon Water	**WC-#-Event-DEC -#**	Soil Excavation	**EX-#**

Composite Samples - Include "C" at the end of the sample name **Examples: SED-1-2-4C** **WC-2-FSI1-R-1C**

System & Compliance Samples			
Influent Air Influent Water	[prefix]-**INF-#-YYYYMMDD** [prefix]-**INF-#-YYYYMMDD**	Midfluent Air Midfluent Water	**MID-#-YYYYMMDD** **MID-#-YYYYMMDD**
Effluent Air Effluent water Stormwater	[prefix]-**EFF-#- YYYYMMDD** [prefix]-**EFF-#- YYYYMMDD** **OUT-#- YYYYMMDD**	**# - Use an iterator if multiple sampling ports of the same type are present.** **Include a 4-char prefix if multiple systems are being sampled from the same site.**	

AUGUST MACK ENVIRONMENTAL SAMPLE NAMING CONVENTION

Chain of Custody Field			Explanation
1	Project Name	Min. Req.	AME Project No. (ex. JR2280.380)
		BMP	AME Project No. and Project Phase Name (ex. JR0688.380 - PRC Interim Measure)
2	Purchase Order	Min. Req.	AME Project No. (ex. JR2280.380)
		BMP	
3	Project Number	Min. Req.	AME Project No. (ex. JR2280.380)
		BMP	
4	Report to/Copy to	Min. Req.	AME Primary Contact
		BMP	AME Primary Contact & Senior Chemistry Manager

NOTES: The primary contact may be a closure Project manager or a Compliance Manager or Specialist or a Building Sciences Manager, whomever is responsible for reporting the results to the client. Min.Req. = Minimum Requirement; BMP = Best Management Practice

COMPOUND LISTS

If your project requires a truncated compound list for a sampling method, the list MUST be written on the COC.

Acceptable Abbreviations

BTEX/MTBE
PAHs or **cPAHs(7)**
RCRA 7 Metals + Hg

UNacceptable Abbreviations

CVOCs or SLVOCS
METALS
APPENDIX IX

GENERIC NAME SYNTAX

The following general syntax should be followed for all investigative media:

Investigation Media Type - Iterator-Descriptor

Investigation Media Type (IMT:)	Type of environmental data being sampled, i.e. Soil Boring (SB), Monitoring Well (MW), Indoor Air (IA), or Underground Utility (UU).
Iterator	The numerical identifier reference for a unique sample in a group of similar media types.
Descriptor	Information that provides additional context on sample info (i.e. spacial info, depth, time, type, modifier).

Examples

SB-1-10-12

SGSS-3-7143-20190211