RCRA CORRECTIVE ACTION
INTERIM MEASURES WORK PLAN
ELLIOTT DITCH – REACHES 1-3 SEDIMENT
& ISOLATED SOIL REMEDIATION

ARCONIC LAFAYETTE OPERATIONS
3131 EAST MAIN STREET
LAFAYETTE, INDIANA 47905

PREPARED FOR:

ARCONIC

MR. ROBERT PREZBINDOWSKI
TENNESSEE OPERATIONS – NORTH PLANT
2300 NORTH WRIGHT ROAD
ALCOA, TENNESSEE 37701

PREPARED BY:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
2704 CHEROKEE FARM WAY, SUITE 101
KNOXVILLE, TENNESSEE 37920

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1.0 INTRODUCTION

1.1 GENERAL

Arconic Corporation (Arconic) Lafayette Operation (Facility), located at 3131 East Main Street in Fairfield Township, Tippecanoe County, Lafayette, Indiana is engaged in the production of aluminum extrusions serving an international market. Manufactured materials include tube, aerospace components, and oil and gas drilling products.

The purpose of this Interim Measures Work Plan (IMWP) is to outline the approach for the remediation of polychlorinated biphenyl (PCB) impacted sediment and isolated soil within Reaches 1 through 3 of Elliott Ditch, which includes from Outfall 001 to just upstream of the 9th Street crossing based on geomorphologic mapping. Soil remediation of the levee situated on the southeast side of Elliott Ditch in Reach 1was performed under the Levee Soil IMWP in spring and summer of 2020. PCB impacts to soil and sediment of Elliott Ditch are believed to be associated with historic discharges from Facility Outfall 001. A risk-based remedial approach, as identified in 40 CFR 761.61(c), is proposed for the sediment and soil targeted for removal as part of this Interim Measures (IM) Project. This IMWP is being submitted to the Indiana Department of Environmental Management (IDEM) and the U.S. Environmental Protection Agency (USEPA), Region 5 to satisfy the notification requirements in 40 CFR 761.61(c) and formally request approval of the risk-based remediation project. The remedial strategy is to remove the PCB impacted sediment and soil to meet the project-specific, risk-based remedial objective (RBRO) of 1.0 milligrams per kilogram (mg/Kg) total PCBs. The removed materials will be managed off-site at an appropriately permitted facility.

1.1.1 Facility Description

Lafayette Operation began production at the site in 1937 and currently it includes 2.3 million square feet of operations on 172 acres. The Facility is located within the northwest 1/4 of Section 34, Township 23 North, Range 4 West on the Lafayette East Indiana, USGS 7.5 Minute Topographic Series Map (Latitude: 040° 23' 26", Longitude: 086° 51' 43"). Topographic relief in the area ranges from approximately 650 to 670 feet above mean sea level (MSL). The locations of the Facility and Elliott Ditch are shown on **Figure 1**.

1.1.2 Description of Elliott Ditch

Elliott Ditch is a tributary to Wea Creek, which is a tributary to the Wabash River, just downstream of Lafayette, Indiana. Please refer to **Figure 1** for the location of Elliott Ditch and its associated streams. The ditch is identified as a regulated drain until the 9th Street crossing, slightly more than 1.60 miles downstream of Facility Outfall 001. The Tippecanoe County Drainage Board maintains the regulated drains within the county, subject to Indiana Code (IC) 36-9-27. Regulated drains include an easement that typically extends 75 feet from the top of each bank. These easements are intended to provide access for maintenance activities to support proper functionality of the drain. The easement areas have construction restrictions regarding the types of improvements that can be made by private property owners without drainage board approval.

Elliott Ditch receives wastewater and storm water discharges from local, industrial sources some of which are monitored under the National Pollution Discharge Elimination System (NPDES). Part of the flow to Elliott Ditch includes receiving water from a NPDES permitted outfall (Outfall 001) of the Facility. Water from Outfall 001 discharges to Elliott Ditch approximately 1-mile south of the Facility. Discharge from the outfall includes treated sanitary and industrial process water, as well as storm water. The distance from Outfall 001 to the Elliott Ditch and Wea Creek confluence is 4.1 miles and to the Wabash River and Wea Creek confluence is 7.5 miles. The geomorphic surface mapping completed for Elliott Ditch by TetraTech CES, as documented in its *Elliott Ditch Geomorphic Surface Mapping and Historic Data Review* dated July 6, 2015, suggests that Elliott Ditch has eight distinct reaches (erosional/depositional regimes) downgradient of the Outfall 001, as identified in the following:

- Reach 1: Outfall 001 to downstream of the railroad bridge;
- Reach 2: The railroad bridge to the South 18th Street Bridge;
- Reach 3: South 18th Street Bridge to upstream of the 9th Street Bridge;
- Reach 4: South 9th Street Bridge to north of Brookside Drive;
- Reach 5: North of Brookside Drive to downstream of Poland Hill Road;
- Reach 6: Downstream of Poland Hill Road to downstream of Old Romney Road Bridge;
- Reach 7: Downstream of Old Romney Road Bridge to upstream of US Hwy 231 South Bridge; and,
- Reach 8: Upstream of US Hwy to the Elliott Ditch – Wea Creek confluence.

More specifically, the general geomorphic nature of Reaches 1 through 3, which are subject of this IMWP, as documented in the geomorphic study, is as follows:

- Reach 1 of Elliott Ditch is characterized by a relatively straight channel, steep valley walls, and no stream terraces. The geomorphology study showed a relatively shallow gradient of 0.4 feet/mile. Some erosion was observed occurring along the channel banks and immediately downstream of the outfall, deposition of relatively fine-grained sediment is occurring in pooled areas within the stream.
- Reach 2 of Elliott Ditch is characterized by a straight channel with a steeper channel gradient of approximately 8 feet/mile. The north side of the channel is upland area and the south side is a preserved T-4 terrace. Sediment deposition occurs in this reach on the T-4 terrace after large flood events and in-channel deposition is associated with pools.

- Reach 3 has a relatively straight channel with only minor meandering. The channel banks are steeper than in Reach 2, but the channel gradient is similar at 8 feet/mile. Elliott Ditch has a deeply incised channel and steep channel banks within this reach. Natural T-6 and T-7 terraces are preserved adjacent to both sides of the ditch. Additionally, a T-5 terrace is present on the north side of the ditch at the downstream end of the reach. Deposition in the overbank area is unlikely except for large flood events and in-channel deposition is limited to the pool areas.

This IMWP is for PCB impacted sediment and isolated soil within Reaches 1 through 3 of Elliott Ditch, which is located between Outfall 001 to upstream of the 9th Street Bridge. This includes a channelized portion of Elliott Ditch that is identified as a regulated drain and therefore subject to IC 36-9-27 statues and enforcement by the Tippecanoe County Drainage Board. Please refer to **Figure 2** for the portion of Elliott Ditch (Milepost 0.00 to 1.59) that is subject of this IMWP.

1.2 CONSENT DECREE AND RCRA CORRECTIVE ACTION

Investigations of Elliott Ditch from the early 2000s through 2012 were conducted per the Consent Decree (CD) between Arconic and the USEPA. The CD is associated with Clean Water Act findings and these issues are in the process of being closed. The Facility is subject to Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) and is in the process of implementing a RCRA Facility Investigation (RFI). Arconic finalized a RCRA CA Agreed Order with the IDEM on August 11, 2020. Upon issuance of the final Agreed Order, Arconic requested coordinated approval from the USEPA Region 5. Outfall 001/Elliott Ditch/Wea Creek are identified as Solid Waste Management Unit (SWMU) 50 in association with RCRA CA due to the suspected release(s) of PCBs. This IM Project is being performed as part of the RCRA CA process.

1.3 RISK-BASED REMEDIATION

The primary constituent of concern (COC) at the Facility and Elliott Ditch are PCBs. There are a few options for remediating PCB impacted sites as outlined in the Toxic Substances Control Act (TSCA) found in 40 CFR Chapter I, Subchapter R. More specifically, clean up and disposal options for PCB remediation projects are found in 40 CFR 761.61. A risk-based clean up and disposal approach is presented as an option in 40 CFR 761.61(c) and is the remedial approach being implemented by this IM Project. An entity wishing to perform a remedial project using the risk-based approach is required to request and receive approval from the USEPA prior to conducting the project in this manner.

The RBRO for this IM Project and subsequent soil and sediment remediation projects at Elliott Ditch is 1.0 mg/Kg. This RBRO has been selected based on conversations with the USEPA and the IDEM, including its respective risk assessors, and the use of this objective on other, like projects in the region. The use of this more restrictive RBRO will eliminate the need for further risk assessments in association with remedial efforts and not subject the remediated areas to future activity or use restrictions.

2.0 ELLIOTT DITCH FIELD SAMPLING ASSESSMENT

Arconic is in the process of conducting SWMU and AOC investigations to assess current conditions and potential releases in support of the RCRA CA process. Arconic retained Civil & Environmental Consultants, Inc. (CEC) to implement the regulatory-approved *Field Sampling Plan* (FSP), as prepared by TetraTech CES and dated February 2, 2016. Implementation of the FSP, conducted in October and November 2017, included the assessment of sediment and soil in Reaches 1 through 3 (Milepost 0.00 to 1.59) of Elliott Ditch. CEC performed two, targeted investigations (February and June 2018) after the implementation of the FSP to further characterize the nature and extent of PCB impacts within Elliott Ditch. These targeted investigations followed the Standard Operating Procedures (SOPs) of the FSP to maintain consistency between the different field efforts. The results of implementing the FSP and the two, targeted investigations are summarized in the *Elliott Ditch Reaches 1-3 Field Sampling Report* dated August 2018, as prepared by CEC. The following references are included as appendices to provide the necessary background information for this IMWP:

- *Elliott Ditch Geomorphic Surface Mapping and Historic Data Review,* TetraTech CES, July 6, 2015 (**Appendix I**);
- *Field Sampling Plan – Elliott Ditch,* TetraTech CES, February 2, 2016 (**Appendix II**); and,
- *Elliott Ditch Reaches 1-3 Field Sampling Report,* CEC, August 2018 (**Appendix III**).

2.1 INVESTIGATION STRATEGY

The FSP was designed based on geomorphic principals, which influenced the sampling locations and depth intervals. The strategy for the FSP was developed following a stepwise process that included the following:

1. Use of fluvial geomorphology to define the erosional and depositional patterns for Elliott Ditch and its floodplain. This step included a desktop review, field survey to verify the results of the desktop review, and identification of sample transects and sample locations perpendicular to the stream. The sample locations were selected to assess the various geomorphic surfaces and erosional and depositional features of the ditch.
2. The second step of the investigation strategy was to use the geomorphic characteristics of Elliott Ditch to determine the area of investigation. The Elliott Ditch area of investigation includes the channel, the floodplain, and terrace surfaces to the upland boundary. The in-channel area includes the parts of the ditch that have deposits of silt and clay because PCBs absorb to these particle sizes. In the overbank areas, PCBs could be deposited on the floodplain and terraces during and after the time of release.
3. The third step of the investigation strategy was to assess what portion of the channel and overbank could be remediated in a single field season.

The sample locations were selected in depositional areas to assess the materials for the concentration of PCBs. An important part of the sampling strategy was to sample in erosional areas that were not subject to deposition to prove the absence of PCBs. This approach allows for confirmation of the erosional surfaces and a confidence that the fluvial geomorphology model of the stream accurately predicts PCB transport and deposition. Additionally, the sampling strategy was designed to allow for iterative sample locations to be incorporated into the FSP based on data obtained during the field work and the analytical results. This aspect was applied during the two, targeted investigations.

Sample intervals varied based on the thickness of the soil horizon/sediment layer. The focus of the investigations was to understand the depositional pattern(s) and this was accomplished by sampling specific soil horizons and sediment layers. The horizon/layer based sampling provides a context of the geomorphic and pedogenic (soil profile) environment and allows an accurate assessment to characterize the PCB distribution. The fluvial geomorphology approach is beneficial to determine where PCBs are located in Reaches 1 through 3 of Elliott Ditch and why the deposits are located where they are. In any investigation, a limited number of sample locations are collected to characterize a large area. It is important to have a scientific method to interpolate or extrapolate data from where it was collected to the other areas of the project.

2.2 INVESTIGATIONS SCOPE

The FSP and the two subsequent, targeted investigations were conducted within and along the first 1.59 miles (Reaches 1 through 3) of Elliott Ditch. Provided in the following is a summary of the field activities performed in association with each assessment.

<u>FSP Implementation</u>

- Sediment poling and surveying;
- Sediment boring installation and sampling at 13 locations; and,
- Soil boring installation and sampling at 33 locations.

<u>February 2018 Targeted Assessment</u>

- Sediment boring installation and sampling at one location; and,
- Soil boring installation and sampling at 11 locations, including a boring at one previously assessed location.

<u>June 2018 Targeted Assessment</u>

- Soil boring installation and sampling at 17 locations, including a boring at one previously assessed location.

The sediment poling was conducted following a grid-based approach with spacing based on the apparent size of the sediment deposit and poling measurements extending one grid spacing beyond the apparent boundary of the feature. In-channel poling was conducted to assess the volume and extent of the soft sediment deposit within the channel at 13 of the 14 sampling locations. Sediment sampling locations were modified based on the poling results such that samples were collected from where the deposit was observed to be thickest. Sediment samples were collected from the 14 locations across two of the three different investigations, all from Reaches 1 through 3. A total of 44 discrete sediment samples and five duplicates were collected from the 14 locations. Samples were collected of the observed sediment layers at each location following the SOP in the FSP. The sampling locations and targeted depths were selected to assess the vertical distribution of PCB impacts in these deposits.

There were 61 soil borings installed across the three different assessments, with 27 of them being installed on the levee in Reach 1 which was remediated as part of the Levee Soil IM Project. The remaining 34 soil borings were installed downstream of the initial railroad crossing in Reaches 1 through 3 of Elliott Ditch, which are subject of this IMWP. These borings were installed on various geomorphic surfaces, including terraces, the floodplain, and upland locations. There were 105 discrete soil samples and seven duplicates collected from Reach 1 downstream of the first railroad crossing and Reaches 2 and 3. Samples were collected of the observed soil horizons at each location. These sampling locations and targeted depths were selected to assess the vertical distribution of PCB impacts on the various geomorphic surfaces.

This IMWP is for sediment and isolated soil remediation in Reaches 1 through 3 of Elliott Ditch; therefore, subsequent investigation results summary discussion will focus on these portions of the assessments only.

2.2.1 Reaches 1 through 3 Sediment Investigations Results Summary

Sediment poling activities were implemented at 13 of the 14 sediment sampling locations in Reaches 1 through 3, as defined in the FSP. The poling results identified significantly more sediment in four poled depositional areas in Reach 1 up stream of the first railroad crossing [523 cubic yards (cy)] when compared to the nine poled depositional areas in Reaches 1 through 3 downstream of the first railroad crossing (113 cy). This is attributable to the shallow stream gradient and pooling that occurs in the upper portion of Reach 1 due to the flow restriction created by the first railroad crossing. These conditions allow for sediment deposition and reduce the potential for resuspension, resulting in more sediment to deposit in this portion of Reach 1.

A total of 44 discrete sediment samples, 19 from Reach 1, 20 from Reach 2, and 5 from Reach 3, were collected from the observed depositional features found in the cores retrieved from each sampling location. Sediment samples were collected to the depths identified during the poling effort. The majority of the sediment samples included an initial layer of medium to coarse sand with varying gravel content (typically in the range of 15 to 35-percent) followed by intermixed layers of sandy and silty loam. At greater depths (i.e. greater than 3-feet below grade) samples included a horizon of silty or sandy clay. The sediment samples were typically black to very dark brown in color. The majority of the sediment samples did not contain appreciable wood or organic content. Shells were identified in less than 10-percent of the samples.

PCBs were quantified in each of the 44 samples, ranging from 0.28 mg/Kg to 39.9 mg/Kg. Sediment samples were collected from the depositional layers identified in the recovered cores. PCB concentrations exceeding the remedial objective of 1.0 mg/Kg we quantified in nine of the 14 depositional areas included in the assessment; all five in Reach 1, four of five in Reach 2, and one of four in Reach 3. The most appreciable PCB concentrations were quantified in samples at depth. More specifically, from Outfall 001 to Milepost 00.47 (Reach 1, Outfall 001 to the first railroad crossing), the highest PCB detections came from the deepest samples at each of the four locations, with the highest concentration (16.87 mg/Kg) being found nearest the outfall. From Milepost 00.47 to 01.00 (end of Reach 1 and Reach 2), the highest PCB concentrations came from 1.75 to 3.50 feet below the top of sediment. The quantified concentrations of PCBs were lower in the shallow sediments. The four depositional areas sampled in Reach 3 contain less than 1.05 feet of sediment and all quantified PCB concentrations were less than 1.0 mg/Kg, with the exception of the only sample collected from Milepost 01.37. The sediment sample at Milepost 01.37 was not able to be collected from the location with the thickest sediment deposit due to access restrictions. Please refer to the field sampling sheets and analytical testing results for the sediment as found in the August 2018, *Elliott Ditch Reaches 1-3 Field Sampling Repor*t, as prepared by CEC and included in **Appendix III**.

2.2.2 Reaches 1 through 3 Soil Investigation Results Summary (Excludes Levee)

The subsurface geology encountered in the soil borings advanced through the various naturally occurring geomorphic surfaces was indicative of native, residual, materials. Soils were typically dark brown to black in color, very plastic, and significant increases in soil consolidation were noted as the depth below ground surface increased. Root and wood content was typically less than 15-percent. Rock and other granular materials were observed in the majority of the soil borings at less than 15-percent; however, a portion of the soil samples contained between 15 and 35 percent. Distinct odors were not observed in the soil samples. The granular structure of the soils was typically fine to very fine with an isolated group of samples exhibiting medium grain characteristics. The majority of the subsurface geology within the investigation area was a loam material with varying amounts of sand and silt. The presence of sand and silt typically decreased with depth. Isolated horizons of clay, clayey loam, and silty clay were observed in a subset of borings typically at depths greater than 1.25-feet below grade.

PCB concentrations, if detected, in the upland soil samples were typically quantified to be less than 1.0 mg/Kg. The lone exception comes from the upland surface at Milepost 00.51 (Reach 1), which contained PCB concentrations in the range of 2.0 to 7.0 mg/Kg. This upland area is situated between the two sets of railroad tracks, which is subject to anthropogenic influences and/or flooding conditions dissimilar to the other upland areas. There is a very small floodplain area at Milepost 00.72 with quantified PCB concentrations from 1.44 mg/Kg to 2.44 mg/Kg. There is a depression at Milepost 00.82 which quantified a PCB concentration slightly more than 1.0 mg/Kg in one of the two samples collected. PCB detections from the fourth terrace (T-4) surfaces were all less than 1.0 mg/Kg; whereas, PCB detections from the T-6 surfaces ranged from non-detect to 4.65 mg/Kg. Of the 16 samples from the T-6 surface, three exceeded 1.0 mg/Kg, and all three were from the same T-6 surface at Milepost 01.24. The T-7 geomorphic surface did not contain concentrations of PCBs greater than 1.0 mg/Kg with the exception of the samples at Milepost 01.14, which contained samples from four different boring locations that exceeded this concentration.

3.0 ELLIOTT DITCH REACHES 1 THROUGH 3 SEDIMENT AND ISOLATED SOIL INTERIM MEASURES OVERVIEW

3.1 INTRODUCTION

Arconic has unilaterally decided to remediate PCB impacted sediment and isolated soil in Reaches 1 through 3 of Elliott Ditch. This IMWP has been prepared to address the safe movement and disposal of these materials, as well as restoration activities. The intent of the IMWP is to demonstrate that the proposed remedial approach will not pose an unreasonable risk to human health or the environment during the remedial actions, or in the manner of disposal. As part of the RCRA CA process, this IMWP is being submitted to the IDEM and the USEPA Region 5 for consideration and to request Risk-based disposal approval in accordance with 40 CFR 761.61 (c) Subsequent efforts will be conducted to delineate and remediate, if necessary, other PCB impacted media within downstream reaches of Elliott Ditch, which exceed the RBRO of 1.0 mg/Kg.

3.2 OBJECTIVE

The IM objective of this project is to remove PCB impacted sediment and isolated soil from Reaches 1 through 3 of Elliott Ditch that contain concentrations exceeding the RBRO, as determined by the geomorphology-based assessments. The proposed sediment excavation depths and extents have been delineated by the sediment sampling analytical testing that has been performed to date, as well as the lateral and verticals extent of soft sediment as observed during the poling evaluation. The lateral extent of the proposed excavation within Reach 1 will include sediment from the right-descending-bank to the left-descending-bank (i.e., the width of the channel) in the portion of this reach that is up gradient of the first railroad crossing. This is due to the amount of deposition that has occurred in this portion of Elliott Ditch, likely attributable to the flow restrictions of the first railroad crossing and accumulated debris causing water to slow and solids to settle, relative to deposition downstream of the first railroad crossing. Sediment removal in the portion of Reach 1 between the two railroad crossings and in Reaches 2 and 3 will be targeted and include the extent of the assessed depositional features. Please refer to **Figures 3, 3A, 3B, and 3C** for the sediment remediation areas.

Isolated soil removal in Reaches 1 through 3 will include the extent of those geomorphic surfaces that have been assessed and determined to be impacted with PCB concentrations exceeding the RBRO. Excavation of these isolated soil impacts will be based on the geomorphic mapping of the surfaces, as performed by TetraTech CES, as documented in its *Elliott Ditch Geomorphic Surface Mapping and Historic Data Review* dated July 6, 2015, and provided in **Appendix I**. The upland soil area between the two railroad crossings will require additional delineation due to the unique nature of this surface and inadequate geomorphic mapping to provide excavation extents. Please refer to **Figures 3, 3A, 3B, and 3C** for the soil remediation areas.

The RBRO for both sediment and soil is 1.0 mg/Kg, total PCBs. The excavated sediment and soil will be managed offsite at an Arconic-approved and appropriately permitted landfill. Although not anticipated, sediment and soil exhibiting PCB concentrations greater than or equal to 50 mg/Kg will be disposed at a RCRA Subtitle C facility or TSCA landfill, as allowed by 40 CFR 761.61(a)(5). Sediment and soil exhibiting PCB concentrations less than 50 mg/Kg but greater than or equal to 1.0 mg/Kg will be disposed at a RCRA Subtitle D facility permitted to accept PCB-containing waste.

3.2.1 Regulations or Guidance to Support the Interim Measures Approach

The USEPA exempts PCB waste from the RCRA waste requirements specified in 40 CFR Parts 261 through 265, parts 268, and 270. PCB wastes are instead regulated under TSCA. The exemption is described in 40 CFR Part 261.8, and includes the notification requirements specified in RCRA. The TSCA regulations governing the manufacturing, processing, distribution in commerce and use prohibitions, including remediation and disposal, are codified in 40 CFR Part 761.

3.2.1.1 Overview of Clean Up Plan

The following outlines the proposed clean-up plan to be performed in accordance with 40 CFR 761.61(c).

1. Clear underground utilities and remove overgrown brush, small trees, and other vegetation, as necessary, in support of preparing for sediment and soil removal.
2. Install water management controls, pump around system, and isolate sediment targeted for removal. The intent is to isolate sediment excavation areas, remove the targeted materials, collect confirmation samples to demonstrate successful remediation, and backfill appropriately. It is anticipated that remediation will occur in the most upstream area first (Reach 1) and move downstream. The process will be repeated until the remedial objective is achieved.
3. Sediment and soil requiring excavation and offsite disposal will be handled based upon the PCB concentration at which it is found, as outlined in 40 CFR 761.61.
4. Temporary storage of excavated, TSCA regulated sediment and soil is subject to the requirements of 40 CFR 761.65(c)(9). Temporary storage is permitted for a period of 180 days from the accumulation start date. Sediment and soil that is stockpiled within the excavation footprint for truck loading purposes will not be subject to these requirements so long as the stockpile is diminished by the end of the working day.
5. Sediment and soil containing less than the 1.0 mg/Kg total PCBs will be left in place. Once it is confirmed via sampling that the removal of sediment and soil within Reaches 1 through 3 have achieved the RBRO, the excavations will be backfilled with clean, borrow material, and remediation areas will be restored to pre-project grades with suitable material. This is likely to include B borrow or an equivalent graded, granular material in the stream and

cohesive soil and organic topsoil in the soil areas. Use of these materials will provide sedimentation and scouring control.

6. Sediment and soil containing greater than or equal to 1.0 mg/Kg and less than 50 mg/Kg PCBs will be excavated and disposed offsite at a RCRA Subtitle D facility, as outlined in 40 CFR 761.61(a)(5)(i)(B)(2)(ii) and §761.61(a)(5)(v)(A). However, no soil or sediment will be shipped to RCRA Subtitle D facilities that have PCB concentrations in excess of the landfill operating permit threshold. The landfill(s) will be notified in writing of the amount and concentration of the waste at least 15 days prior to the first shipment, as outlined in §761.61(a)(5)(i)(B)(2)(iv).
7. Although not expected, sediment and soil containing greater than or equal to 50 mg/Kg PCBs will be excavated and disposed offsite at a RCRA Subtitle C facility or TSCA landfill, as outlined in 40 CFR 761.61(a)(5)(i)(B)(2)(iii). If a RCRA Subtitle C facility is used for disposal, it will be notified in writing of the amount and concentration of the waste at least 15 days prior to the first shipment, as outlined in §761.61(a)(5)(i)(B)(2)(iv).
8. Sediment and soil shipped off-site will be managed in accordance with the storage and disposal requirements defined in 40 CFR 761 Subpart D.
9. Waste disposal records and reports will be maintained for PCB remediation waste shipped off-site in accordance with 40 CFR 761 Subpart K.
10. Equipment used during the interim measure that contacts impacted materials will be decontaminated following the standards and procedures described in 40 CFR 761.79.

3.3 PERMITTING AND PLANNING REQUIREMENTS

Other regulatory and legal requirements were evaluated, other than TSCA, in preparing this IMWP. Provided in this section are those requirements identified as being applicable to this IM Project.

3.3.1 Community Relations Plan

The IM Project will include updating the Community Relations Plan (CRP) developed as part of the Levee Soil IM Project, as necessary. The initial CRP was prepared to cover IM activities within the first three reaches of Elliott Ditch and updates are expected to be necessary now that the scope for this IM Project has been defined. The CRP will includes the following content:

- Property owners and property occupants that own or abut the properties that are subject to IM Project activities.
- Known or registered neighborhood organizations serving the location of the IM Project, if any.
- A sample of a written notice to be sent to the property owners/property occupants and neighborhood organizations, which shall include:
    - a short description of the IM Project to be performed;

- information concerning the public comment period, including the time period and procedures for public comment, and the address to which comments are to be directed; and,
- the location of the record repository where the IMWP has been placed.

- The name(s) and mailing address(es) of all affected local governmental units with jurisdiction within one mile of the property(ies) affected by the proposed IM Project. IDEM will notify the affected local government units about the IM Project and the anticipated remediation. In addition, local government units that are affected by the proposed IM Project will be notified by Arconic of the IMWP at the beginning of the public comment period. These local government units will include those located in Tippecanoe County only since no other counties are within one mile of the project.
- The name(s) and mailing address(es) of at least two newspaper(s) or other appropriate circulars in which notice of the public comment period will be published.
- Information regarding the public repository where this IMWP can be reviewed. Arconic intends to continue to utilize an electronic repository at, http://elliottditchproject.cecinc.com/.
- In addition, a sign shall be posted that:
  - identifies the location as a IM Project site;
  - provides USEPA Region 5 project manager, IDEM OLQ project manager, and Arconic project manager phone numbers;
  - meets the following criteria:
    - be visible/readable from 20 feet;
    - be in English and the language predominantly used in the neighborhood if other than English;
    - place one sign per site access point and no more than three signs total; and,
  - posting starting with the end of the public comment period for the IMWP, before any work begins and remain posted until the project has been completed.

The initial CRP has been provided in **Appendix IV**. Once updated with informational applicable to this IMWP, Arconic will provide to USEPA and IDEM for review and approval.

3.3.2 Private Property Owner Access and Use Agreements

This IM Project requires coordination and *Access and Use Agreements* with all private property owners immediately adjacent to Elliott Ditch within Reach 1 and a subset of private property owners with Reaches 2 and 3. The private property owners who will need to provide *Access and Use Agreements* in Reaches 1 through 3 are those that:

- Own property where remediation is to occur; and/or,
- Own the property where access is needed to facilitate remediation.

Access and Use Agreements have been provided to each of the private property owners where access are required and the agreements include remediation and restoration as part of the permitted activities. Based on current plans, Arconic will need access to 57 private properties to perform this IM Project. As of the date of this IMWP, access has been granted for 38 properties with 19 properties remaining. Arconic is actively pursuing *Access and Use Agreements* for the remaining 19 properties. If access to other private property(ies) outside of those 57 currently identified is required to support other project functions, the *Access and Use Agreement* used during implementation of the FSP will be used to document private property owner approval prior to use. Please refer to **Figures 4, 4A, 4B, and 4C** for the soil and sediment remediation areas and the private properties that will need to be accessed as part of the IM Project.

3.3.3 Tippecanoe County Drainage Board Coordination

The Tippecanoe County Drainage Board has regulatory authority over easements associated with regulated drains. The easement for the regulated portion of Elliott Ditch extends 75 feet from the top of both banks from the center of the channel. The majority of this IM Project will take place within this easement and coordination with the Tippecanoe County Drainage Board will be required. It is understood that Tippecanoe County Surveyor's Office is the ex-officio, non-voting, member of the Drainage Board. This provides the County Surveyor with authority over construction, reconstruction, and maintenance of all regulated drains and proposed regulated drains within the county. It is understood that the Drainage Board meets on the 1st Wednesday of every month at 10 a.m. If needed, this meeting time can be used to engage the Drainage Board to discuss this IM Project and provide an opportunity for the Drainage Board to ask questions or solicit additional information. The Tippecanoe County Drainage Board will be actively involved during planning for the IM Project and be provided updates regularly.

3.3.4 USACE Nationwide Permit 38 – Clean Up of Hazardous and Toxic Waste

The United States Army Corps of Engineers (USACE) Nationwide Permit 38 (NW38 Permit) applies to this IM Project since it involves the containment, stabilization, or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority. Regulatory authority of this IM Project resides with IDEM and USEPA Region 5. This permit includes a Pre-Construction Notification (PCN) to the district engineer prior to commencing construction activities and includes general conditions that must be followed. The USACE NW38 will be applied for in lieu of a USACE Section 404 permit since loss of waters to the United States will not be realized as part of the IM Project (i.e., preconstruction contours and elevations will be met after construction).

3.3.5 IDEM Section 401 Water Quality Certification

The IDEM regulates activities in Indiana that have the potential to impact waters of the United States. As such, a Section 401 Water Quality Certification will be necessary as part of the IM Project. Issuance of a Water Quality Certification means that IDEM anticipates that an applicant's project will comply with state water quality standards and other aquatic resource protection requirements under IDEM's authority. The 401 Water Quality Certification will cover both the construction and operation of the proposed IM Project and will supplement the general conditions defined in the NW38 Permit.

3.3.6 IDNR Construction in a Floodway Permit

As part of the Elliott Ditch Levee IMWP dated November 2019, and subsequently approved by IDEM via letter dated January 7, 2020, and USEPA letter dated March 24, 2020, CEC submitted a construction in a floodway permit application to the Indiana Department of Environmental Management (IDNR) in April 2019 (FW-29895). The application was submitted due to excavation activities being required within the floodway. After IDNR's preliminary review, IDNR requested a Floodway Habitat Mitigation Plan (Plan) be prepared to compensate for clearing and grubbing activities in the riparian corridor (i.e., non-wetland tree removal) required in order to access impacted levee soils, as well as, future clearing and grubbing required in downstream reaches. The Plan proposed a 2:1 restoration mitigation (totaling 3.8 acres) immediately adjacent to Elliott Ditch within Reach 1. The Plan was developed in accordance with the *Indiana Natural Resources Commission Information Bulletin #17 (Fourth Amendment): Floodway Habitat Mitigation* dated January 15, 2019 (Bulletin). Arconic will coordinate with IDNR to update the approved permit application accordingly to encompass sediment removal activities in Reach 1 prior to project commencement. In addition, a construction in a floodway permit will be applied for in the remaining reaches prior to implementation.

3.3.7 Erosion and Sedimentation Control

The area of disturbance associated with the IM Project will exceed the 1.0-acre threshold for requiring an Erosion and Sediment Control Plan and coverage under the NPDES General Permit Rule Program. Therefore, an Erosion and Sediment Control Plan will be implemented in accordance with applicable Indiana Administrative Code (IAC) requirements, specifically outlined in 327 IAC 15-5 (Rule 5) "Stormwater Run-off Associated with Construction Activity", and local regulations. The process will include submitting an Erosion and Sediment Control Plan to the City of Lafayette (City) for review, since it is its own Municipal Separate Storm Sewer System (MS4). Once the City has reviewed and approved the plan, a Notice of Intent (NOI) will then be filed with the City for its review and approval, prior to submittal to the IDEM. A City Inspector may periodically visit the project to review and assess the adequacy of in-place erosion and sedimentation control measures. Sediment control devices will be installed before or concurrently with initial clearing and grubbing, and prior to land disturbing activities. Removal of the devices will not occur until the construction site is stabilized. The Erosion and Sedimentation Control Plan, NOI, and approval letter from the City will be provided to the USEPA Region 5 and the IDEM for informational purposes.

4.0 ELLIOTT DITCH REACHES 1 THROUGH 3 SEDIMENT AND ISOLATED SOIL INTERIM MEASURES CLEAN UP PLAN

The following outlines the clean-up plan that is proposed to address sediment and isolated soil impacts in Reaches 1 through 3 of Elliott Ditch. The proposed plan has been developed based on the regulatory requirements identified previously and PCB remediation waste requirements specified in 40 CFR 761.61(c).

There are two distinct clean-up approaches described in the following; one for sediment removal and the other for isolated soil removal. The two approaches will use mechanical excavation equipment to remove the targeted sediment and soil materials. However, the sediment remedial efforts have the added complexity of isolating the remediation areas from Elliott Ditch surface water flow such that the targeted materials can be removed. In Reach 1 up stream of the first railroad crossing, sediment deposition is more pronounced and substantial, resulting in remediation occurring throughout this section. In Reach 1 downstream of the first railroad crossing and Reaches 2 and 3, sediment accumulation is observed in the depositional features that exist in minor stream bends where pooling occurs. Sediment remediation in these portions of Elliott Ditch will be limited to those depositional features that have PCB impacts exceeding the RBRO.

Provided in the following is additional detail regarding the two different clean-up approaches.

4.1 REACHES 1 THROUGH 3 SEDIMENT CLEAN UP PLAN

The remediation process will include the removal of PCB impacted sediment throughout Reach 1 up stream of the first railroad crossing and in targeted, depositional features with PCB concentrations exceeding the RBRO in Reach 1 downstream of the first railroad crossing and Reaches 2 and 3. The excavation extent in Reach 1 up stream of the first railroad crossing will extend from the bottom of each bank and include soft sediment down to the underlying hard pan (up to 5-feet below stream bottom). The excavation extents of targeted depositional features in Reach 1 downstream of the first railroad crossing and Reaches 2 and 3 will be based on the geomorphic principals used in the assessment, poling data, and the sediment sampling analytical results. Please refer to **Figures 3, 3A, 3B, and 3C** for the proposed excavation extents of the targeted sediment. The following outlined steps describe the conceptual approach to sediment removal as part of this IM Project.

1. Mobilization – Transport materials, equipment, and personnel to the site.
2. Benchmarks – Field benchmarks will be established by the Owner/Engineer and maintained during remediation. The number of benchmarks to be established at each excavation area will be established by a State of Indiana Professional Land Surveyor and used for delineating the excavation extents.

a. Benchmark locations will be recorded with horizontal and vertical data on Project Record Documents. The datum used will be a known coordinate system, such as Indiana State Plane. The use of a local coordinate system will not occur.

b. Where the actual location or elevation of layout points cannot be marked, temporary reference points will be provided as necessary to locate the extents of sediment removal activities.

c. Temporary reference points will be removed when no longer needed.

3. Project Stakeout – Prior to starting excavation, improvement features will be field located, including: entrance(s), access road(s), erosion and sedimentation controls, temporary structures (dams, cofferdams, etc.), sediment dewatering impoundments, support area(s), and excavation footprints. These features will be located either by the contractor or a subcontracted surveyor, so long as survey grade equipment is used.

4. Site preparation – Furnish and install silt fence, stabilized construction entrance, access road(s), heavy equipment decontamination area and other sedimentation control devices as applicable. Sediment remediation within Reach 1 up stream of the first railroad crossing will utilize the existing construction entrance from Concord Road and the gravelled access road and laydown area installed as part of the Levee Soil IM Project. This infrastructure will be upgraded as needed to support this IM Project. Sediment remediation in Reach 1 downstream of the first railroad crossing and Reaches 2 and 3 will require new access features to be constructed. Access features on private property will also include other controls, such as construction fencing, to secure the travel path and sensitive improvements. These additional controls will be based on discussions with the private property owners and potential activity in and around the remediation areas.

5. Clearing, grubbing, and disposal of vegetative waste – Trees, shrubs, and plants will be designated for removal using boundary markers or spray paint. The IM Project will try and maintain vegetation outside of the access path and remediation area, to the extent practicable. Much of the vegetation along the eastern and southern side of Elliott Ditch in Reach 1 up stream of the first railroad crossing was removed during the Levee Soil IM Project; however, it is expected that a portion of the cleared brush will re-establish before initiating this IM Project and need to be removed. Vegetation along the Elliott Ditch bank slopes that will impact sediment removal operations will be cut off above ground and the root balls left intact. This will allow equipment to operate with adequate sight lines from the top of the banks and reduce the potential for the bank failure. Vegetation within the remedial footprint is expected to be limited and will be cut off approximately 2 inches above the ground surface and the stump and roots removed during excavation of PCB impacted soil. Grubbed materials (vegetative material only) from below surface grades that are in contact with PCB impacted material will be transported offsite for disposal along with the sediment removed from the areas. Cleared materials from above surface grades will be transported offsite for disposal at a RCRA Subtitle D (non-hazardous, municipal solid waste) facility or chipped and used for erosion and sedimentation control.

6. Installation of water control devices – Flow in Elliott Ditch will need to be managed in support of sediment removal activities. In Reach 1 up stream of the first railroad crossing, this will require the installation of a dam, electric or diesel powered bypass pumps (submersible, centrifugal, or other), and piping to reroute ditch flow around the active

excavation area. It is anticipated that the dam will be installed slightly up gradient of Outfall 001 and the discharge piping routed downstream to expose and dry the targeted sediment. A completely redundant pumping system will be provided at the dam in the event that the primary system fails. The exact discharge location from the bypass piping may be periodically extended downstream as excavation progresses. Energy dissipation features will be installed at the discharge to reduce the potential for scouring and mobilizing sediment targeted for removal. The flow in Elliott Ditch has been monitored during 2019 and 2020 and base flow in Reach 1 up stream of the first railroad crossing has been observed to vary between 0.75 cubic feet per second (cfs) to 1.5 cfs. Episodic flow as a result of precipitation was also monitored in Reach 1 for bypass design purposes. Given the anticipated schedule for this IM Project to occur during the late spring/early summer of 2021, the anticipated base flow is expected to be towards the lower range of what has been measured. Episodic flow resulting from a heavy precipitation events still has the potential to occur. Therefore, the pumping system, which will include a redundant system, will have a rated capacity of 28 cfs (12,500 gallons per minute), which is over two times the measured average episodic flow in Elliott Ditch as a result of a precipitation event during monitoring. Should the flow in the ditch exceed the design capacity of the pumping system, the dam will likely overtop and flow in the active remediation area will occur. In instances where heavy precipitation is forecasted, the contractor will attempt to complete excavation in the current decision unit and prepare the area. No new excavation areas will be started in order to reduce the potential exposure of a partially remediated area to a high flow event.

There are several discharges into Reach 1 of Elliott Ditch that are situated between the proposed dam location and the first railroad crossing. This includes Outfall 001 from the Facility, as well as stormwater drains from the surrounding residential areas and commercial developments. These discharges pipes will either be plugged and pumped downstream of the excavation area, or additional piping added directly to the discharge to route the flow downstream of the excavation area. The locations, sizes, invert elevations, and pipe material of the discharges have been mapped and are included on **Figure 5**.

Sediment remediation in Reach 1 downstream of the first railroad crossing and Reaches 2 and 3 is targeted to depositional features that will not require full damming of the ditch and rerouting of the flow. Cofferdams or another capable structure will be installed around these depositional features to isolate the areas from flow. Residual water remaining in the isolated areas will be pumped into Elliott Ditch to allow the sediment to dry in support mechanical removal. The exact construction of the cofferdams or other capable structure will be dependent on observed streambed conditions and access restrictions.

Water control devices will be removed after the targeted sediment has been excavated, confirmation samples demonstrate the RBRO has been achieved, and the area has been successfully backfilled. It is anticipated that sediment removal will start in the most upstream location of Reach 1 and move downstream, with water control device removal following a similar progression.

The final water control device approach, including equipment and materials, will be left up to the discretion of the selected remedial contractor so long as their approach is acceptable to the conditions set forth in the project permits, work plan, and technical specifications. Once finalized, Arconic will provide the USEPA and IDEM details regarding the selected water control devices prior to deployment. These details will be summarized and provided via email.

7. Installation of sediment dewatering impoundment(s) – The water control devices will promote sediment drying in the ditch; however, it is expected that additional drying will be needed in an impoundment once the sediment is removed. Bermed sediment staging pad(s) will be constructed with a 40-mil polyethylene liner overlain with 1-foot of sand at locations to be selected by the contractor based on its sediment removal approach and sequencing. The pads will be sloped to drain such that decant water can be removed and managed as discussed in **Section 4.3**. Sediment will be stockpiled to allow water to drain from sediment pore space. If necessary, mixing with a drying agent [cement kiln dust (CKD), super absorbent polymer, etc.] will occur in the impoundment to dry sediment for offsite transportation and disposal. In order for a drying agent to be considered for use, it must not present the potential for an exothermic reaction to occur resulting in the temperature of the material to increase to greater than 275°C. It is at this temperature that the PCBs could be volatilized. The sand that will be placed between the liner and the sediment will assist in the decant process and also provide a buffer between the mechanical equipment and the liner. Stockpiled sediment within the impoundments will be covered with poly-sheeting to protect from exposure to wind and precipitation, as necessary. The poly-sheeting will be weighted down with sandbags to secure when sediment is not being actively loaded/unloaded. The contractor will monitor impoundment areas when it use to assure proper functionality. Erosion control measures will be deployed to reduce the potential for sedimentation from the impoundment areas.

8. Removal of targeted materials – The excavation plans will be used to direct remediation. Sediment deposition in Reach 1 up stream of the first railroad crossing is 3 to 5 feet thick and pervasive throughout. Excavation of the targeted materials in Reach 1 near the stream banks will likely require slight over excavation to decrease the bank slope to prevent failure. Please refer to **Figure 7** for typical excavation cross-sections that are expected in Reach 1 up stream of the first railroad crossing. In Reach 1 downstream of the first railroad crossing and Reaches 2 and 3, sediment accumulation occurs in distinct depositional areas with sediment thickness varying from roughly 2.5 to 4.5 feet thick. Sediment removal will include soft sediment down to the underlying inorganic cohesive soil that has historically been referred to as hard pan. The excavation process in Reach 1 up stream of the first railroad crossing will be performed with mechanical equipment either situated on the bank or directly within the dewatered streambed, if capable of supporting the equipment load. In Reach 1 downstream of the first railroad crossing and Reaches 2 and 3, sediment will be removed with mechanical equipment situated on the bank. Sediment will be removed and directly placed into dewatering impoundments, transported to a stockpile load out area, or placed directly into trucks for offsite transport and disposal. Ultimately how the sediment is managed upon removal will be dependent on the water content. The intent is to excavate and manage sediment efficiently; for example, if excavated materials are dry enough, the preference will be to direct load into lined trucks instead of stockpiling. Alternate means of removal will be considered if proposed by the contractor, so long as it does not present more risk to human health or the environment.

   In general, the removed sediment will be managed offsite as follows:

a. Sediment containing greater than or equal to 1.0 mg/Kg and less than 50 mg/Kg total PCBs will be excavated, loaded, and hauled off-site to an approved RCRA Subtitle D landfill.

b. Although not expected, sediment containing greater than or equal to 50 mg/Kg total PCBs will be excavated, loaded, and hauled off-site to an approved RCRA Subtitle C or TSCA landfill.

9. Water management – Water that accumulates within the remediation areas after water control devices are installed and prior to disturbance will be pumped through a sedimentation bag(s) prior to discharge back into Elliott Ditch. Water that collects within an open excavation footprint and is in contact with disturbed sediment potentially containing PCBs will be treated the same as the decontamination wastewater as discussed in **Section 4.3**.

10. Excavation equipment management – To the extent practical, equipment will remain either within or outside of the disturbed excavation footprint during sediment removal efforts. This will protect against mobilizing potentially impacted materials into other areas. Haul trucks will remain out of the excavation footprint or on clean materials placed within to protect against mobilizing impacted materials. Equipment that has been in contact with impacted materials will be decontaminated in the appropriate area prior to being mobilized to another area of the site. Decontamination procedures are described in more detail in **Section 4.3**.

11. Confirmation sample collection – Confirmation samples will be collected from the bottom and side walls of the sediment excavation area to confirm the removal of materials containing total PCBs greater than or equal to 1.0 mg/Kg. See Post Excavation Confirmation Sampling, **Section 4.5**, for additional detail.

12. Retrieve B Borrow material or approved equivalent from the offsite source(s) – Borrow material will be excavated and placed into dump trucks and transported to the sediment remediation areas for use in backfilling the excavations. Excavation areas will be backfilled immediately following excavation and confirmation that the decision unit meets the RBRO. The fill material will be directly dumped into the excavation footprint or temporarily stockpiled locally for use in the backfilling process. If temporary stockpiles for the borrow material are created, erosion and sedimentation controls will be installed as necessary.

13. Backfilling of sediment excavation areas – Sediment removal areas will be backfilled using a B Borrow material per the Indiana Department of Transportation (INDOT) specification 211 – B Borrow and Structure Backfill or approved equivalent. Excavations will be restored to an elevation that is consistent with existing conditions of the reach where the remediation occurs. Compaction of the fill material will be performed with mechanical tamps, vibratory equipment, and/or the equipment used during placement, where appropriate. Additionally, the longitudinal gradient of Elliott Ditch, as documented in *Elliott Ditch Geomorphic Surface Mapping and Historic Data Review,* prepared by TetraTech CES, and dated July 6, 2015, will be restored. Per this report, the gradients in Reaches 1 through 3 are 0.4 feet/mile (ft/mi), 8 ft/mi, and 8 ft/mi, respectively. Storm water outfalls that enter into excavation areas will be restored with appropriately sized aggregate for energy dissipation and stabilization. This will help prevent bank and

streambed scouring that could occur at these locations. Please refer to **Figures 7** through **9** that provide typical cross-sections for how backfilling will occur.

The vendor(s) of the offsite fill materials will provide certification statements or documentation (i.e. analytical testing reports) indicating the fill is free of contamination. If no certification statement is provided or the source of the borrow material is suspect, environmental samples will be collected to confirm it is free of contamination prior to use. Confirmation sampling will be performed at a rate of roughly one sample per 500 cys of fill material.

14. Backfill equipment management – Equipment will take special precautions to not track PCB impacted soil across clean areas. If equipment is suspected of coming into contact with impacted materials, it will be properly decontaminated, as discussed in **Section 4.3**, prior to mobilization into clean areas.

15. Removal of access road(s), sump(s), sediment dewatering impoundments, and temporary stockpile areas – Any project support features, i.e. sump(s), temporary stockpile areas, etc. will be removed, unless specifically requested to be left in place by the Tippecanoe County Drainage Board, if it is within its easement, or the private property(ies) owner, or identified as being needed for subsequent remedial efforts, after successful execution of this IM Project. Samples of the materials will be collected prior to removal to assess for PCB presence in support of proper management. Additionally, confirmation samples will be collected from the footprints of temporary features upon removal. Should any of these temporary features to be left in place, the remaining materials will be sampled to assure no PCB impacts associated with the execution of the IM Project.

16. Post excavation and post backfill topographic surveys – Periodic topographic surveys will be conducted after successful excavation of PCB impacted sediment to the RBRO. The surveys will collect information regarding the depth and extent of the completed excavation and be used to estimate the volume of material removed during the IM Project. The periodic surveys will be conducted by onsite staff trained to use survey-grade GPS equipment. A State of Indiana Professional Land Surveyor will perform the post backfill topographic survey to document completed conditions are similar to pre-project conditions and maintain the gradient of the reach in which remediation occurred. The survey elevations will be recorded it in a known coordinate system, such as Indiana State Plane, and North American Vertical Datum 1988 (NAVD88).

17. Vegetative planting – Areas, such as the top of banks, along access roads, sediment dewatering impoundments, etc., disturbed by the sediment remediation portion of the IM Project will receive at least a single, loose 3-inch lift of topsoil and be subject to vegetative planting. The topsoil will be pH of 5.5 to 7.0 and contain a minimum of 3-percent organic matter and no stones larger than 1-inch in any dimension. Phosphorus free fertilizer (12 – 0 – 12) will be applied at a rate of 23 pounds per 1,000 square feet to assist in germination and growth. The selected seed mixture and application rate will be determined based on the completion date of the IM Project and soil conditions. Erosion and sedimentation controls will not be removed until adequate vegetative coverage has been established and the Notice of Termination (NOT) for the NPDES General Permit has been submitted.

4.2 REACHES 1 THROUGH 3 ISOLATED SOIL CLEAN UP PLAN

The remediation process will include the removal of isolated, PCB impacted soil from various geomorphic surfaces in Reaches 1 through 3 of Elliott Ditch that exceed the RBRO. The excavation extents will be based on the geomorphic principals used in the assessment of this reach of Elliott Ditch and the soil sampling analytical results that confirm the use of this approach. Please refer to **Figures 3, 3A, 3B, and 3C,** for the proposed excavation extents of the targeted geomorphic surfaces. The geomorphic surfaces that are targeted for soil removal include an upland area (Milepost 00.51), a floodplain area (Milepost 00.72), a depression (Milepost 00.82), a T-7 surface (Milepost 01.14), and a T-6 surface (Milepost 01.24). The following outlined steps describe the conceptual approach to isolated soil removal as part of this IM Project.

1. Upland soil PCB delineation at Milepost 00.51 – Additional upland soil delineation for PCBs is required near Milepost 00.51 (between the two railroad crossings) prior to removal activities. The PCB impacts quantified in this upland area are not reflective of those in other upland areas assessed during implementation of the FSP. This is likely caused by the railroad tracks or some other form of anthropogenic source in this area. The additional delineation will be performed via soil borings and laboratory analytical testing in accordance with the approved FSP, as prepared by TetraTech CES. Results from the additional delineation will be used to prepare an updated remediation area and associated decision unit that will supplement this IMWP. It is anticipated that this additional delineation will occur in the summer of 2020.
2. Mobilization – Transport materials, equipment, and personnel to the site.
3. Benchmarks – Field benchmarks will be established by the Owner/Engineer and maintained during remediation. The number of benchmarks to be established at each excavation area will be established by a State of Indiana Professional Land Surveyor and used for delineating the excavation extents.
    a. Benchmark locations will be recorded with horizontal and vertical data on Project Record Documents. The datum used will be a known coordinate system, such as Indiana State Plane. The use of a local coordinate system will not occur.
    b. Where the actual location or elevation of layout points cannot be marked, temporary reference points will be provided as necessary to locate the extents of soil removal activities.
    c. Temporary reference points will be removed when no longer needed.
4. Project Stakeout – Prior to starting excavation, improvement features will be field located, including: entrance(s), access road(s), erosion and sedimentation controls, support area(s), and excavation footprints.
5. Site preparation – Furnish and install silt fence, stabilized construction entrance, access road(s), heavy equipment decontamination area and other sedimentation control devices as applicable. Soil remediation areas on private, residential property will also include other controls, such as construction fencing, to secure the excavation area and sensitive

improvements. These additional controls will be based on discussions with the private property owner and potential activity in and around the remediation area.

6. Clearing, grubbing, and disposal of vegetative waste – Trees, shrubs, and plants will be designated for removal using boundary markers or spray paint. The IM Project will try and maintain vegetation outside of the access path and remediation area, to the extent practicable. Vegetation within the remedial footprint will be cut off approximately 2 inches above the ground surface and the stump and roots removed during excavation of PCB impacted soil. Grubbed materials (vegetative material only) from below surface grades that are in contact with PCB impacted material will be transported offsite for disposal along with the soil removed from the areas. Cleared materials from above surface grades will be transported offsite for disposal at a RCRA Subtitle D (non-hazardous, municipal solid waste) facility.

7. Removal of targeted materials – The excavation plans will be used to direct remediation. The excavation process will be conducted to efficiently handle removed materials; for example, excavated materials may be direct loaded into lined trucks instead of stockpiling, if capable. Smaller mechanical equipment will be considered for use on private, residential property to limit the ground disturbance while still being able to successfully remove the targeted materials. In general, the removed soil will be managed as follows:

    a. Soil containing greater than or equal to 1.0 mg/Kg and less than 50 mg/Kg total PCBs will be excavated, loaded, and hauled off-site to an approved RCRA Subtitle D landfill.

    b. Although not expected, soil containing greater than or equal to 50 mg/Kg total PCBs will be excavated, loaded, and hauled off-site to an approved RCRA Subtitle C or TSCA landfill.

8. Precipitation accumulation management – Rain water that collects within the open excavation footprint and is in contact with soil potentially containing PCBs will be treated the same as the decontamination wastewater as discussed in **Section 4.3**.

9. Excavation equipment management – To the extent practical, equipment will remain either within or outside of the disturbed excavation footprint during soil removal efforts. This will protect against mobilizing potentially impacted materials into other areas. Haul trucks will remain out of the excavation footprint or on clean materials placed within to protect against mobilizing impacted materials.

10. Confirmation sample collection – Confirmation samples will be collected from the bottom and side walls of the excavation to confirm the removal of materials containing total PCBs greater than or equal to 1.0 mg/Kg. See Post Excavation Confirmation Sampling, **Section 4.5**, for additional detail.

11. Borrow soil specification and confirmation sample collection – An offsite borrow source(s) will be needed to backfill and restore the excavation areas back to grade. Borrow soil will be subject to the following requirements:

    a. Consist of clean, well-graded, natural soil classified as SW, SM, SM-SC, SC, ML, CL-ML, or CL (ASTM D 2488) containing no topsoil or other deleterious material.

b. Stones or rock fragments will not exceed one quarter the maximum lift thickness (9-inches) as compacted in any dimension. Isolated rocks will be a maximum of 6-inches in any dimension and removed if observed.

c. Fill materials will have a 10-percent maximum loss on ignition (ASTM D 2974).

The excavation areas will be restored to grade such that drainage patterns are similar both before and after the IM Project. The vendor(s) of the offsite source will provide certification statements or documentation (i.e. analytical testing reports) indicating the soil is free of contamination. If no certification statement is provided or the source of the borrow material is suspect, environmental samples will be collected to confirm it is free of contamination prior to use. Confirmation sampling will be performed at a rate of roughly one sample per 500 cys of fill material. Additionally, geotechnical samples will be collected by the selected contractor to establish the Standard Proctor curve for the material if it is not provided by the vendor.

12. Retrieve borrow soil from the offsite source(s) – Borrow soil will be excavated and placed into dump trucks and transported to the soil remediation areas for use in backfilling the excavations. Excavation areas will be backfilled immediately following excavation and confirmation that the decision unit meets the RBRO. The fill material will be directly dumped into the excavation footprint or temporarily stockpiled locally for use in the backfilling process. If temporary stockpiles for the borrow material are created, erosion and sedimentation controls will be installed as necessary.

13. Place, grade, and compact the backfill soil – Soil backfill materials are to be placed in loose lifts not to exceed 9 inches in depth for material compaction by heavy equipment. Placement will occur in a manner such that equipment is not in direct contact to the completed excavation bottom. Backfill materials are to be compacted to not less than 90-percent of maximum dry unit weight according to ASTM D-698 (Standard Proctor Test) using mechanical equipment. Compacted fill will be placed to at least pre-project elevations such that positive drainage is maintained.

14. Backfill equipment management – Equipment will take special precautions to not track PCB impacted soil across clean areas. If equipment is suspected of coming into contact with impacted materials, it will be properly decontaminated, as discussed in **Section 4.3**, prior to mobilization into clean areas.

15. Removal of access road(s), sump(s), and temporary stockpile areas – Any project support features, i.e. sump(s), temporary stockpile areas, etc. will be removed, unless specifically requested to be left in place by the Tippecanoe County Drainage Board, if it is within its easement, or the private property(ies) owner, or identified as being needed for subsequent remedial efforts, after successful execution of this IM Project. Samples of the materials will be collected prior to removal to assess for PCB presence in support of proper management. Additionally, confirmation samples will be collected from the footprints of temporary features upon removal. Should any of these temporary features to be left in place, the remaining materials will be sampled to assure no PCB impacts associated with the execution of the IM Project.

16. Post excavation and post backfill topographic surveys – Periodic topographic surveys will be conducted after successful excavation of PCB impacted soil to the RBRO. The surveys

will collect information regarding the depth and extent of the completed excavation and be used to estimate the volume of material removed during the IM Project. The periodic surveys will be conducted by onsite staff trained to use survey-grade GPS equipment. A State of Indiana Professional Land Surveyor will perform the post backfill topographic survey to document completed conditions meet or exceed pre-project conditions and record it in a known coordinate system, such as Indiana State Plane, and NAVD88.

17. Vegetative planting – Areas disturbed by the IM Project will receive at least a single, loose 3-inch lift of topsoil and be subject to vegetative planting. The topsoil will be pH of 5.5 to 7.0 and contain a minimum of 3-percent organic matter and no stones larger than 1-inch in any dimension. Phosphorus free fertilizer (12 – 0 – 12) will be applied at a rate of 23 pounds per 1,000 square feet to assist in germination and growth. The selected seed mixture and application rate will be determined based on the completion date of the project and soil conditions. Erosion and sedimentation controls will not be removed until adequate vegetative coverage has been established and the Notice of Termination for the NPDES General Permit has been submitted.

4.3 DECONTAMINATION OF HEAVY EQUIPMENT

Decontamination areas will be constructed and maintained at the equipment exits from the remediation excavations. The locations for these areas will be selected by the contractor and approved by Arconic. Clean gravel will cover the areas to prevent potential recontamination of vehicles after being decontaminated. The decontamination area will be lined with construction-grade plastic to prevent infiltration of fluids into the subsurface and sloped to drain to a collection sump, preferably away from Elliott Ditch. Dry soil and sediment removal from heavy equipment will occur by using disposable brushes, trowels, and hand tools. Removed dry soil and sediment will be returned to the appropriate staging area or live loaded for offsite management. The remaining soil and sediment removal from heavy equipment will be in accordance with 40 CFR 761.79 *Decontamination Standards and Procedures*. The process is likely to include using a pressure washer followed by cleaning with environmentally friendly detergent/water, rinsing with potable water, and wiping down equipment areas that were in contact with impacted soil with a solvent (e.g. hexane, acetone, diesel fuel, or others). Management of decontamination fluids, including spent solvents, will be in 55-gallon drums or tanks that will be stored in a secure area for characterization sampling and analytical testing purposes. Management of these materials will be according to the analytical results.

Residual sediment present in the pressure washer run-off will be collected in the decontamination sump. Once the sediment accumulation in the sump is at least half of the sump depth, it will be sampled and analyzed for PCBs. Excavation and offsite management of the sediments will be per the PCB analytical results. Sediment containing greater than or equal to 50 mg/Kg PCBs, although not expected, will be removed and disposed of offsite at a RCRA Subtitle C facility or TSCA landfill. Sediment containing concentrations of PCBs less than 50 mg/Kg will be removed and disposed of offsite at a RCRA Subtitle D facility.

Sediment to be hauled offsite for disposal must first pass the "paint filter test". If necessary, the sediment will be amended with drying agents such as lime, super absorbent polymer, etc., so long as the selected disposal facility approves the use. Amending will occur in the sediment dewatering impoundments or an approved alternate.

Wastewater from the decontamination process will also collect in the wash pad sump. Sampling of the wastewater may occur to establish PCB concentrations prior to treatment. This information will help estimate the treatment system operations, such as the flow rate and contact time. Removal of the wastewater will be by pump to an adjacent treatment system consisting of storage tanks, bag/cartridge filter units, and carbon filter units. The storage tanks and treatment system will be within secondary containment. Pumping will occur at a frequency necessary such that the sump does not overflow and at a flow rate for adequate contact time with the carbon filter media to achieve the necessary removal efficiency.

The wastewater will be pumped into a storage tank after it has passed through the carbon filtration process. Filtered wastewater in the storage tank will be subjected to PCB analytical testing in order to determine how it can be reused or if it requires offsite treatment and disposal. The wastewater will be used for dust suppression on stockpiles or haul roads, if total PCBs concentration is less than 0.5 micrograms per Liter (µg/L), for decontamination purposes, if total PCBs concentration is less than 1.0 milligrams per Liter (mg/L), or sent offsite for disposal, if total PCBs concentration is equal to or greater than 1.0 mg/L. At the end of the IM Project, any remaining containerized water will be sampled to assess total PCB concentration and managed based on the analytical testing results. Should the total PCB concentration be less than 0.5 µg/L, it can be discharged back into Elliott Ditch, with approval from the IDEM, or used on remaining stockpiles for dust suppression. Otherwise, it will be transported to a licensed and permitted facility for treatment and disposal.

4.4 WASTE MANAGEMENT

4.4.1 Liquid Waste

Management of the wastewater generated during the decontamination of heavy equipment will be handled as described previously. The amount of reused water, sampling analytical results, and volume transported offsite for treatment and disposal will be identified in the Post Construction Report.

4.4.2 Solid Waste

The proposed IM Project includes the excavation and offsite disposal of impacted soil with PCB concentrations greater than or equal to 1.0 mg/Kg. It is anticipated that 7,725 cys of sediment will be excavated for offsite disposal. Of the 7,725 cys, 7,615 is anticipated to be removed from

Reach 1 upstream of the first railroad crossing, 85 from Reach 1 between the two railroad crossings and Reach 2, and 25 from Reach 3. Based on analytical testing performed to date, all of the sediment has total PCBs concentrations less than 50 mg/Kg and will be disposed of at a RCRA Subtitle D facility. Following removal of this material, confirmation samples will be collected for laboratory analysis of PCBs, as described in **Section 4.5**. If confirmation sampling identifies remaining material exceeding the RBRO, this material will be excavated and disposed at a RCRA Subtitle D facility. Excavation will continue until confirmation sampling demonstrates successful remediation of each decision unit.

It is anticipated that 2,950 cys of soil with an estimated mass of 4,720 tons will be removed as part of the IM Project. Based on analytical testing performed to date, all of the soil has a total PCBs concentrations less than 50 mg/Kg and will be disposed of at a RCRA Subtitle D facility. Following removal of this material, confirmation samples will be collected for laboratory analysis of PCBs, as described in **Section 4.5**. If confirmation sampling identifies remaining material exceeding the RBRO, this material will be excavated and disposed at a RCRA Subtitle D facility. Excavation will continue until confirmation sampling demonstrates successful remediation of each decision unit.

The management of solid waste includes the management of sediment that has accumulated in the heavy equipment decontamination pad run-off collection sump (as described in **Section 4.3** above), as well as any used filters and spent carbon that has been generated from the wastewater treatment process.

During the implementation of this IM Project, Arconic will work with the disposal facilities to profile each waste stream such that it complies with the permits for the respective disposal facility prior to transportation. The mode of transportation will be by lined and covered truck. Also, Arconic will comply with applicable USEPA and Department of Transportation (DOT) regulations for either transportation method. In support of this IM Project, Arconic has identified the following potential disposal facilities. Other disposal facilities will be considered so long as it is Arconic approved and permitted to accept the identified waste streams. If RCRA Subtitle C or D facilities are used for PCB waste disposal, notification to the facility will be made at least 15 days prior to the date of the first shipment of material.

4.4.2.1 Potential RCRA Subtitle D Facilities

Soil containing greater than or equal to 1.0 mg/Kg and less than 50 mg/Kg PCBs can be sent to:

- Waste Management – Liberty Landfill (White County, Indiana)
- Waste Management – Oak Ridge Recycling and Disposal (Cass County, Indiana)
- Republic – Clinton County Landfill (Clinton County, Indiana)

4.4.2.2 Potential RCRA Subtitle C Facilities (not anticipated to be needed for this IM Project)

Soil containing greater than 50 mg/Kg PCBs can be sent to:

- Heritage – Heritage Landfill (Roachdale, Indiana)
- US Ecology – US Ecology Alabama (Sulligent, Alabama)
- Clean Harbors – Lone Mountain Landfill (Waynoka, Oklahoma)

4.4.2.3 Potential TSCA Landfills (not anticipated to be needed for this IM Project)

Soil containing greater than 50 mg/Kg PCBs can be sent to:

- US Ecology – US Ecology Michigan (Belleville, Michigan)
- Clean Harbors – Grassy Mountain Landfill (Grantsville, Utah)
- Chemical Waste Management – Hazardous Waste Facility (Emelle, Alabama)

Upon selection of the appropriate disposal facilities, Arconic will conduct additional sampling, if necessary, to complete profile development for the solid waste stream.

4.5 POST EXCAVATION CONFIRMATION SAMPLING

Confirmation sampling will occur from within the remedial excavation areas to document the successful excavation of PCB impacted soil and sediment containing concentrations greater than or equal to the RBRO of 1.0 mg/Kg. The confirmation sampling approach for the excavation bottoms will follow the Incremental Sampling Methodology (ISM) and for the sidewalls will be as specified in 40 CFR 761.61(a)(6).

Samples will be collected following guidance from the IDEM's July 9, 2012 *Conceptual Site Model (CSM) Development: Sampling* document and the July 1992 USEPA *Preparation of Soil Sampling Protocols: Sampling Techniques and Strategies*. The collected soil and sediment samples will be placed into appropriate laboratory-supplied container(s) while wearing a new pair of chemical resistance gloves, such as nitrile. The samples will be sealed, labelled, and placed in a cooler on ice for shipment to the laboratory under proper chain-of-custody control. Reusable sampling equipment will be properly decontaminated before collecting samples and between incremental sample locations (excavation bottoms) and composite sample locations (sidewalls) as described in the guidance referenced above.

Additional detail regarding the two confirmation sampling approaches is provided in the following.

4.5.1 CONFIRMATION SAMPLING APPROACH

4.5.1.1 Excavation Bottoms

The confirmation sampling approach will include collecting samples from 0 to 0.25 feet below grade following removal of targeted soil or sediment. This approach will be used for all areas outside of the sediment remediation in Reach 1 upstream of the first railroad crossing. The approach is the same strategy used to collect confirmation samples at the SWMUs 8, 31, and 48 IM projects at the Lafayette Operations. The sampling strategy is based on the application of a 5 foot by 5 foot grid cell (approximately 25 square feet) as the basis for each discrete confirmation sample location from a larger 15 foot by 15 foot decision unit (DU). The excavation bottom confirmation samples will be collected at the approximate center from each 5 foot by 5 foot grid cell arranged within a 15 foot by 15 foot DU resulting in 9 discrete samples collected from a DU. If the bottom of the excavation cannot be evenly divided into 15 foot by 15 foot DUs due to the dimensions of the remedial excavation, the smaller areas along the perimeter of the excavation boundaries will be grouped together in a manner that maximizes the number of full-sized grid cells. If the remaining space between the side of a full-sized 5 foot by 5 foot grid cell and the vertical wall of the excavation is less than 2.5 feet, then no additional samples will be collected from that area. If the remaining space between the side of a full-sized 5 foot by 5 foot grid cell and the vertical wall of the excavation is greater than 2.5 feet, then that space will become a 5-foot-long by 2.5 foot (or more up to 5 feet) grid cell for the purpose of sampling. In remediation areas with irregular shapes, the DU grids will be aligned such that as many full sized DUs fit into the area as possible. If the distance from the edge of a DU to the extent of the remediation area is more than 2.5 feet, a separate DU will be created. The dimensions of the DU will be the distance by a length that creates an area that is approximately 225 square feet and contains 9 sampling grids that are each approximately 25 square feet. The compositing approach will be the same, with the 9 discrete samples from each grid being composited into a sample representative of the DU as a whole. Should the area between the last full sized DU and the extents of remediation be less than 225 square feet, the area will be divided into 25 square foot grids, a discrete sample collected from each, and a composite sample prepared. In instances such as these, the composite sample from the DU will be made up of less than 9 discrete samples. Please refer to **Figure 10** for a schematic of how this sampling methodology will be applied.

The application of this approach to the sediment remediation area in Reach 1 up stream of the first railroad crossing differs slightly from what was described previously. The approach for this area is based on the application of 9 square grid cells. The difference is this approach uses the width of the ditch to set the width and length of each DU and the 9 grid squares. The DU dimensions would be the width of the ditch by the width of the ditch, with each of the grid squares being 1/3 the width of the ditch by 1/3 the width of the ditch. For reference, Elliott Ditch is 15 to 25 feet wide in most portions of Reach 1 where this approach will be applied. The excavation bottom confirmation samples will be collected at the approximate center from each grid cell arranged within the DU resulting in 9 discrete samples collected from a DU. The 9 discrete samples are then composited into a sample that is representative of the DU as a whole. The reason for the slight variation is to allow for the full width of Elliott Ditch to be included in each DU. This will expedite the confirmation sampling and backfilling process. Please refer to **Figure 10** for illustrative examples of how the confirmation sampling approach would be applied in the sediment remediation area in Reach 1, up stream of the first railroad crossing, as well as in other remediation areas.

Sampling will be coordinated first to collect the discrete samples from each of the 9 grid cells within a DU. Approximately equally sized aliquots of the 9 discrete samples will be used to produce the composite sample for that DU. Then the composite samples for the remaining grid blocks will be collected in a similar manner until each of the DUs have been sampled. Following this methodology will maximize the number of composite samples that consist of 9 discrete samples. However, the possibility does exist that a composite sample may be comprised of less than 9 discrete samples, as noted previously.

The total PCB analytical testing results for the composite sample from each DU, which in most instances will be comprised of 9 discrete samples, will be compared to the RBRO of 1.0 mg/Kg. If the RBRO is exceeded in a DU, additional excavation and resampling will be performed.

4.5.1.2 Sidewalls

The excavation sidewall confirmation samples will be collected at the approximate center from each 5 foot wide by excavation depth tall grid cell aligned along the excavation sidewall. The basic sidewall sampling block is based on a pattern of one grid cell in height and 9 grid cells (45 feet) in length. This pattern results in nine discrete samples from an area that is the excavation depth tall by 45 feet long (refer to **Figure 11**). All sidewall sampling grid cells will be 5 feet wide at the top of the excavation (with the exception of the last sidewall grid cell necessary to complete full length of the excavation sidewall). Sampling will be coordinated to collect one discrete sample from each sampling grid cell. Nine discrete samples will be used to produce one composite sample. If there are fewer than nine sampling grid cells available to produce the composite, then the composite sample will be produced from the remaining grid cell discrete samples. For the excavation with sloped walls, the corner of the excavation will be recognized as a grid cell and one discrete sample will be collected from the corner of the sloped wall excavation as part of the sampling process (refer to **Figure 11**).

4.5.2 SAMPLE PROCESSING AND ANALYSIS

PCBs are the COCs for Elliott Ditch and the soil and sediment targeted for remediation. Therefore, the laboratory analysis of the composite soil and sediment confirmation samples will be for PCBs by USEPA Method 8082, following sample preparation Method 3540/3541 Soxhlet extraction. All results will be reported on a dry weight basis for comparison to the RBRO. Under current

USEPA and IDEM guidelines, a trip blank is only appropriate for aqueous VOC samples. Aqueous VOC samples will not occur as part of the IM Project, thus trip blanks are not appropriate. Soil and sediment samples are typically heterogeneous and field duplicate samples frequently do not have good reproducibility due to that heterogeneity. Therefore, field duplicates will occur at a rate of one per every 20 incremental samples to assess the level of heterogeneity present in the soil. Should a duplicate sample indicate an exceedance of the RBRO, where the original sample did not, the DU will be subjected to additional excavation and resampling, as discussed previously.

One matrix spike/matrix spike duplicate (MS/MSD) sample for every 20 incremental samples will also be collected to assess for matrix interferences. Additionally, aqueous equipment blank sample(s) will be collected periodically by running distilled water over decontaminated sampling equipment and collecting the water in laboratory provided containers. These blank samples will be subjected to laboratory analysis for PCBs by USEPA Method 8082 and the results reviewed to assess the potential for cross-contamination.

4.6 POST CONSTRUCTION REPORT

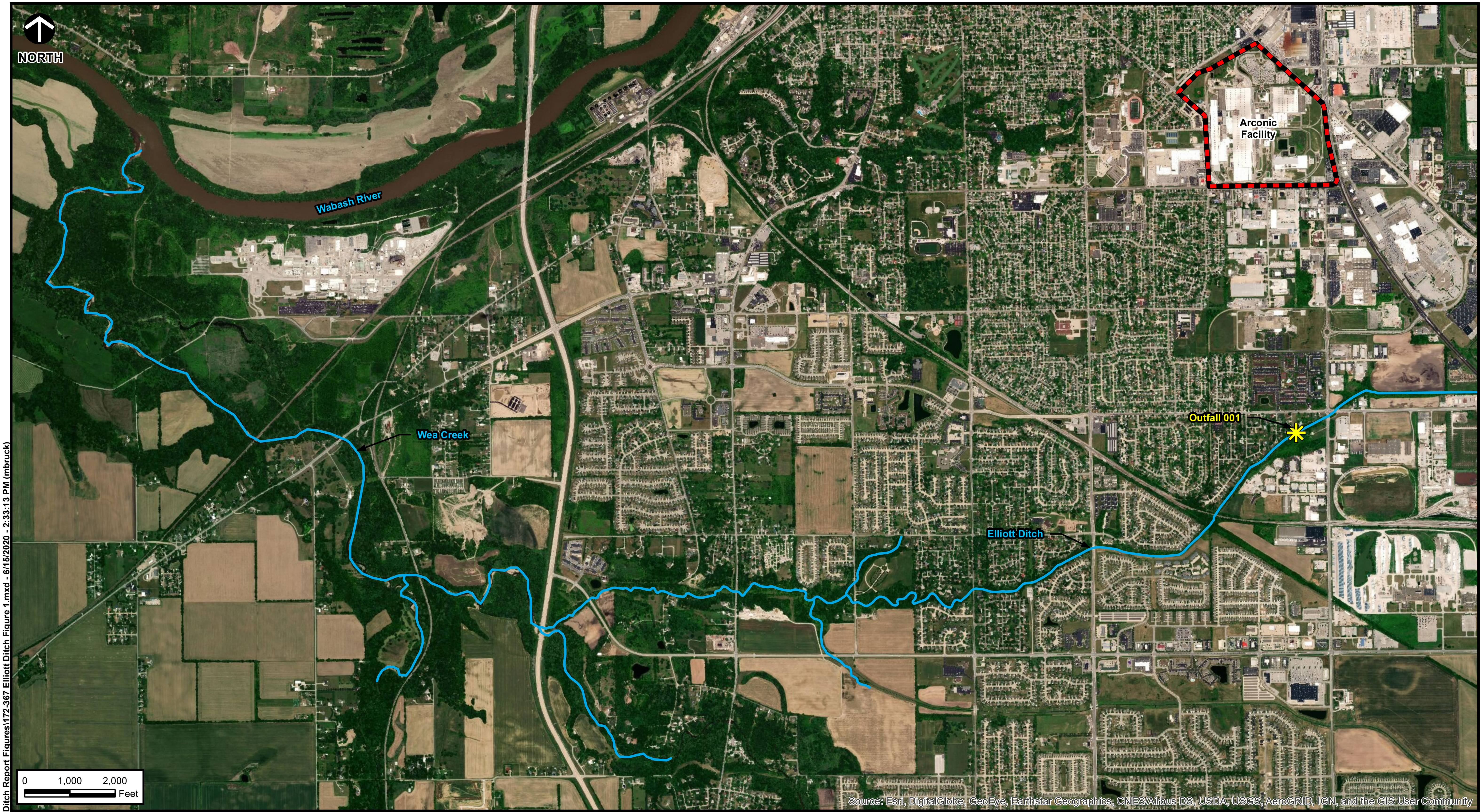
A Post Construction Report will be developed and submitted to the IDEM and the USEPA Region 5 within 120 days after completion of the IM Project and successful closeout of any associated permits. The following activities will be documented in the Post Construction Report.

a. Summary of IM Project activities, including:
    1. Discussion of IM Project sequencing and execution.
    2. Results from additional delineation sampling of the upland soil area at Milepost 00.51 (between the two railroad tracks).
    3. Types (TSCA and non-TSCA) and volumes of soil and sediment materials removed – volumes will be included showing the type and number of tons hauled for off-site disposal.
    4. Method of solid and liquid waste management including discussion regarding the processes and copies of disposal documents (weight tickets, manifests, and certificates of disposal).
    5. Post excavation confirmation sampling locations, results, and analytical reports.
    6. Photos documenting completion of the IM Project according to the IMWP.
b. Copies of permits obtained in support of the execution of this IM Project.
c. Copies of the Erosion and Sedimentation Control Plan, NOI, approval letter from the City, and the Notice of Termination (NOT). If the disturbed areas have not achieved the required vegetative coverage for NPDES Permit closure and the Post Construction Report has been prepared, it will be submitted without the NOT. The NOT will be provided upon filing.
d. Final engineering as-built drawing showing: the completed excavation extents and grades, as well as the completed backfill grades. The as-built drawing(s) will be prepared in

AutoCAD and labelled to include: the project name, date, owner's name, name of the engineer, surveyors signed seal, name of the construction manager, and the contractor.

e. Engineer certification statement.

FIGURES



LEGEND

- Outfall 001
- Arconic Facility
- Elliott Ditch

REFERENCE

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ELLIOTT DITCH VICINITY MAP

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DATE: JUNE 15, 2020	SCALE: 1 " = 2,000 '	PROJECT NO: 172-367.0014	

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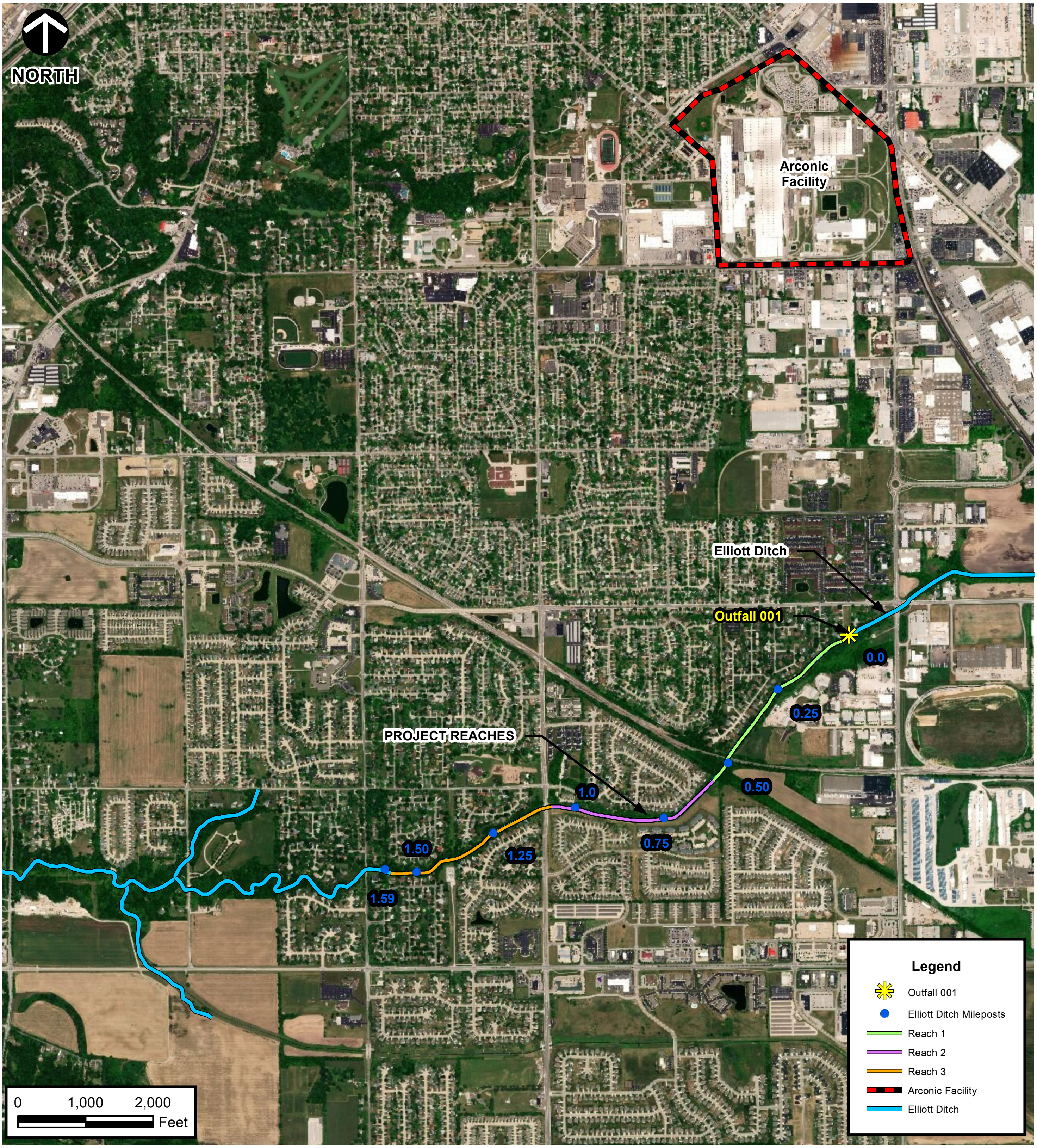

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ELLIOTT DITCH REACHES 1-3

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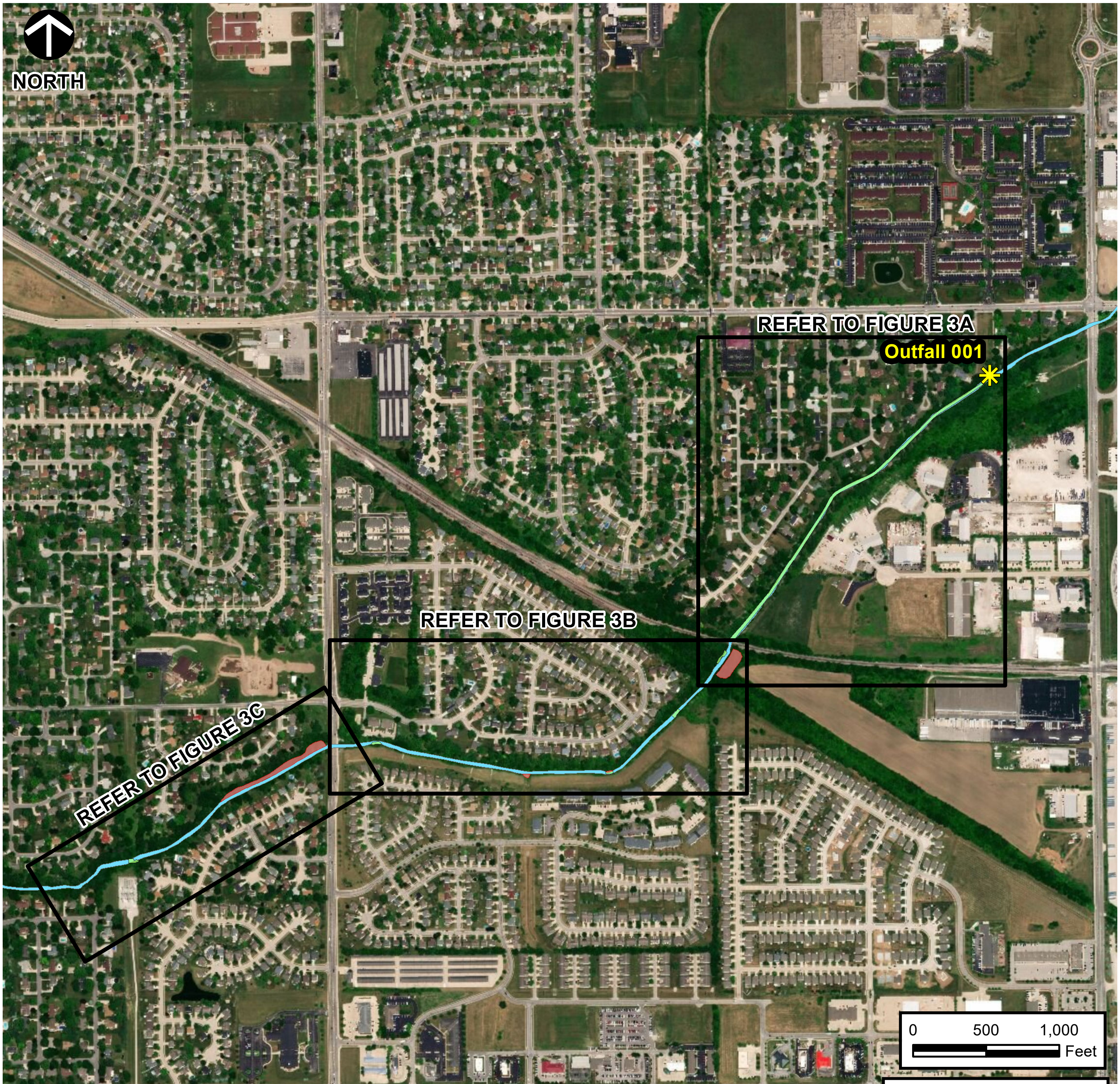

NOTES:
1. Geomorphic surfaces shown as soil remediation areas are as mapped by TetraTech CES and documented in its July 6, 2015 report.
2. The soil remediation area at Milepost 00.51 (upland soil) is approximate. Further delineation of this area is planned in the summer of 2020.

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SOIL AND SEDIMENTATION REMEDIATION AREAS

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NOTES:
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REACH 1 SOIL AND SEDIMENTATION REMEDIATION AREAS

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REACH 2 SOIL AND SEDIMENTATION REMEDIATION AREAS

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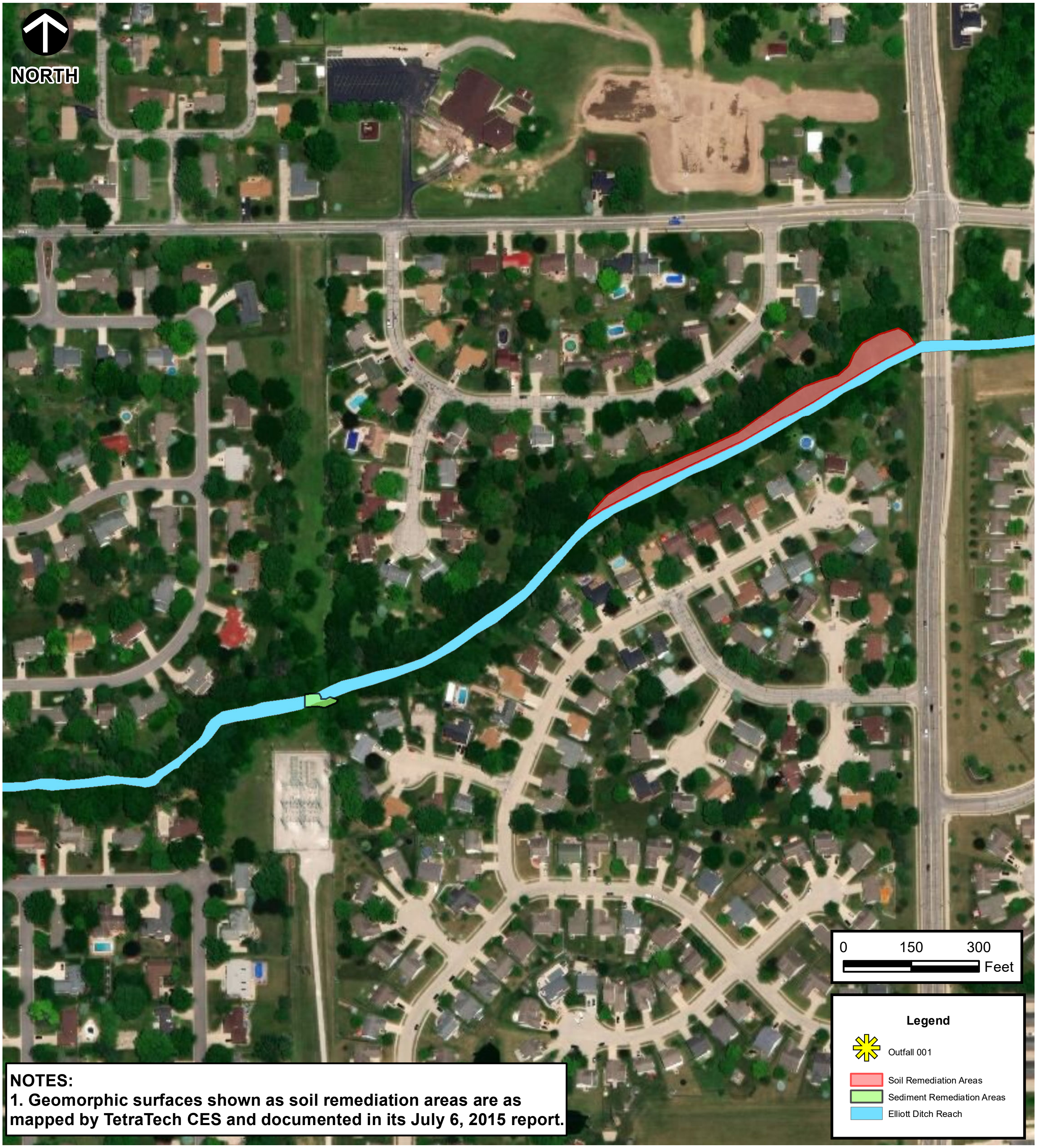

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REACH 3 SOIL AND SEDIMENTATION REMEDIATION AREAS

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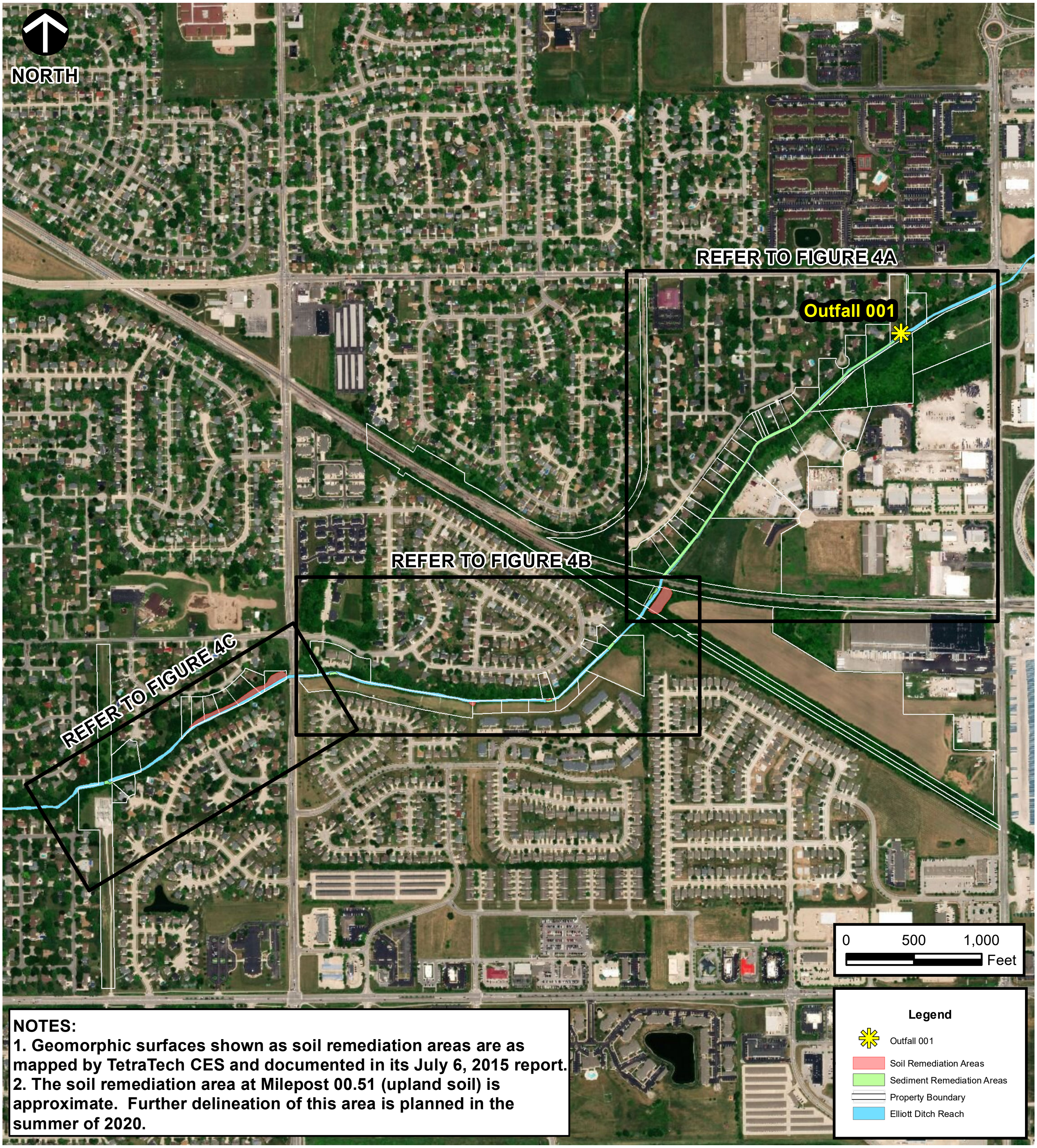

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PRIVATE PROPERTY ACCESS FOR REMEDIATION

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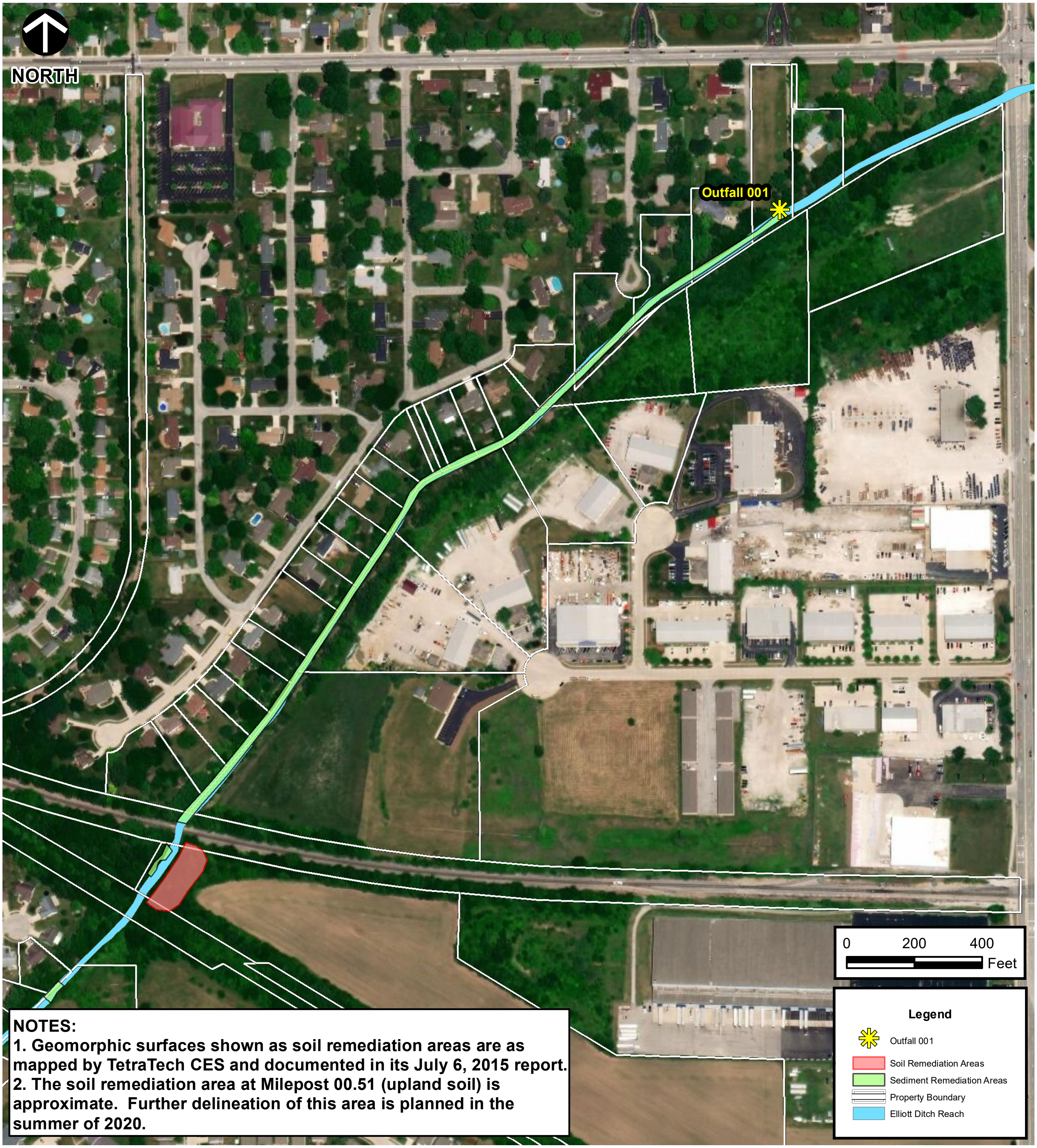

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REACH 1 PRIVATE PROPERTY ACCESS FOR REMEDIATION

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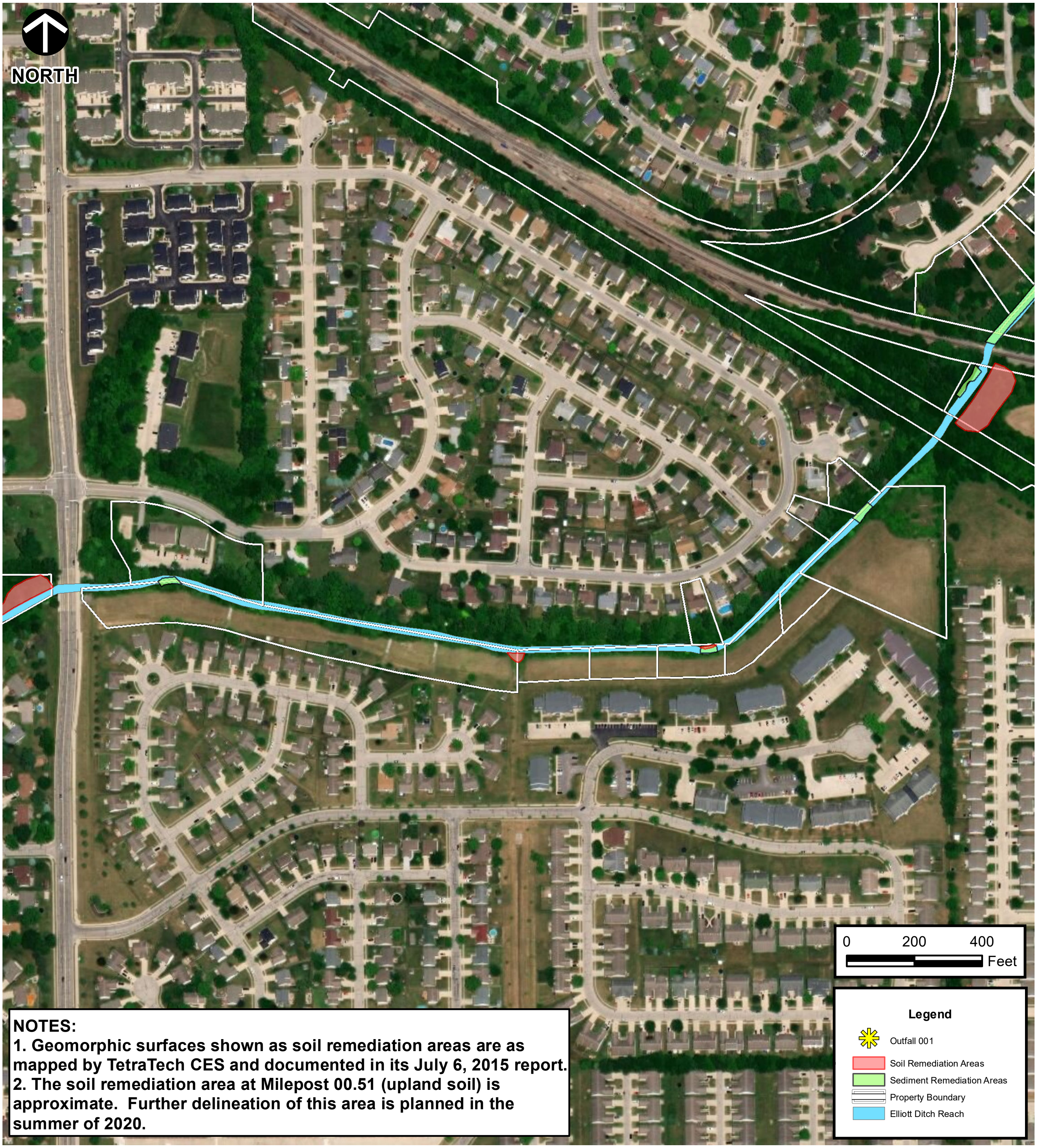

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REACH 2 PRIVATE PROPERTY ACCESS FOR REMEDIATION

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DATE: JUNE 22, 2020	DWG SCALE: 1 " = 400 '	PROJECT NO: 172-367.0014		

Signature on File *

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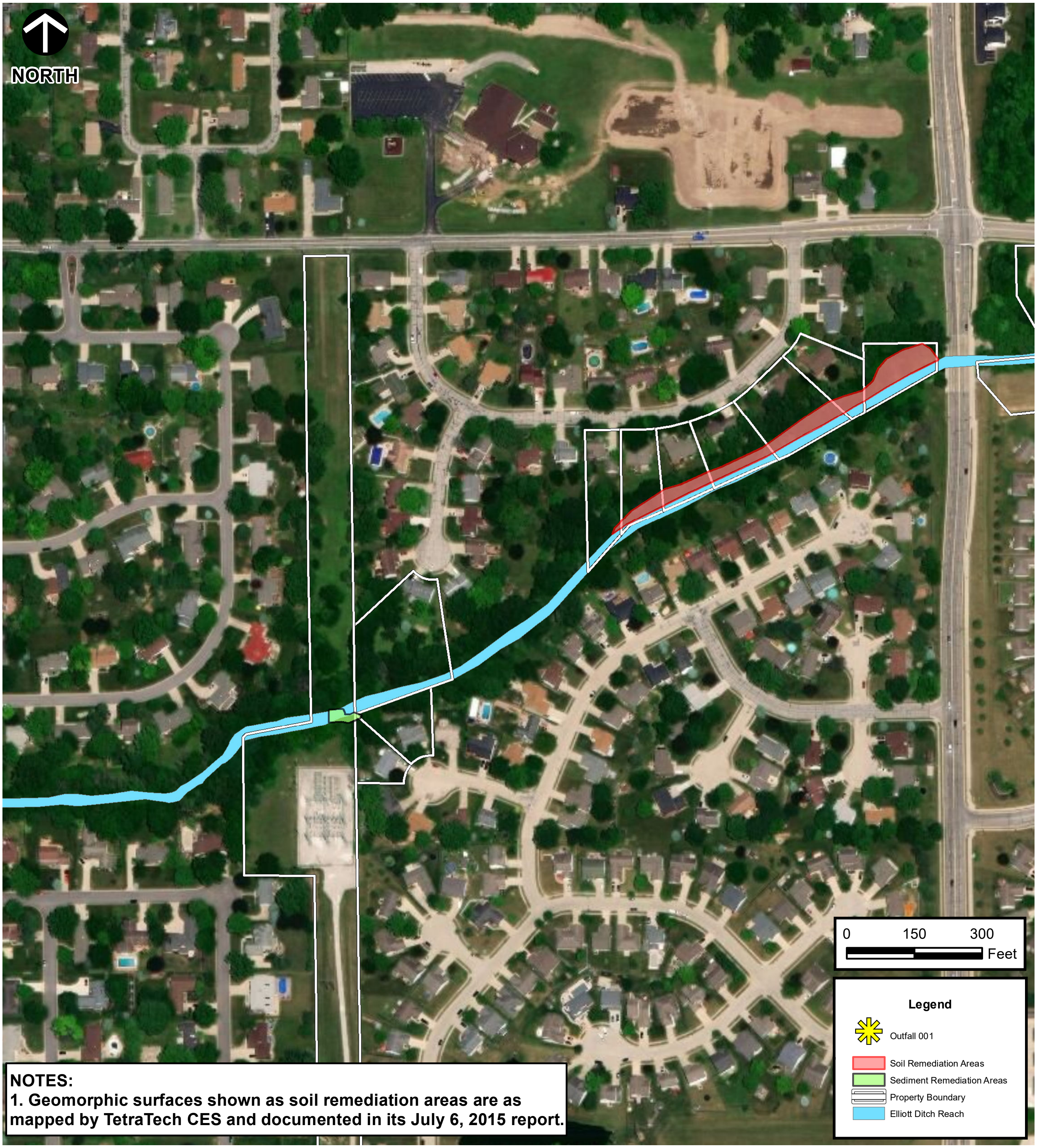

NOTES:
1. Geomorphic surfaces shown as soil remediation areas are as mapped by TetraTech CES and documented in its July 6, 2015 report.

SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 6/22/2020
IMAGE DATE: 03/12/2011

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ELLIOTT DITCH INTERIM MEASURES WORK PLAN
REACHES 1-3 SEDIMENT AND SOIL
LAFAYETTE, INDIANA

REACH 3 PRIVATE PROPERTY ACCESS FOR REMEDIATION

DRAWN BY: DMM	CHECKED BY: JMB	APPROVED BY: JMB*	FIGURE NO:
DATE: JUNE 22, 2020	DWG SCALE: 1 " = 300 '	PROJECT NO: 172-367.0014	4C

Signature on File *

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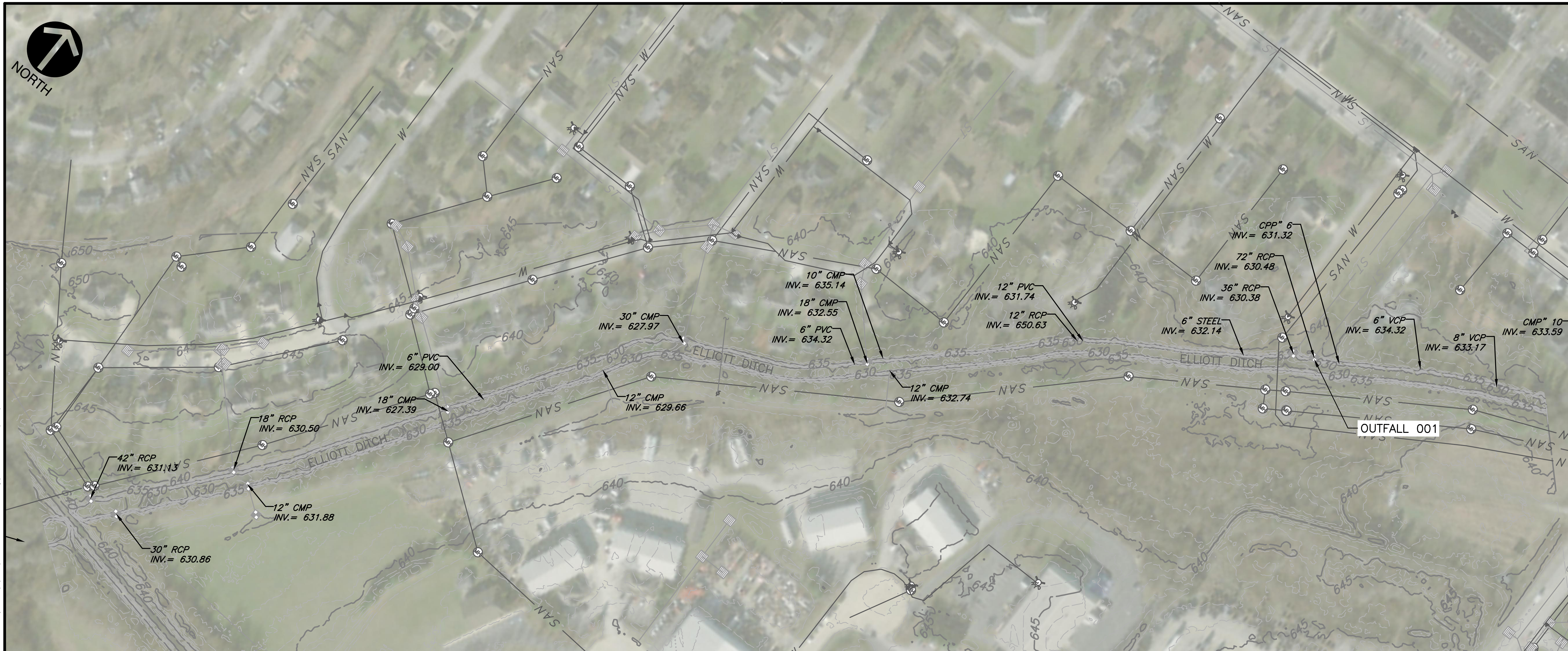

REFERENCE

1. EXISTING CONDITIONS TOPOGRAPHY GENERATED FROM DATA PROVIDED BY INDIANA'S STATEWIDE IMAGERY AND LIDAR PROGRAM AND AVAILABLE AT WWW.OPENTOPO.SDSC.EDU. AIRBORNE LIDAR SURVEY PERFORMED BETWEEN 3/13/2011 AND 4/30/2012.

2. MAPPING FOR EXISTING STORM, SANITARY, AND WATER UTILITIES IN THE VICINITY OF THE PROJECT WERE PROVIDED TO CEC BY BUTLER, FAIRMAN, AND SEUFERT, INC. FROM THE CITY OF LAFAYETTE GIS. DATA PROVIDED ON 5/23/2019.

3. REACH 1 DISCHARGE PIPE SIZES, PIPE MATERIALS, AND INVERT ELEVATIONS BASED ON FIELD SURVEY COMPLETED BY CEC ON 1/31/2019.

LEGEND

———	EXISTING MAJOR CONTOUR	MH	EXISTING SANITARY MANHOLE
- - - -	EXISTING MINOR CONTOUR		EXISTING STORM OUTFALL
— ST —	EXISTING STORM SEWER		EXISTING WATER VALVE
— W —	EXISTING WATER LINES		EXISTING HYDRANT
— SAN —	EXISTING SANITARY SEWER		EXISTING COMMUNICATIONS POLE
	EXISTING CATCH BASIN	— OH-T —	EXISTING OVERHEAD COMMUNICATIONS LINE
S	EXISTING STORM MANHOLE		

SCALE IN FEET

0 200 400

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ELLIOTT DITCH INTERIM MEASURES WORK PLAN

REACHES 1-3 SEDIMENT AND SOIL

LAFAYETTE, INDIANA

REACH 1

DISCHARGE PIPES INTO ELLIOTT DITCH

DRAWN BY: KAM	CHECKED BY: GAW	APPROVED BY: JMB	FIGURE NO.: 5
DATE: JUNE 2020	DWG SCALE: 1"=200'	PROJECT NO: 172-367.0014	

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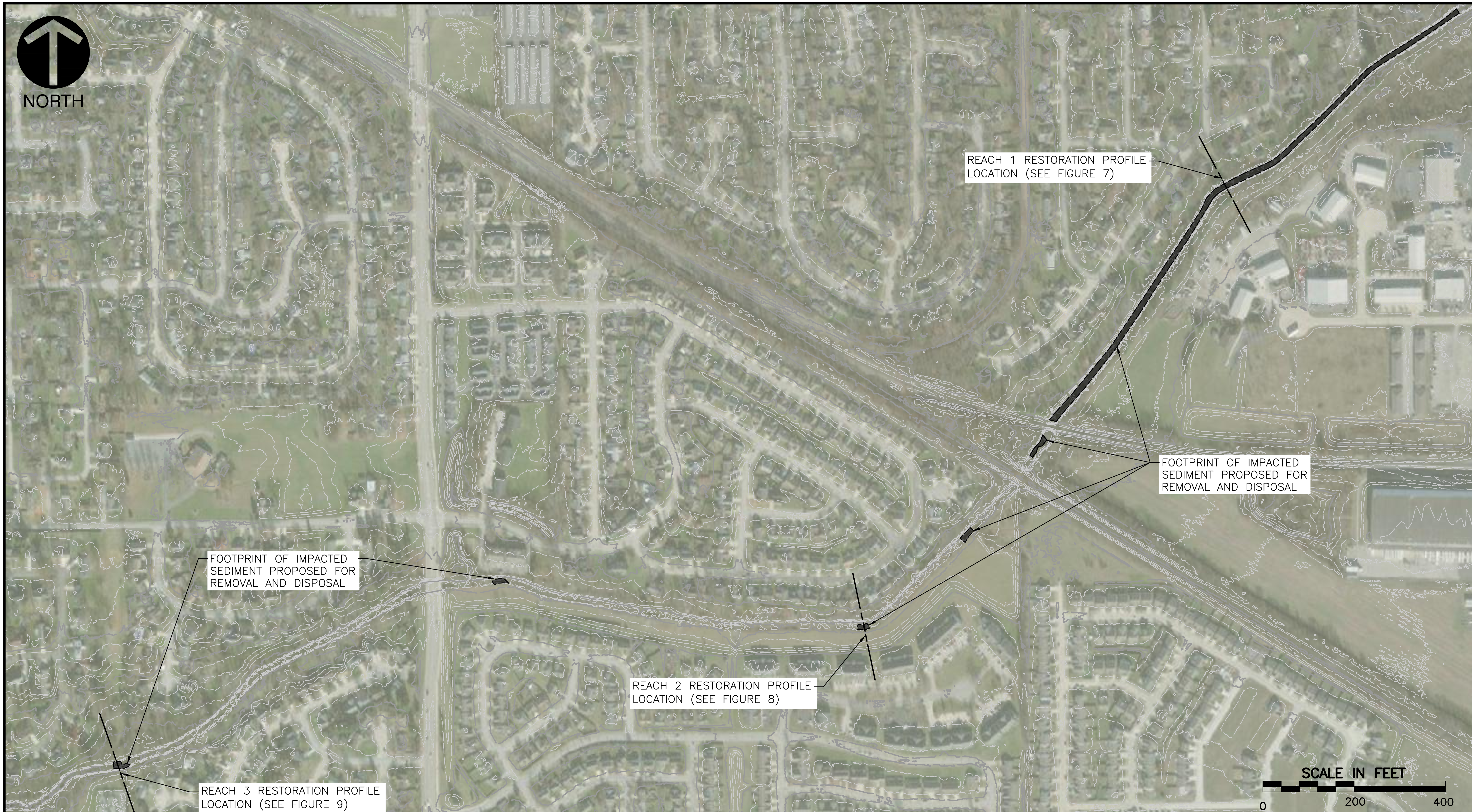

REFERENCE

1. EXISTING CONDITIONS TOPOGRAPHY FOR CHANNEL BANKS AND ADJACENT AREAS GENERATED FROM DATA PROVIDED BY INDIANA'S STATEWIDE IMAGERY AND LIDAR PROGRAM AND AVAILABLE AT WWW.OPENTOPO.SDSC.EDU. AIRBORNE LIDAR SURVEY PERFORMED BETWEEN 3/13/2011 AND 4/30/2012.

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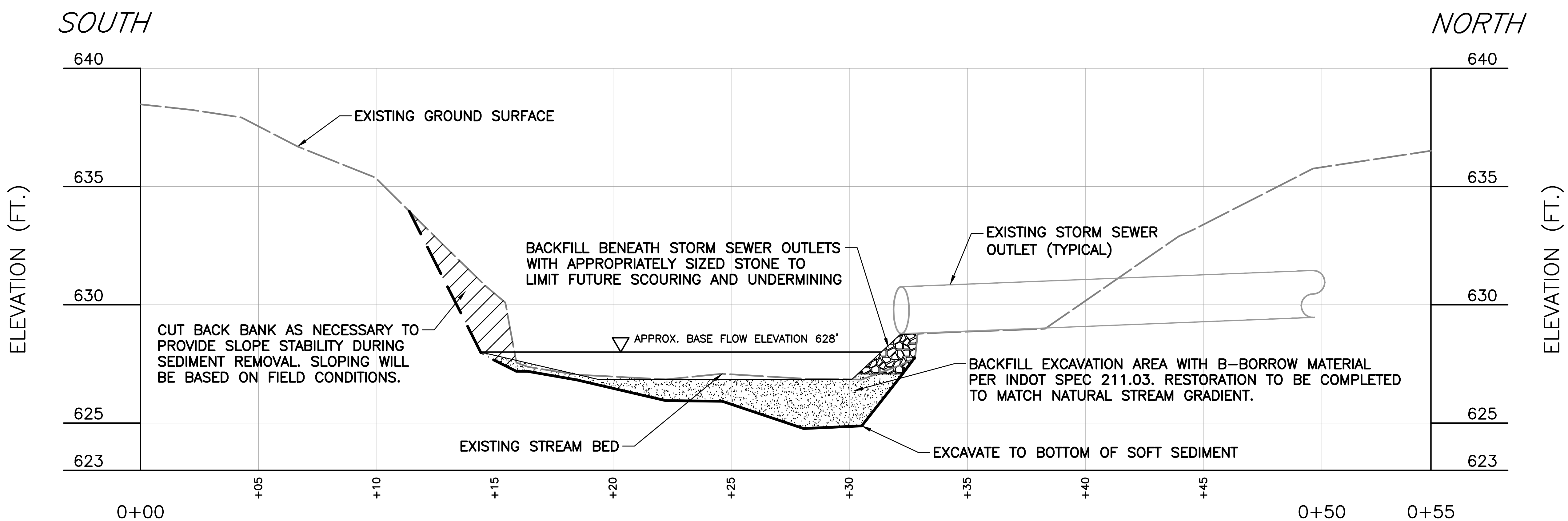
REACHES 1-3 SEDIMENT AND SOIL
LAFAYETTE, INDIANA

SEDIMENT REMEDIATION AREAS OVERVIEW

DRAWN BY: KAM	CHECKED BY: GAW	APPROVED BY: JMB	FIGURE NO.:		
DATE: JUNE 2020	DWG SCALE: 1"=200'	PROJECT NO: 172-367.0014	6		



REACH 1 PROPOSED TYPICAL PROFILE

SCALE H:1"=5'; V:1"=5'

REFERENCE

1. EXISTING CONDITIONS TOPOGRAPHY FOR CHANNEL BANKS AND ADJACENT AREAS GENERATED FROM DATA PROVIDED BY INDIANA'S STATEWIDE IMAGERY AND LIDAR PROGRAM AND AVAILABLE AT WWW.OPENTOPO.SDSC.EDU. AIRBORNE LIDAR SURVEY PERFORMED BETWEEN 3/13/2011 AND 4/30/2012.
2. ELLIOTT DITCH STREAM BED TOPOGRAPHY GENERATED FROM SURVEY DATA COLLECTED BY CEC IN OCTOBER 2017 DURING SEDIMENT POLING EFFORTS. STREAM BED ELEVATIONS COLLECTED IN ACCORDANCE WITH THE STANDARD OPERATING PROCEDURE FOR POLING MEASUREMENTS TO ESTIMATE SOFT SEDIMENT THICKNESS AS INCLUDED IN ATTACHMENT A OF THE ELLIOTT DITCH FIELD SAMPLING PLAN, PREPARED BY TETRA TECH, INC. AND DATED 2/2/2016.
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NOTES

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6. DURING STREAM CHANNEL RESTORATION, UPGRADIENT AND DOWNGRADIENT LIMITS OF TARGETED SEDIMENT REMOVAL AREAS WILL BE GRADED INTO THE EXISTING ADJACENT CHANNEL BOTTOM.

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PROPOSED TYPICAL PROFILE
REACH 1

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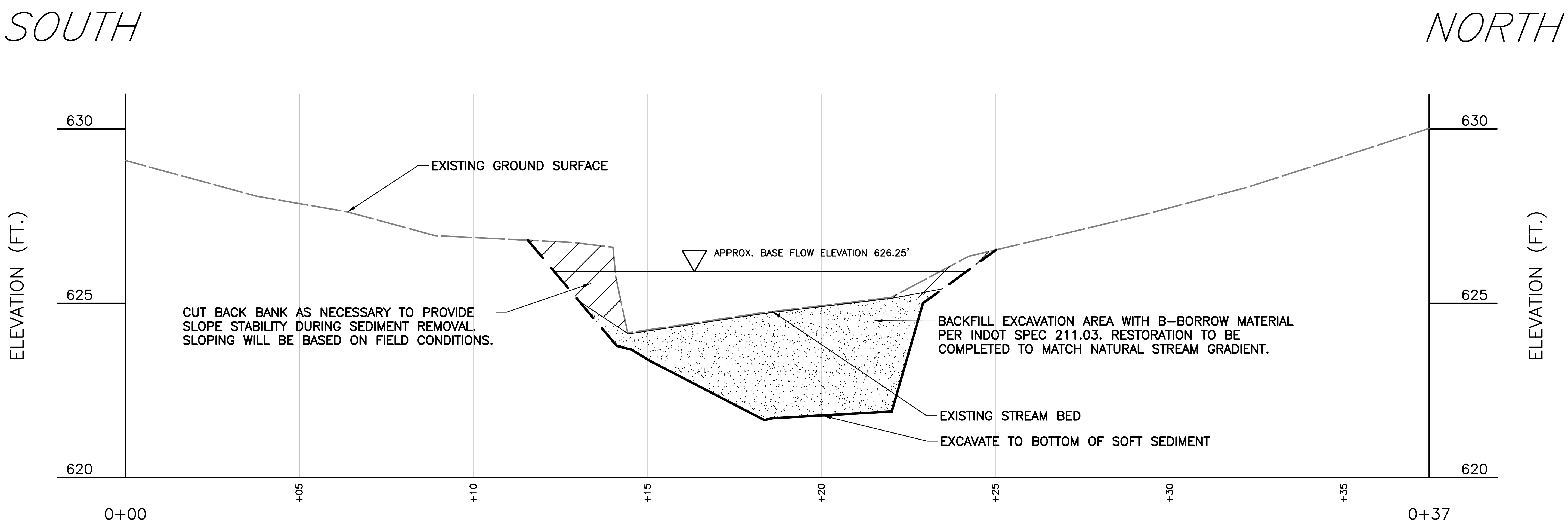
DATE: JUNE 2020	DWG SCALE:	AS SHOWN	PROJECT NO:	172-367.0014		7



REACH 2 PROPOSED TYPICAL PROFILE

SCALE H:1"=5'; V:1"=5'

REFERENCE

1. EXISTING CONDITIONS TOPOGRAPHY FOR CHANNEL BANKS AND ADJACENT AREAS GENERATED FROM DATA PROVIDED BY INDIANA'S STATEWIDE IMAGERY AND LIDAR PROGRAM AND AVAILABLE AT WWW.OPENTOPO.SDSC.EDU. AIRBORNE LIDAR SURVEY PERFORMED BETWEEN 3/13/2011 AND 4/30/2012.
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PROPOSED TYPICAL PROFILE
REACH 2

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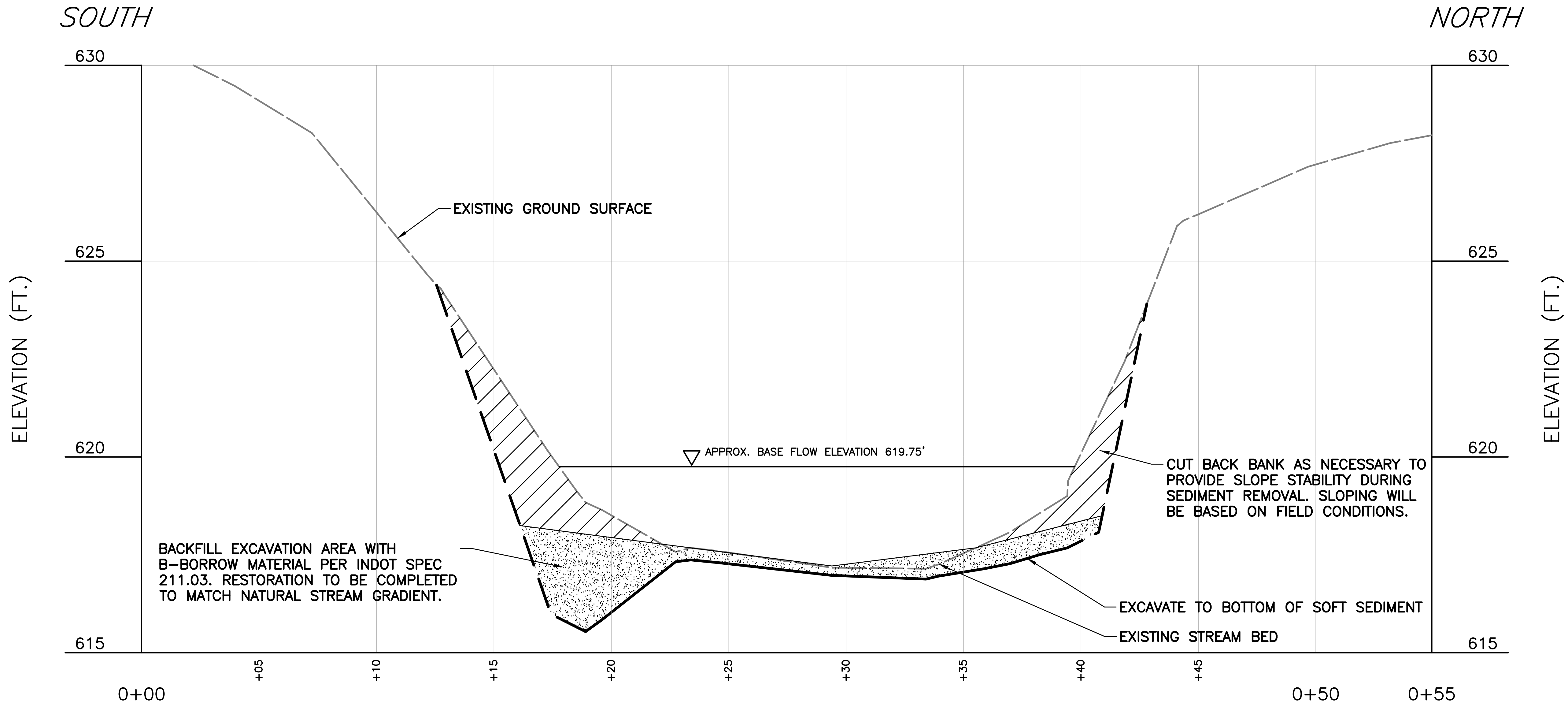
DATE: JUNE 2020	DWG SCALE: AS SHOWN	PROJECT NO: 172-367.0014	



REACH 3 PROPOSED TYPICAL PROFILE

SCALE H:1"=5'; V:1"=3'

REFERENCE

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PROPOSED TYPICAL PROFILE
REACH 3

DRAWN BY: KAM	CHECKED BY: GAW	APPROVED BY: JMB	FIGURE NO.:
DATE: JUNE 2020	DWG SCALE: AS SHOWN	PROJECT NO: 172-367.0014	9

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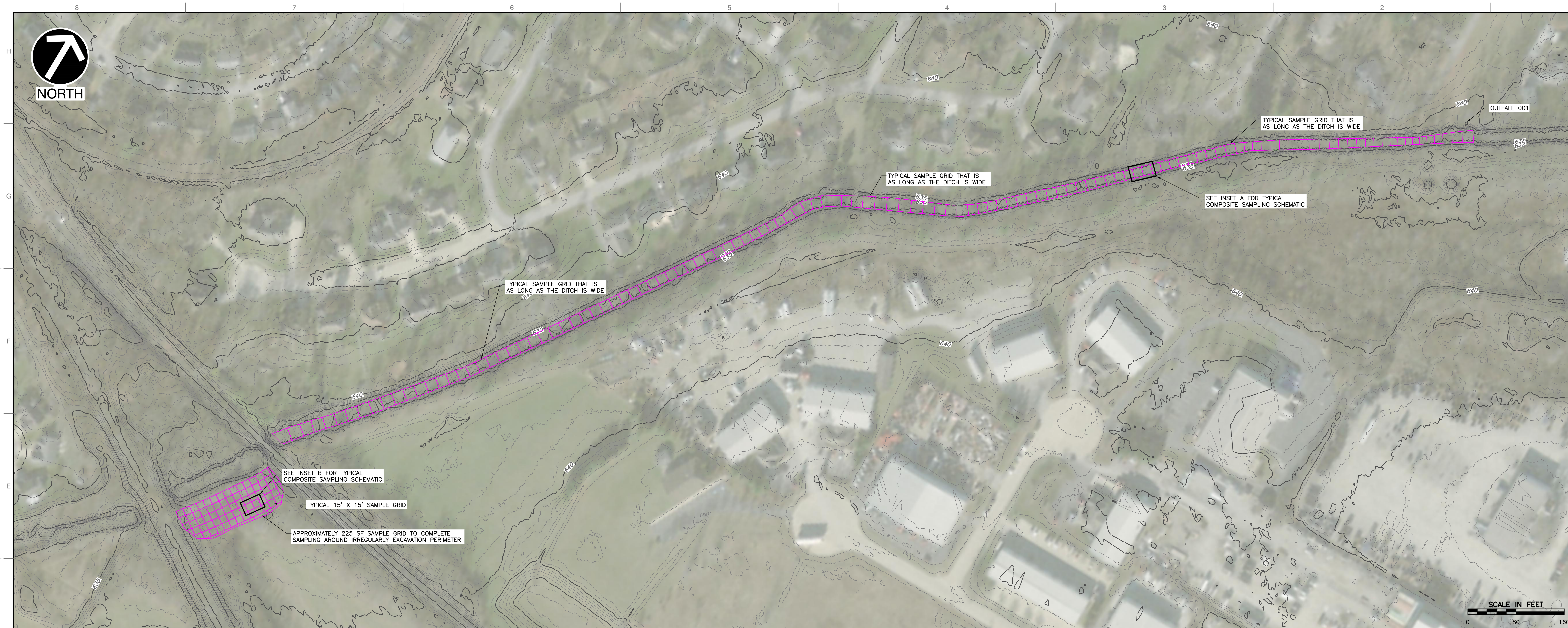
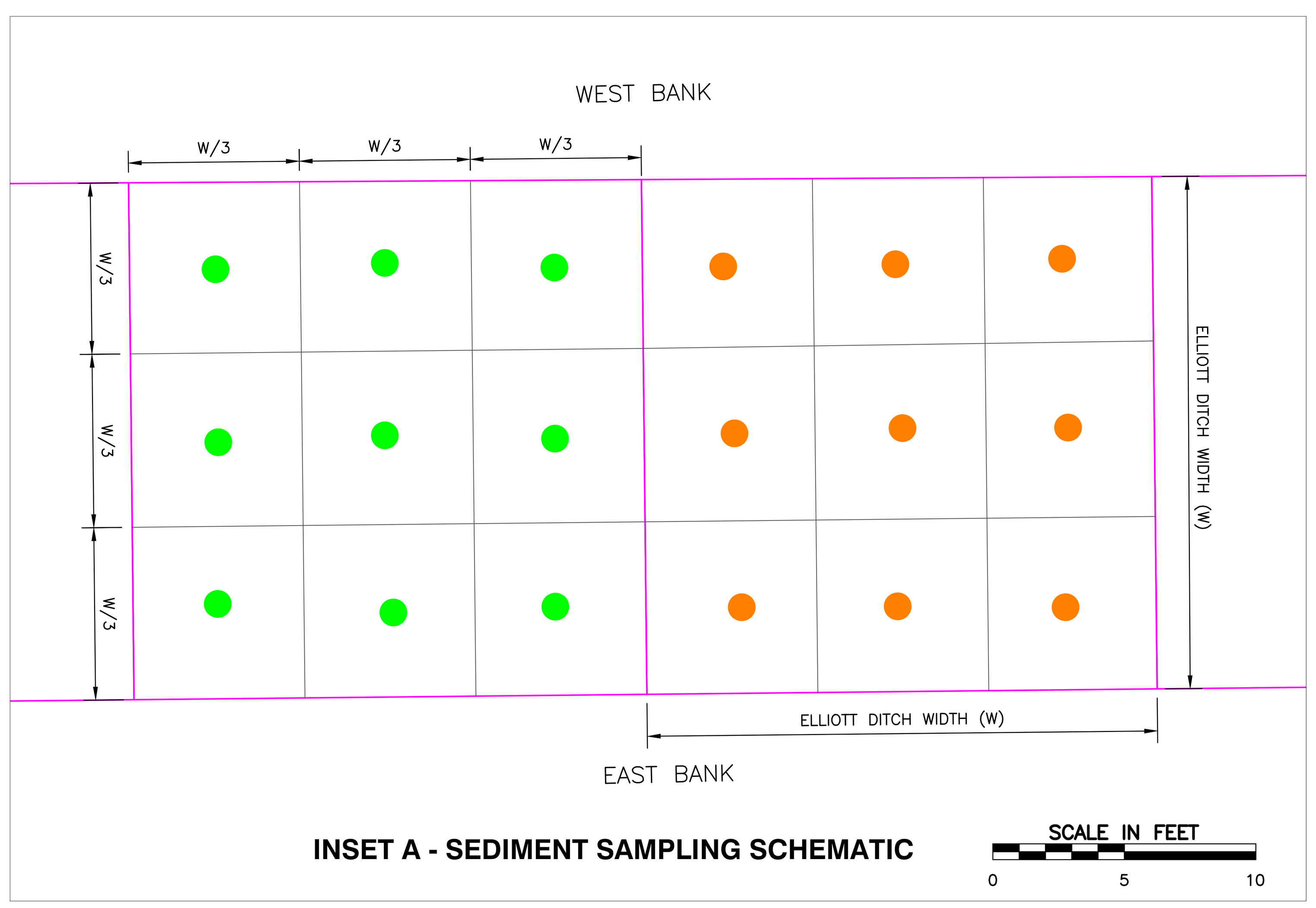
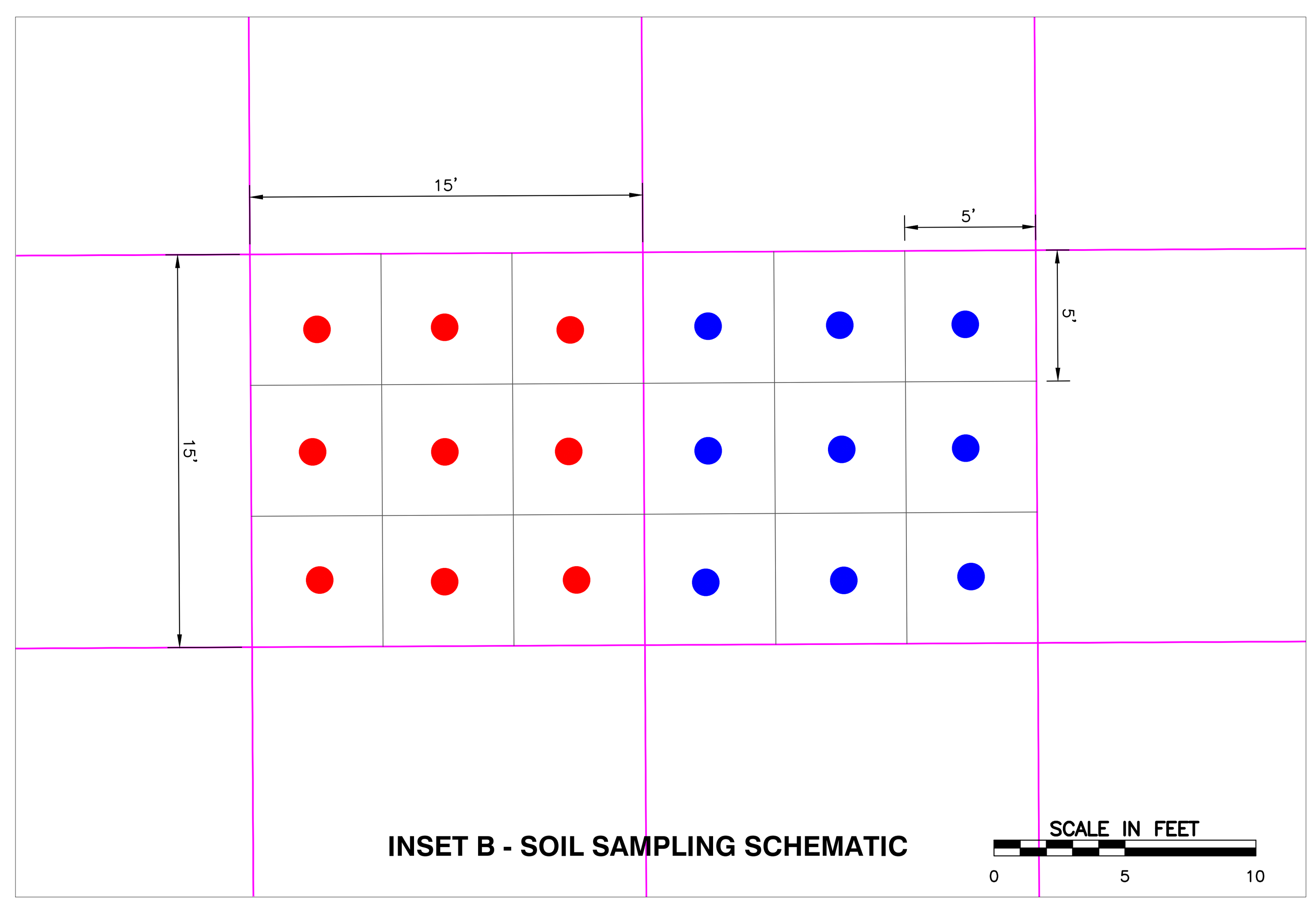




INSET A - SEDIMENT SAMPLING SCHEMATIC

- 9 DISCRETE SAMPLES = 1 COMPOSITE SAMPLE (green)
- 9 DISCRETE SAMPLES = 1 COMPOSITE SAMPLE (orange)



INSET B - SOIL SAMPLING SCHEMATIC

- 9 DISCRETE SAMPLES = 1 COMPOSITE SAMPLE (red)
- 9 DISCRETE SAMPLES = 1 COMPOSITE SAMPLE (blue)

REFERENCE

1. EXISTING CONDITIONS TOPOGRAPHY GENERATED FROM DATA PROVIDED BY INDIANA'S STATEWIDE IMAGERY AND LIDAR PROGRAM AND AVAILABLE AT WWW.OPENTOPO.SDSC.EDU. AIRBORNE LIDAR SURVEY PERFORMED BETWEEN 3/13/2011 AND 4/30/2012.

REVISION RECORD

NO	DATE	DESCRIPTION

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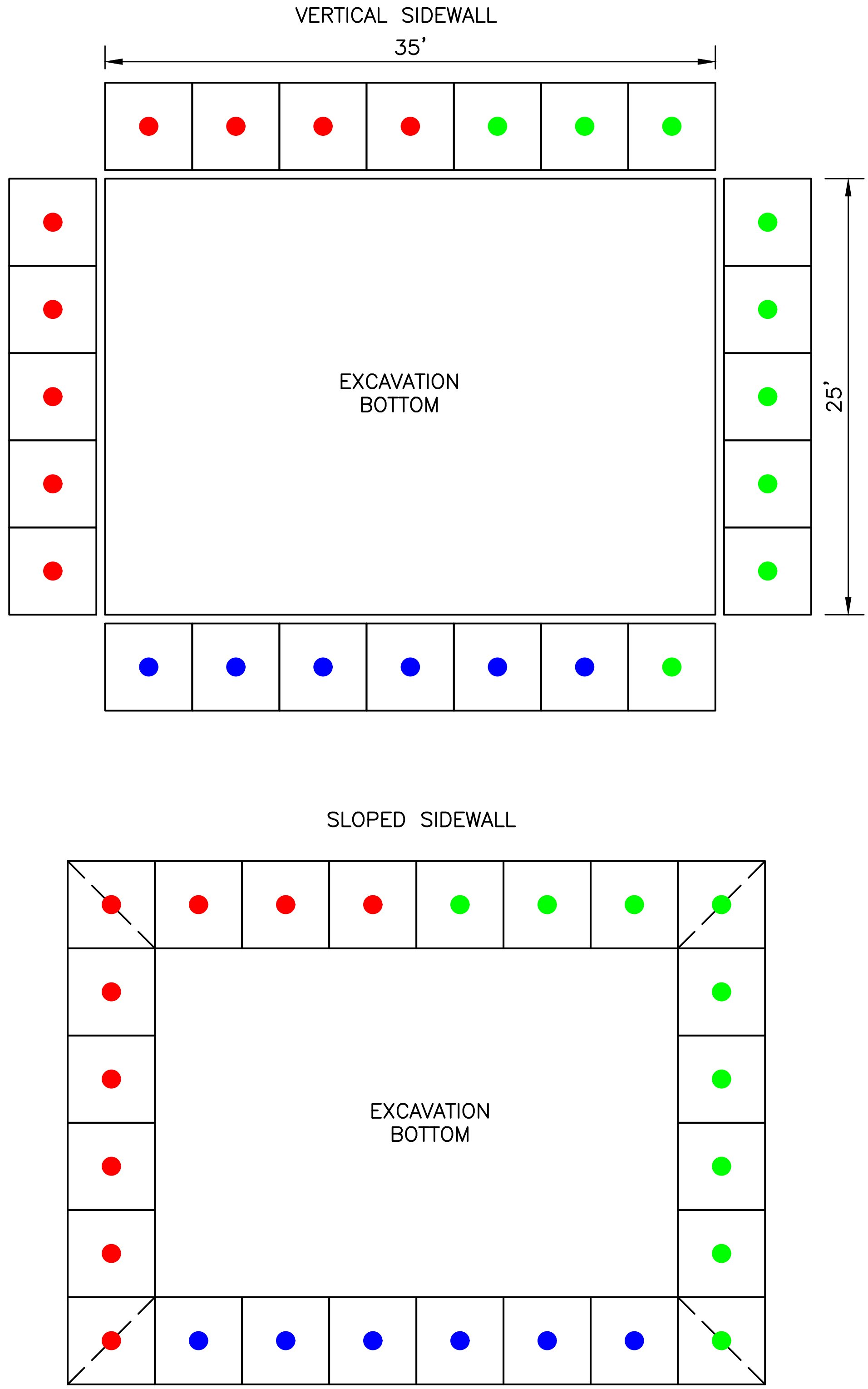
INTERIM MEASURES WORK PLAN
REACH 1-3 SEDIMENT AND SOIL
LAFAYETTE, INDIANA

BOTTOM CONFIRMATION SAMPLING SCHEMATIC

DATE:	NOVEMBER 2020	DRAWN BY:	KAM
DWG SCALE:	1"=80	CHECKED BY:	JMB
PROJECT NO:	172-367.00014		
APPROVED BY:			JMB

DRAWING NO.: 10



- (red) 9 DISCRETE SAMPLES = 1 COMPOSITE SAMPLE
- (green) 9 DISCRETE SAMPLES = 1 COMPOSITE SAMPLE
- (blue) 6 DISCRETE SAMPLES = 1 COMPOSITE SAMPLE

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SIDEWALL CONFIRMATION SAMPLING SCHEMATIC

DRAWN BY: KAM	CHECKED BY: GAW	APPROVED BY: JMB	FIGURE NO.: 11
DATE: JUNE 2020	DWG SCALE: N.T.S.	PROJECT NO: 172-367.0014	

APPENDICES

APPENDIX I

ELLIOTT DITCH GEOMORPHIC SURFACE MAPPING AND HISTORIC DATA REVIEW (TETRATECH CES)

TETRA TECH

Elliott Ditch Geomorphic
Surface Mapping and Historic Data Review
July 6, 2015

Prepared for Alcoa

Prepared by Tetra Tech CES

Submitted: July 6, 2015

TABLE OF CONTENTS

APPENDICES

LIST OF ACRONYMS

GPS	Global Positioning System
USEPA	United States Environmental Protection Agency
PCB	Polychlorinated Biphenyl
PPM	parts per million
RTK	Real Time Kinematic
PPB	parts per billion
USGS	United States Geological Survey
DEM	Digital Elevation Model
FEMA	Federal Emergency Management Agency
DEM	Digital Elevation Model
GIS	Geographic Information System
LDB	Left descending bank
RDB	Right descending bank

1.0 OVERVIEW

Tetra Tech performed a geomorphology and depositional pattern assessment of Elliott Ditch (between Alcoa's Outfall 001 and Wea Creek) and the surrounding floodplain in Lafayette, Indiana in 2013 and 2014. Assessment work proceeded, over this period, on an iterative basis. In 2013, preliminary geomorphic surface mapping (desktop) was conducted to evaluate the depositional/erosional pattern in the channel and surrounding floodplain. Field work included a detailed survey of the upstream 0.5 mile of Elliott Ditch and the 100-year floodplain to complete detailed channel profiles. In 2014, the desktop geomorphic surfaces were field confirmed and edited to reflect the field confirmation findings.

This report describes the purpose and tasks, methods, and results of the work completed in 2013 and 2014 by Tetra Tech.

2.0 PURPOSE AND TASKS

2.1 PURPOSE

The purpose of this study was to use geomorphic methods to evaluate the deposition and erosion patterns in Elliott Ditch and the surrounding floodplain. A geomorphology based approach will be implemented to guide an investigation of Elliott Ditch. The objective of this investigation is to support a site conceptual model to understand the distribution of potential PCB impacts in Elliott Ditch and the adjacent floodplain caused by historical releases from Alcoa's storm water outfall. Elliott Ditch is a dynamic fluvial system. A typical grid-based sampling investigation approach often provides results that are difficult to interpret. Fluvial geomorphology provides a framework for sampling and data analysis that incorporates the predictable environmental and fluvial processes ongoing in Elliott Ditch and the surrounding floodplain.

2.1.1 Fluvial Geomorphology and Geomorphic Sampling Approach

Geomorphology is the science of landform evolution. Fluvial geomorphology focuses on river formation, evolution, and function. Fluvial geomorphology can be used to identify, delineate, and remediate impacts in river systems. The science provides an understanding of the depositional and erosional pattern of river systems.

A grid network sampling approach has been used to define sediment and soil sample locations on many sediment projects. The advantage of this approach is that sample locations are readily established by superimposing a grid pattern with predefined transects over a map that includes the area of concern. A significant disadvantage of grid network sampling is the probability that physical conditions influencing spatial distribution of sediment are not considered because rivers are not homogeneous surfaces. The sample density distribution within areas of low potential for impacted sediment is similar to that of areas with high potential for impacted sediment. Therefore, sampling efficiency and data optimization are compromised because grid networks are adapted to conditions with limited spatial variability; which is not typical of a fluvial system.

An environmental investigation based upon geomorphic principles assumes that deposition, erosion, and impacted sediment distribution are not random; rather they are predictable and the result of known physical processes. A geomorphic sampling approach is based on focusing the sampling effort in areas with high potential for impacted sediment. Using geomorphic analysis, the sample location density distribution is based on potential for deposition and spatial variability. This approach is more efficient and it provides more informative data compared to a uniform sample location distribution (grid network). The geomorphic sampling approach is based on selection of sample transects and locations for each geomorphic surface category because each geomorphic surface type represents a specific depositional/erosional environment.

Tetra Tech completed desktop and field activities sufficient to establish a baseline geomorphic conceptual model for Elliott Ditch in 2013 and 2014. The methods and results of the geomorphic analysis of Elliott Ditch are presented in this report. Additionally, a summary of the historic sampling efforts conducted in Elliott Ditch is presented, as well as a brief summary of the geologic history.

2.2 TASKS

The Tetra Tech scope of work included the following tasks:

- Desktop Tasks
    - Background data collection and desktop geomorphic surface mapping
    - Review of historic data
    - Elliott Ditch longitudinal profile
    - Floodplain data collection and review
    - Landowner parcel mapping
    - Survey transect mapping
    - Incorporate historic data analysis, where appropriate, into geomorphic analysis of Elliott Ditch
    - Determine geologic history of Elliott Ditch

- Field Tasks
    - Global positioning survey (GPS)/total station topographic survey data collection
    - Photo log
    - Geomorphic surface mapping field confirmation
    - Top of water and water depth measurement

3.0 METHODS

The methods that were used to complete the tasks listed in Section 2.2 are described below.

3.1 DESKTOP TASKS

3.1.1 Preliminary Geomorphic Surface Mapping

A geomorphic surface is an area formed by similar physical factors related to morphology and time (e.g. elevation, floodplain configuration, and deposition/erosion environment). Fluvial geomorphology provides a basis for supporting the development of depositional or erosional environments, and therefore contaminant distribution, using multiple lines of evidence. Each line of evidence is evaluated independently within a Geographic Information System (GIS) to develop an understanding of its effect on deposition or erosion. Geomorphic surfaces are edited on an iterative basis to incorporate each dataset into the surface mapping process.

The multiple lines of evidence are merged to support geomorphic interpretation and contaminant distribution for a river system. This method provides a means to identify inconsistencies and data gaps that may require additional review or data collection. For Elliott Ditch, the following lines of evidence were available for desktop geomorphic surface mapping:

- Aerial Photographs (recent and historic)
- One foot contour intervals, derived from a ten-meter Digital Elevation Model (DEM)
- Channel longitudinal profile (gradient)
- Surface aspect
- Geomorphic setting
- Water velocity
- Water depth
- Channel width
- Valley width
- Land use
- Anthropogenic impacts (e.g. channel armoring, dams, bridges, dredging, etc.)

The initial geomorphic surfaces developed for Elliott Ditch were based on changes in topography. Aerial photographs and one-foot topographic contours were used to support the development of geomorphic surface boundaries. Several topographic factors were considered when delineating geomorphic surfaces using contours. Elevation changes were identified by tight groupings of contours. Abrupt changes in elevation are indicative of two different geomorphic surface boundaries. The best example for Elliott Ditch elevation change is the steep slope associated with the valley wall between the geomorphic surfaces in the floodplain and the upland area outside of the floodplain. Subtle changes in topography were also used in the delineation. For example, broad surfaces of relatively uniform elevation were delineated as the same surface.

Information related to geologic history and past anthropogenic activities were reviewed to understand past influences on the fluvial process. Historical information was obtained from public records and published literature sources. The historical information was used to relate evolution and formation to past development and constituent release over time. The information discussed in the preliminary geomorphic analysis, including the historical aerial photographs, was used to support the historical analysis. Industrial and urban development, structures (e.g. dams, channel alignment), and watershed condition including land use change from agricultural to industrial were incorporated in the geomorphic surface mapping.

To assist in data analysis and mapping, a milepost system was developed for Elliott Ditch using GIS. The stream channel was digitized using the most recent aerial photos and used as an input for a GIS tool that creates equally spaced points based on a user-defined distance. The distance between mileposts for Elliott Ditch is 0.10 miles (Figure 1, Appendix A).

3.2 FIELD TASKS

Tetra Tech conducted work in 2014 to perform a topographic field survey of the lower reaches of Elliott Ditch. The survey was performed within the Elliott Ditch stream channel and the adjacent Federal Emergency Management Agency (FEMA) mapped 100-year floodplain. The survey was conducted along 66 transects on Elliott Ditch from Alcoa's Outfall 001 to the confluence with Wea Creek, a distance of approximately 4.10 miles (Figure 2, Appendix A). Field work was completed in coordination with TBIRD Design Services Corp., a professionally licensed survey company based in Lafayette, IN. TBIRD provided notification to landowners within the survey area prior to the start of field work.

Tetra Tech conducted the field activities in two mobilizations. In mid-March, the upper 0.5 miles from Outfall 001 to the railroad bridge was surveyed. In mid-November, the remaining 3.6 miles from the railroad bridge to the confluence with Wea Creek were surveyed. The field crew consisted of one TBIRD survey crew chief and one Tetra Tech geomorphologist.

The methods used to conduct the topographic survey are described below.

3.2.1 Topographic Survey Data Collection

Tetra Tech and TBIRD collected topographic survey data to support the geomorphic surface mapping during leaf-off conditions. Collecting surface boundary information during periods of sparse vegetation increases surface boundary visibility in the field.

A Real Time Kinematic Global Positioning System (RTK-GPS) and total station were used to collect topographic survey data in Indiana State Plane West (NAD83 datum) coordinate system.

The linear units were collected in US survey feet and the horizontal and vertical accuracy was set to a tolerance of ten centimeters.

Survey point data was collected at the following locations on each transect:

- Top of the water surface
- Top of sediment surface in the thalweg
- Edges of stream channel
- Top of channel banks
- Edge of escarpments marking the boundaries between stream terraces or floodplain surfaces
- Edge of FEMA mapped 100-year floodplain boundaries
- A location that is approximately half the horizontal distance from the channel banks to the 100-year floodplain boundaries

3.2.2 Geomorphic Surface Mapping Field Confirmation

Desktop geomorphic surface mapping provided a preliminary estimate of the geomorphology of Elliott Ditch. A field assessment of geomorphic surfaces was required to confirm the surface boundaries. The preliminary geomorphic surfaces were mapped from one-foot contours derived from ten meter DEMs. All data derived from secondary sources like DEMs have inherent inaccuracies. Field confirmation of surfaces reduces the errors introduced by the secondary datasets.

Geomorphic surface boundaries were confirmed by evaluating elevation changes at the edges of surfaces (e.g. terrace scarps) observed in the field. Additionally, anthropogenic features were identified or confirmed and incorporated into the geomorphic surface mapping.

A photo log was developed to document the channel morphology and sequence of geomorphic surfaces at each survey transect as well as photograph any significant natural or anthropogenic impacts to stream flow. Site photographs are provided in Appendix B.

4.0 RESULTS

The results of the desktop and field activities completed in 2013 and 2014 are presented below.

4.1 GEOMORPHIC HISTORY OF WABASH RIVER BASIN

Elliott Ditch is located in the Wabash River Basin in Tippecanoe County, IN, and flows west into Wea Creek, a tributary of the Wabash River. The streams of the Wabash River Basin formed in glacial outwash deposited during the Pleistocene epoch. During the Pleistocene, various glaciations leveled plains and filled in valleys, resulting in a gently undulating plain. As glaciers receded, meltwater streams cut drainage ways and stream valleys that drain toward the Wabash River. The streams draining the Wea Plains (which includes Elliott Ditch), were formed after glaciers receded from the area. Generally, the topography of the area is relatively unchanged by stream development since glaciation, as most streams are typically shallow and have gently sloping gradients. Glacial landforms (e.g. kames, eskers, swales, etc.) are plentiful (USDA, 1958).

Review of the aerial photographs provided by Alcoa reveals that Elliott Ditch formed sometime before 1939; the Ditch is clearly visible in the 1939 aerial photo. The 1939 aerial suggests that at least part of Elliott Ditch originated as a naturally formed stream that was later modified by human activity. The stream appears to be free flowing and naturally meandering along the western portion of the stream in 1939. Some channelization may have occurred prior to the photo because the stream channel appears abnormally straight where Elliott Ditch crosses the railway.

4.2 GEOMORPHIC SURFACE MAPPING

Geomorphic surface mapping is an iterative, science-based process that uses multiple lines of evidence to assess the erosional/depositional pattern in streams. Flowing bodies of water have specific characteristics resulting from factors that affect flow regime. Channel gradient, width, and geometry, bed texture, water velocity, valley wall width, watershed soil type, and anthropogenic features all affect the flow of the water and the resulting geomorphology. To interpret stream geomorphology as a cohesive system, geomorphologists look at the flow regime factors and organize streams into river reaches and further into geomorphic surfaces for both the in-channel and overbank areas.

For Elliott Ditch, river reaches were developed based on similarities (within a reach) and differences (between reaches), resulting in areas grouped by broad depositional characteristics. The factors used to define the Elliott Ditch reaches were channel gradient, sinuosity, land use, and geomorphic surfaces. The Elliott Ditch reaches are further described in Section 4.3.2.

Overbank geomorphic surfaces were initially based on their spatial and topographic relationships including topography, proximity to the river, and the elevation differences between the surfaces. Aerial photographs were used to determine anthropogenic influences to stream function. Additional anthropogenic impacts (not visible on the aerial photos) and surface soil development were incorporated into surface boundaries during the field confirmation process. Other lines of evidence incorporated during the field process include evidence of high water (e.g. high water marks, sediment deposited over vegetation, etc.), and differences in vegetation cover.

The results of the desktop and field confirmed geomorphic surface mapping are presented below.

4.2.1 Geomorphic Surface Mapping Results

Floodplains are areas of low-lying ground directly adjacent to streams subject to regular flooding. Floodplains typically have relatively young soils formed in river sediments. Based on topography and the relative lack of soil development, the lowest surfaces in the overbank were categorized as floodplain (Figure 3, Appendix A). Approximately 0.2 acres of floodplain were mapped adjacent to Elliott Ditch.

The other surfaces mapped were stream terraces. Stream terraces are the remnants of historic floodplains that existed at a time when a stream was flowing at a higher elevation than present. Streams down cut into sediments and/or bedrock and create new floodplains over time. This process results in a series of stream terraces that reflect the stream's channel at a given point in the history of the stream. These surfaces are denoted by increasing elevations relative to each other. Terraces are typically level, discontinuous surfaces along the sides of the stream valley. Each surface that has the same relative elevation above the stream is given the same designation. In fluvial geomorphology, the terrace 1 (T-1) is the geomorphic surface with an elevation immediately above that of the floodplain. Each surface higher in elevation from the T-1 is sequentially numbered in ascending order (i.e. T-2, T-3, T-4, etc.). The lower numbered terraces are considered to be younger surfaces (i.e. the most recent active floodplain of a stream). The highest numbered terrace is the oldest surface. Within the portion of the Elliott Ditch valley mapped for this task, a total of seven stream terraces were identified.

Below is a summary of the area in square feet (ft^2) and acres of each geomorphic surface mapped within the Elliott Ditch valley from Outfall 001 to the confluence with Wea Creek.

Geomorphic Surface	Area (ft^2)	Acres
Floodplain	10,068	0.2
T-1	194,823	4.5
T-2	3,923,312	90.0
T-3	604,721	13.9
T-4	583,998	13.4
T-5	290,788	6.7
T-6	776,714	17.8
T-7	28,020	0.6
TOTAL	**6,412,444**	**147.1**

The preservation of active floodplain and T-1 surfaces along Elliott Ditch appears to be extremely rare. Combined, they account for less than 5 acres of the 147 acres mapped. The floodplains found along Elliott Ditch appeared to be mainly erosional surfaces based on the abundance of coarse grain material found on this surface with little to no vegetation cover. Often, the floodplains consisted of surfaces of sand and/or gravel. Based on this evidence, the floodplain appears to be inundated by flood waters at a high frequency. Surface soils on the T-

1 were typically loosely consolidated sandy material, suggesting relatively limited soil development. Some patchy vegetation, such as forbs and groundcover, covered the T-1 surface, implying the surface is likely flooded several times per year.

The T-2 surface comprised the largest portion of the surfaces mapped along Elliott Ditch, 90 acres in total. Based on the exposed soils of the T-2 along the stream, soils appeared to be fully developed. Vegetation on the T-2 surface consisted of forbs, shrubs and trees. Flood debris, such as organic detritus and garbage, was often present on the T-2 surface, suggesting that flood waters reach that elevation on occasion.

The remaining stream terrace surfaces comprise about 52 acres. These surfaces all displayed well developed soils and vegetation included groundcover, shrubs and trees, indicating rare inundation by floodwaters.

4.2.2 Geomorphic Interpretation

The overbank depositional pattern for Elliott Ditch is a result of elevation and proximity to the channel. Sediment deposition will decrease as distance from the stream and elevation increase. For example, older terraces like the T-5 will flood less often than the T-2 terrace, because the T-5 is higher in elevation. Higher elevations require larger floods to become inundated and subject to sediment deposition.

The floodplain and younger terraces that are flooded during the one and two year flood events will have the most sediment deposition. The floodplain is not vegetated, suggesting it is inundated regularly. Additionally, the surface soils on the floodplain are typically coarse grained (i.e. sand, gravel, cobbles), suggesting fine-grained materials (silt, clays) have eroded away during high-velocity flood events. In Elliott Ditch, the floodplain is an erosional surface rather than a depositional surface.

The in-channel depositional pattern for Elliott Ditch is characterized by pool and riffle systems common in running water bodies. Streams develop pool and riffle systems based on channel gradient, water velocity, channel width, sinuosity (a stream's tendency to move back and forth across its floodplain, in an s-shaped pattern, over time), and bed type. The pools are deeper areas of the stream that have a reduced water velocity, resulting in a depositional area. The riffles are shallow parts of the stream with steeper gradients and higher water velocities, resulting in erosional areas.

The geomorphic surface mapping completed for Elliott Ditch suggests that Elliott Ditch has eight distinct reaches (erosional/depositional regimes):

- Reach 1: Outfall 001 to just downstream of the railroad bridge (Transects 1-14)
- Reach 2: Transect 14 to the South 18th Street Bridge (Transect 19)

- Reach 3: South 18th Street Bridge to just upstream of the 9th Street Bridge (Transects 19-30)
- Reach 4: South 9th Street Bridge (Transect 30) to Transect 39, located north of Brookside Drive
- Reach 5: Transect 39 to Transect 50 (located downstream of Poland Hill Road)
- Reach 6: Transect 50 to Transect 60 (located just downstream of the Old Romney Road Bridge)
- Reach 7: Transect 60 to Transect 64 (located just upstream of US Highway 231 South Bridge)
- Reach 8: Transect 64 to Transect 66 (Elliott Ditch –Wea Creek confluence)

Reach 1 of Elliott Ditch is characterized by a relatively straight channel, steep valley walls, and no stream terraces (Figure 2, Appendix A). The longitudinal profile (Figure 4, Appendix A) for Segment 1 indicates a relatively shallow gradient (0.4 feet/mile) compared to downstream reaches. While some erosion is occurring along the channel banks and immediately downstream of the outfall, deposition is occurring within the stream in pools in areas of relatively fine-grained sediment. The erosional/depositional areas of Reach 1 are presented in Figure 5 (Appendix A).

Reach 2 of Elliott Ditch is characterized by a straight channel and a steeper channel gradient of approximately 8 feet/mile (Figure 4, Appendix A). The north side of the channel is upland, but the south side has a preserved T-4 terrace adjacent to the ditch. Deposition in this reach may occur on the T-4 terrace after large flood events and locally in-channel associated with pools.

Reach 3 has a relatively straight channel with only minor meandering. The channel banks are steeper than in Reach 2 and the channel gradient is similar (8 feet/mile). Elliott Ditch has a deeply incised channel and steep channel banks in Reach 3. T-6 and T-7 terraces are preserved adjacent to both sides of the ditch. Additionally, a T-5 terrace is present on the north side of the ditch at the downstream end of the reach. Deposition in the overbank is unlikely except for large flood events; in-channel deposition will be limited to the pool areas.

Reach 4 is the first naturally occurring reach of the ditch downstream of Outfall 001, featuring meanders and increased sinuosity compared to upstream reaches. Channel gradient increases to 20 feet/mile. Terraces adjacent to the ditch include T-4 through T-6, indicating steep banks. Deposition in the overbank is still limited to larger flood events.

Reach 5 is similar to Reach 4 in channel gradient and sinuosity; however, Reach 5 has the T-2 through T-4 terraces preserved adjacent to the ditch. The terrace segments are smaller than upstream and their development is more affected by the sinuosity. The terraces on the inside of the meander bends are fairly well preserved, with depositional point bars often found at the apex of the meanders. This reach has more potential for overbank deposition than Reaches 1 – 4 due to the sinuosity of the ditch and the lower elevation terrace development.

Reach 6 is characterized by an increased gradient relative to upstream reaches (28 feet/mile) and an increase in valley wall width. The broader valley allows terrace development and promotes overbank deposition as the ditch meanders over time. The terrace sequence ranges from T-1 to T-6 terraces. The lower terraces are subject to overbank deposition.

Reach 7 has a similar channel gradient to Reach 6 and a broader valley width. Terrace development in Reach 7 is limited to T-1 through T-3. Reach 7 has potential for overbank deposition because the terraces are relatively low in elevation and the valley is wide.

Reach 8 has a similar channel gradient and amount of terrace development as Reach 7. However, several geomorphic and anthropogenic factors result in an erosional environment in Reach 8. Wea Creek has eroded an outside meander upstream of the bridge, moving the confluence with Elliott Ditch east. The channel banks are high, limiting flood waters outside of the channel and increasing erosion potential in-channel. Further, the US 231S Bridge constricts the channel, increasing water velocity and erosion potential during flood events. For example, a historic point bar under and downstream of the US 231S Bridge, predominately composed of sand and cobbles, suggests fine-grained materials have eroded away.

4.2.3 Geomorphic Interpretation of Historic Data

A review of the most recent historic sediment data provides some insights into the geomorphology of Elliott Ditch. The Anchor 2004 and 2010 sample locations ranged from upstream of Outfall 001 (#2) to the Veterans Parkway/Co Road 350 S Bridge (#9) (Anchor, 2013). This discussion is limited to the sampling locations inside the current project area (locations 3-9). Anchor sampling locations are presented on the geomorphic surfaces in Figure 6 (Appendix A). The geomorphic analysis of historic data is summarized below.

4.2.3.1 Sampling in Erosional Areas

Several Anchor sample locations were placed in erosional environments such as the downstream side of bridges and adjacent to Outfall 001:

- Locations 6-9 were placed at bridges
- Location 4-6 placed in dredged portion of Elliott Ditch (1990/1991) and between two bridges
- Location 3 was placed at Outfall 001

The conclusion from the results of these sample events suggests that natural recovery may be occurring; however, variability in PCB concentrations hindered trend observation (Alcoa, 2013). The variability in the data from the same locations between sampling events is the result of the sample location (erosional environments), anthropogenic features, and flood history. The data from the Anchor sampling events support the geomorphic interpretation for Elliott Ditch.

The increased gradient downstream, the historic point bar consisting of cobbles and gravel, and the amount of debris moving in the channel suggests high velocity water flow during flood events. The presence of several bridges will exacerbate natural flood processes ongoing in the channel. The dynamic nature of deposition and erosion at bridges requires a review of the flood history to understand whether the bridge area is in a low flow depositional mode or a post flood event erosion mode.

The overall distribution of geomorphic surfaces identified within the Elliott Ditch valley is displayed in Figure 3, Appendix A: Geomorphic Surface Map.

4.2.4 Example Sampling Locations

Example sampling locations were developed for Elliott Ditch based on the geomorphic surface mapping. Locations were placed to maximize sampling in depositional areas, with some locations placed to verify the absence of impacts (erosional areas).

The fate and transport characteristics of PCBs is important when determining the depositional pattern. The PCBs attach to silt and clay sediment particles and are transported as a silt and clay (soft sediment). The deposition areas for silt and clay need to have little to no water velocity to allow time for the silt and clay particles to settle out of the water column. These soft sediment depositional areas are the areas identified in the geomorphology approach.

The sample locations are divided into groups of transects with one location in-channel and one or two adjacent locations overbank, based on the stream morphology (Figure 5, Appendix A). The following summarizes the sample location rationale:

- Sample Transect 1 is placed along anthropogenic bank armoring. Areas upstream of bank armoring may be depositional because they are wider and thus have slower water velocities. The overbank locations will determine if spoils from past dredging activity are present along the top of the channel banks. The left-descending bank (LDB) of this section of Elliott Ditch has a fairly continuous levee that appears to be man-made. No levee is present on the right-descending bank (RDB); the sample location on the RDB will verify the absence of a man-made feature.
- Sample Transect 2 is located at a slight meander bend. The in-channel proposed sample location is on the inside of the meander bend (depositional surface). The overbank location is on the inside meander bend of the stable upland surface. This location is assumed to be relatively untouched by stream erosion and therefore, a good sample location.
- Sample Transect 3 is located near the upstream end of a depositional area (implied by a fine-grained sediment bed type). The overbank samples are located on upland surfaces with slightly different elevations. The LDB is slightly higher due to the presence of the levee. The RDB side is about 0.5 foot lower in elevation. If flooding reached the top of

the channel banks, the flood waters would naturally flow (and deposit sediment) towards the RDB.

- Sample Transect 4 is located just downstream of the depositional area. The in-channel sample here would confirm the absence of sediment deposition. The overbank sample locations on the RDB and LDB here are lower relative to the channel banks upstream, perhaps due to the anthropogenic impact of the railroad bridge.

5.0 SUMMARY

Elliott Ditch is a unique water body because the combination of natural stream evolution and anthropogenic activities have altered natural depositional/erosional processes. Typically, stream gradient decreases downstream as the channel erodes toward local base level. However, the gradient in Elliott Ditch increases downstream. Anthropogenic features such as the additional water from storm water outfalls and dredging downstream of Outfall 001, combined with glacial deposits that feature a significant amount of cobbles that armor the channel bed have resulted in a unique geomorphic environment in Elliott Ditch.

The geomorphic surface mapping suggest Elliott Ditch is regularly affected by high water velocities that limit sediment deposition in-channel. The majority of the overbank deposition is present on the lower terraces, T-1, T-2, and T-3. Large flood events could deposit sediment on the higher terraces. The primary area of overbank deposition is in the downstream reaches where the low terraces are present and the valley walls are wider.

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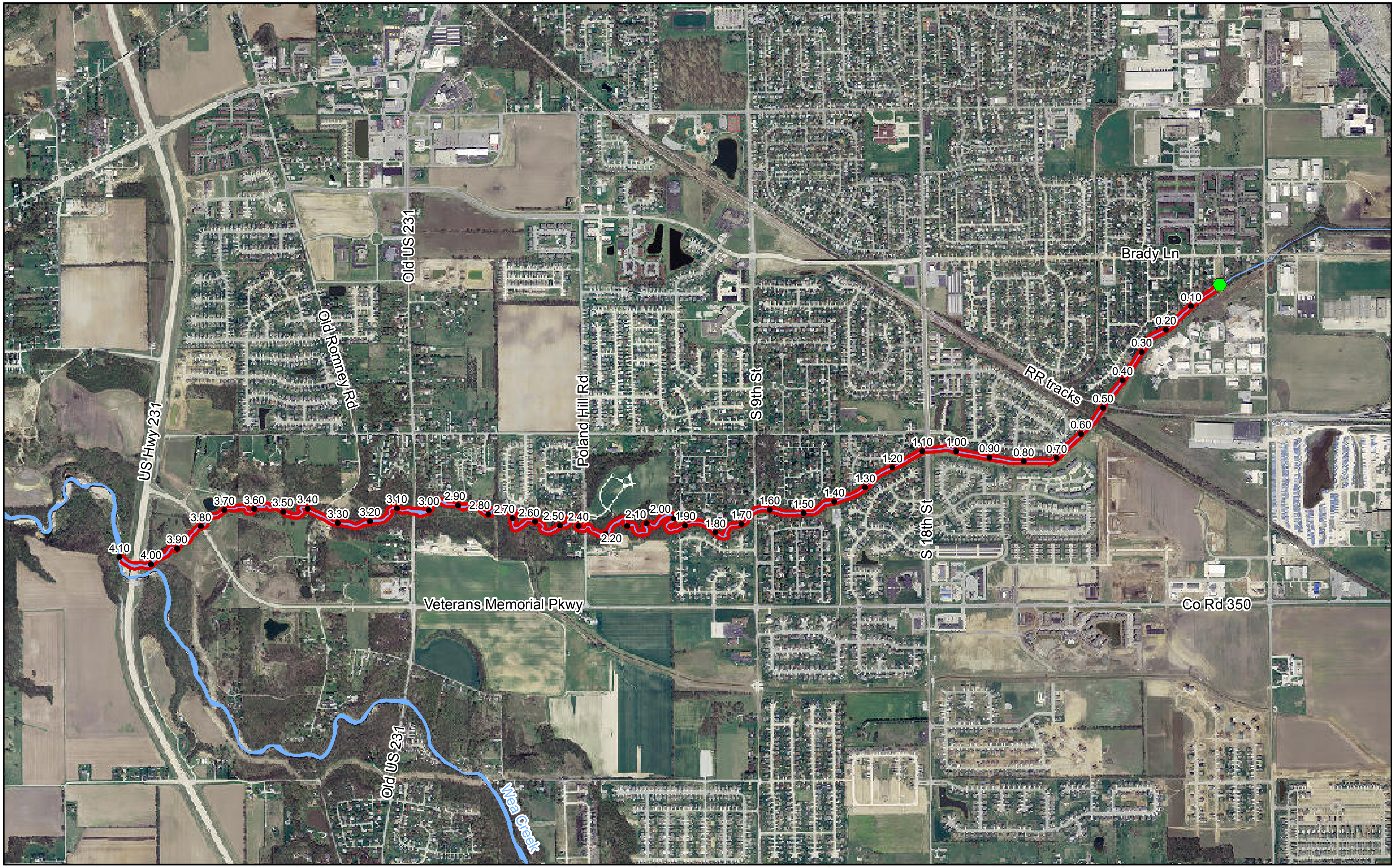
Appendix A

Figure 1

Overview – Elliott Ditch



Tetra Tech, Inc.
630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

OVERVIEW - Elliott Ditch

Outfall 001

Milepost

Survey Area

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Date Created: 6/17/2013
Last Revised: 12/31/2014
Approved By: DBR
Document Name: AlcoaElliottDitch.mxd
File Path: F:\Alcoa Elliott Ditch\GIS\AlcoaElliottDitch.mxd

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Appendix A

Figure 2

Stream Reaches and Survey Transects

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630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

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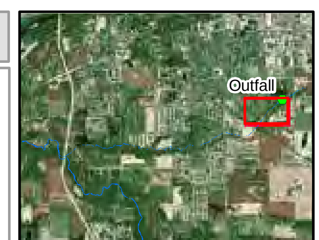
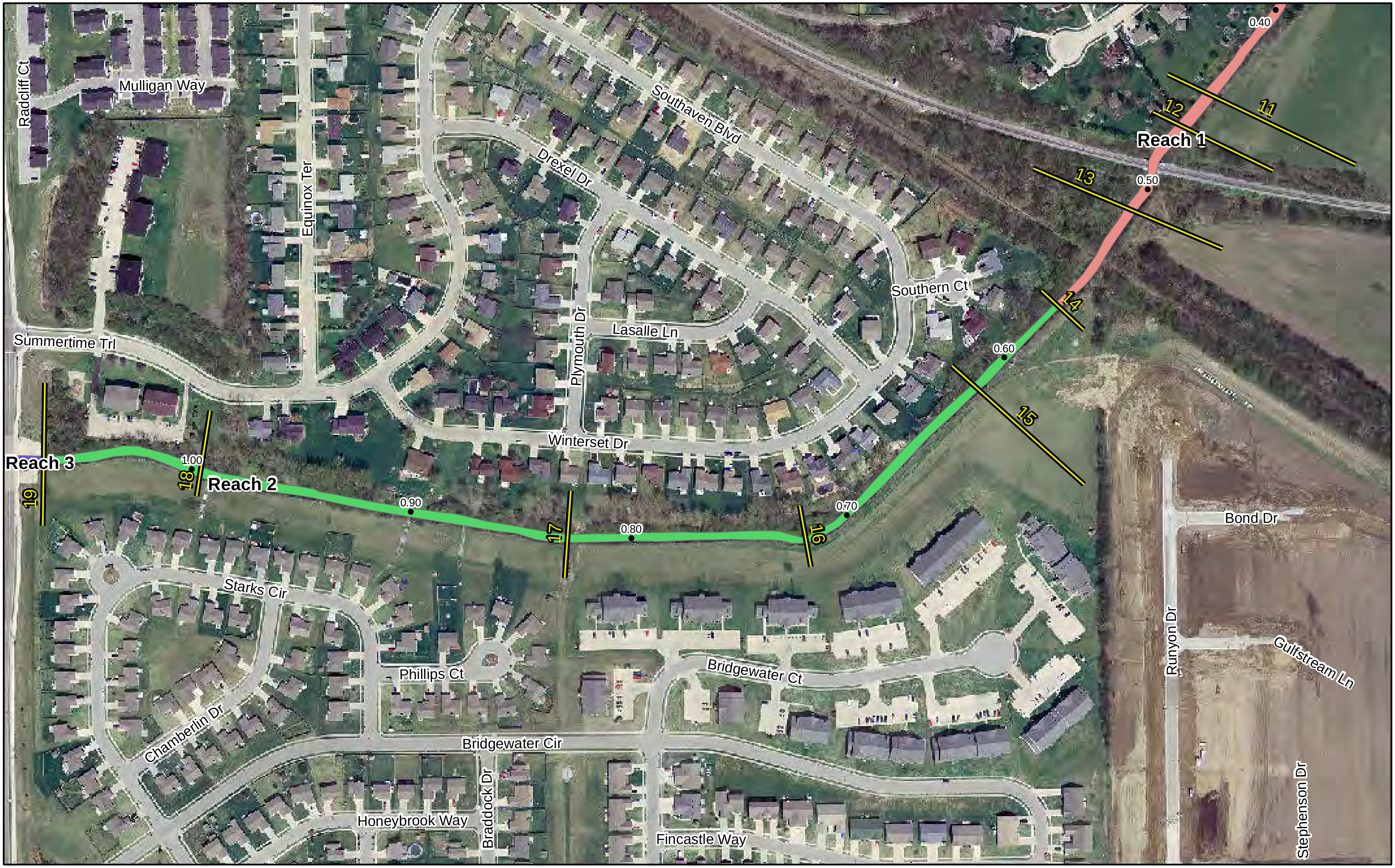
SCALE = 1:3,690

STREAM REACHES & SURVEY TRANSECTS - Elliott Ditch

Outfall 001
Milepost
Transect

Stream Reach
Reach 1
Reach 2
Reach 3
Reach 4
Reach 5
Reach 6
Reach 7
Reach 8





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Sheboygan, WI 53081
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Fax: (920) 457-2357

STREAM REACHES & SURVEY TRANSECTS - Elliott Ditch

• Milepost
Transect

Stream Reach
Reach 1
Reach 2
Reach 3
Reach 4
Reach 5
Reach 6
Reach 7
Reach 8

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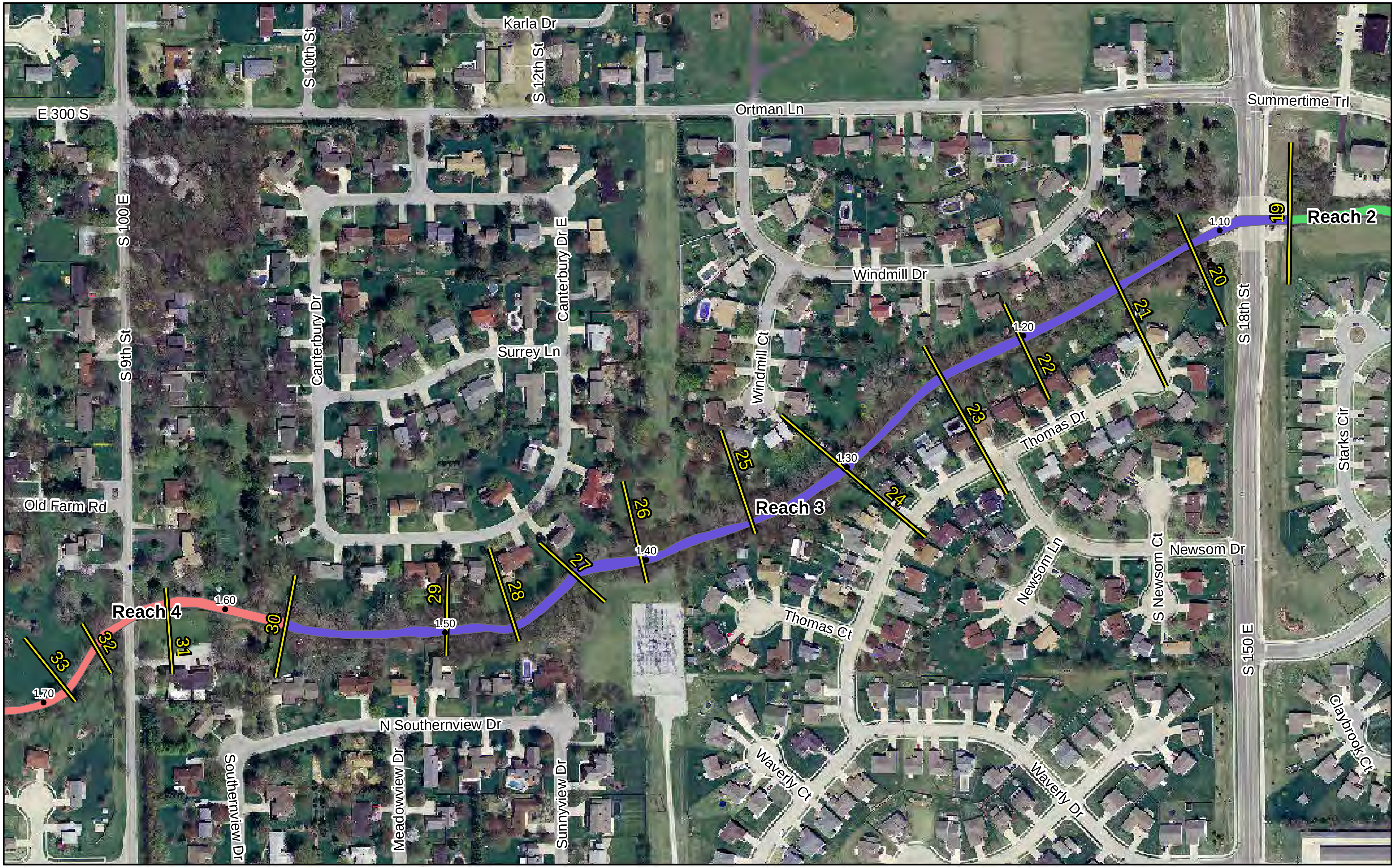

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STREAM REACHES & SURVEY TRANSECTS - Elliott Ditch

• Milepost	**Stream Reach**	Reach 3	Reach 6
Transect	Reach 1	Reach 4	Reach 7
	Reach 2	Reach 5	Reach 8

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STREAM REACHES & SURVEY TRANSECTS - Elliott Ditch

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Tel: (920) 452-7962
Fax: (920) 457-2357

• Milepost
Transect

Stream Reach
Reach 1
Reach 2
Reach 3
Reach 4
Reach 5
Reach 6
Reach 7
Reach 8

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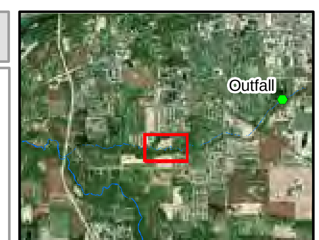

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Sheboygan, WI 53081
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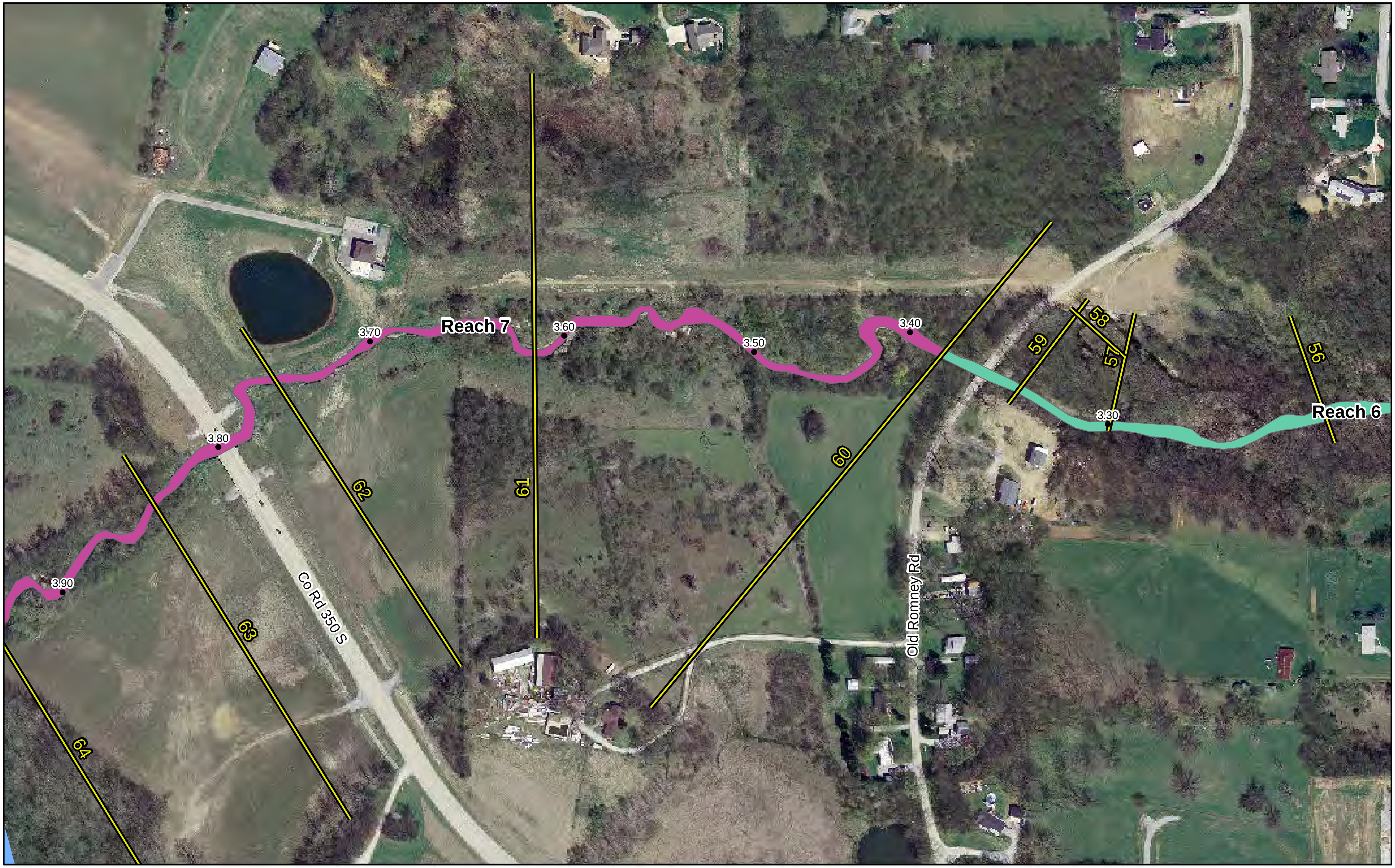
STREAM REACHES & SURVEY TRANSECTS - Elliott Ditch

Milepost
Transect

Stream Reach
Reach 1
Reach 2
Reach 3
Reach 4
Reach 5
Reach 6
Reach 7
Reach 8



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630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

STREAM REACHES & SURVEY TRANSECTS - Elliott Ditch

Legend:
- • Milepost
- Transect

Stream Reach
- Reach 1
- Reach 2
- Reach 3
- Reach 4
- Reach 5
- Reach 6
- Reach 7
- Reach 8

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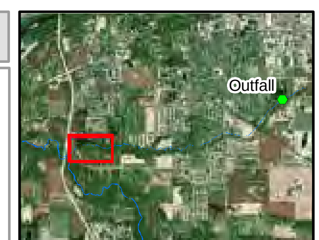

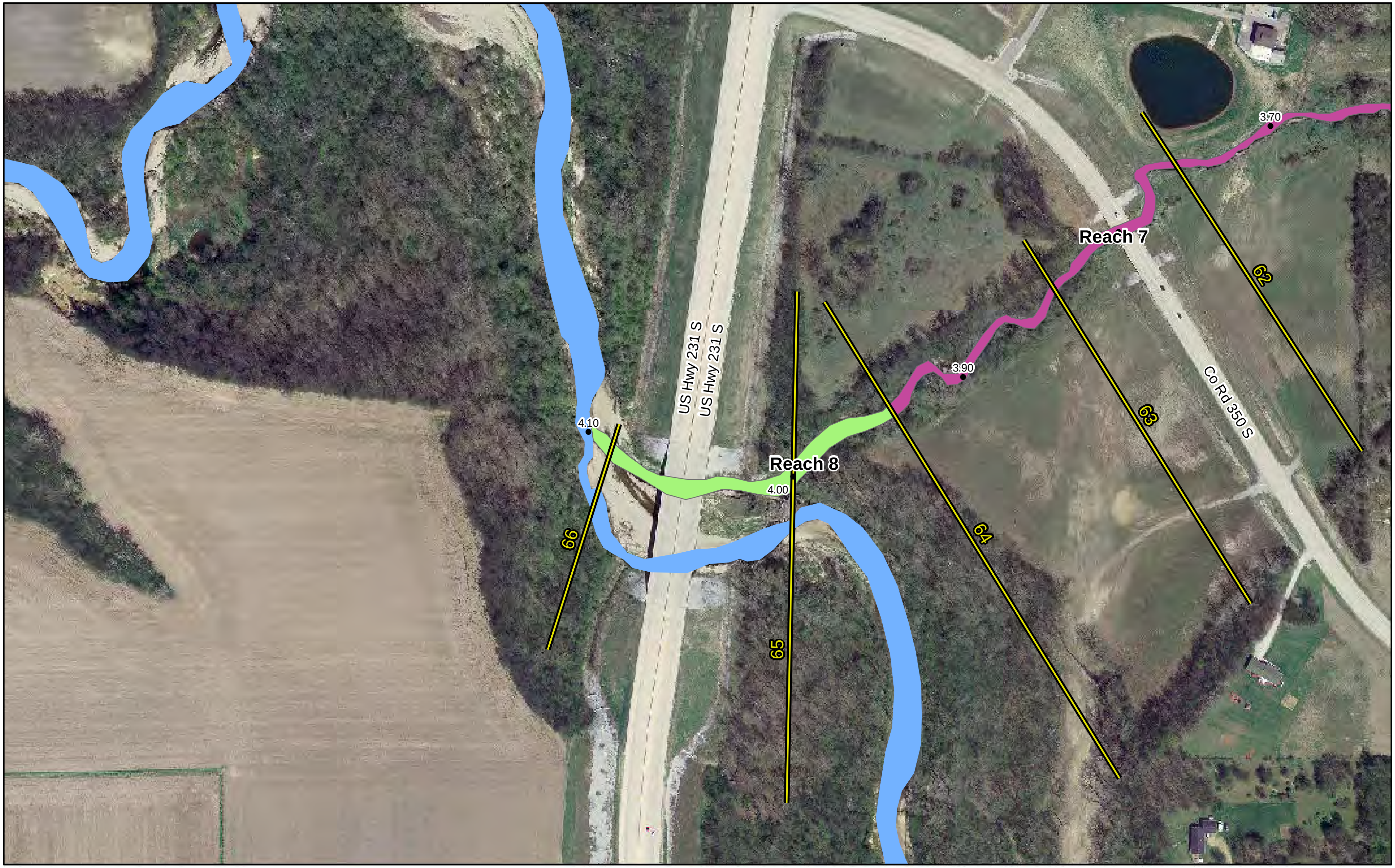

Tetra Tech, Inc.
630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
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Fax: (920) 457-2357

STREAM REACHES & SURVEY TRANSECTS - Elliott Ditch

• Milepost	**Stream Reach**	Reach 3	Reach 6
Transect	Reach 1	Reach 4	Reach 7
	Reach 2	Reach 5	Reach 8

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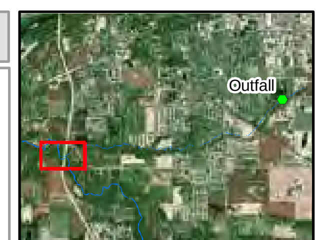


Appendix A

Figure 3

Geomorphic Surfaces

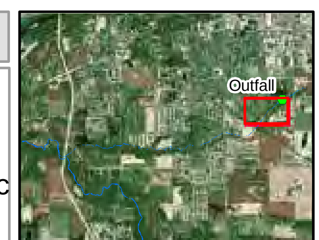
Tetra Tech, Inc.
630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

GEOMORPHIC SURFACES - Elliott Ditch

Outfall 001
Milepost
Geomorphic Surface Boundary

Geomorphic Surface

stream	T-1	T-5	depression
floodplain	T-2	T-6	oxbow
	T-3	T-7	anthropogenic
	T-4		upland



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Date Created: 6/17/2013
Last Revised: 12/29/2014
Approved By: DBR
Document Name: AlcoaElliottDitch.mxd
File Path: F:\Alcoa Elliott Ditch\GIS\AlcoaElliottDitch.mxd

N 0 150 300 Feet
SCALE = 1:3,690

Tetra Tech, Inc.

630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

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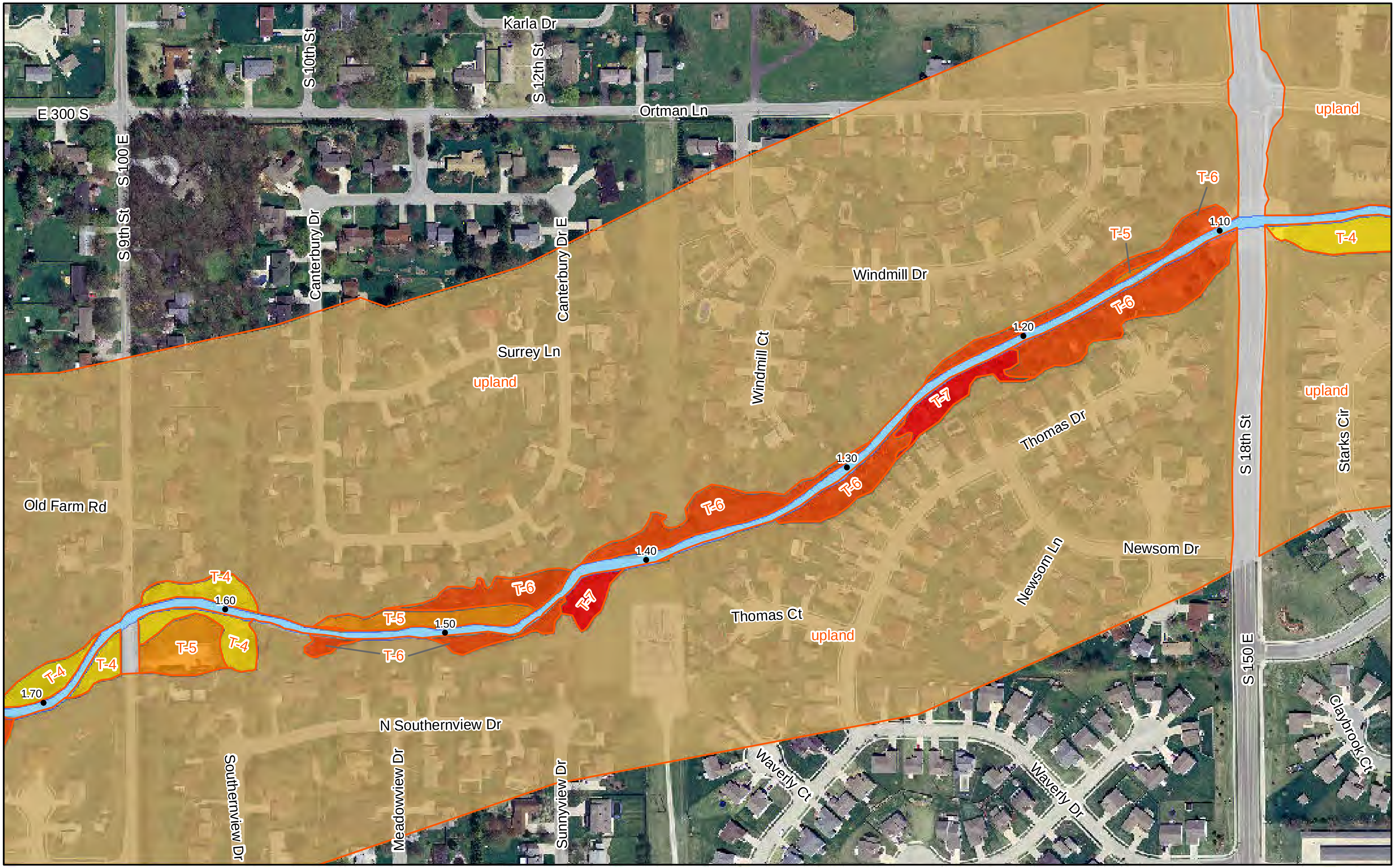
GEOMORPHIC SURFACES - Elliott Ditch

• Milepost
Geomorphic Surface Boundary

Geomorphic Surface

stream
floodplain
T-1
T-2
T-3
T-4
T-5
T-6
T-7
depression
oxbow
anthropogenic
upland



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Sheboygan, WI 53081
Tel: (920) 452-7962
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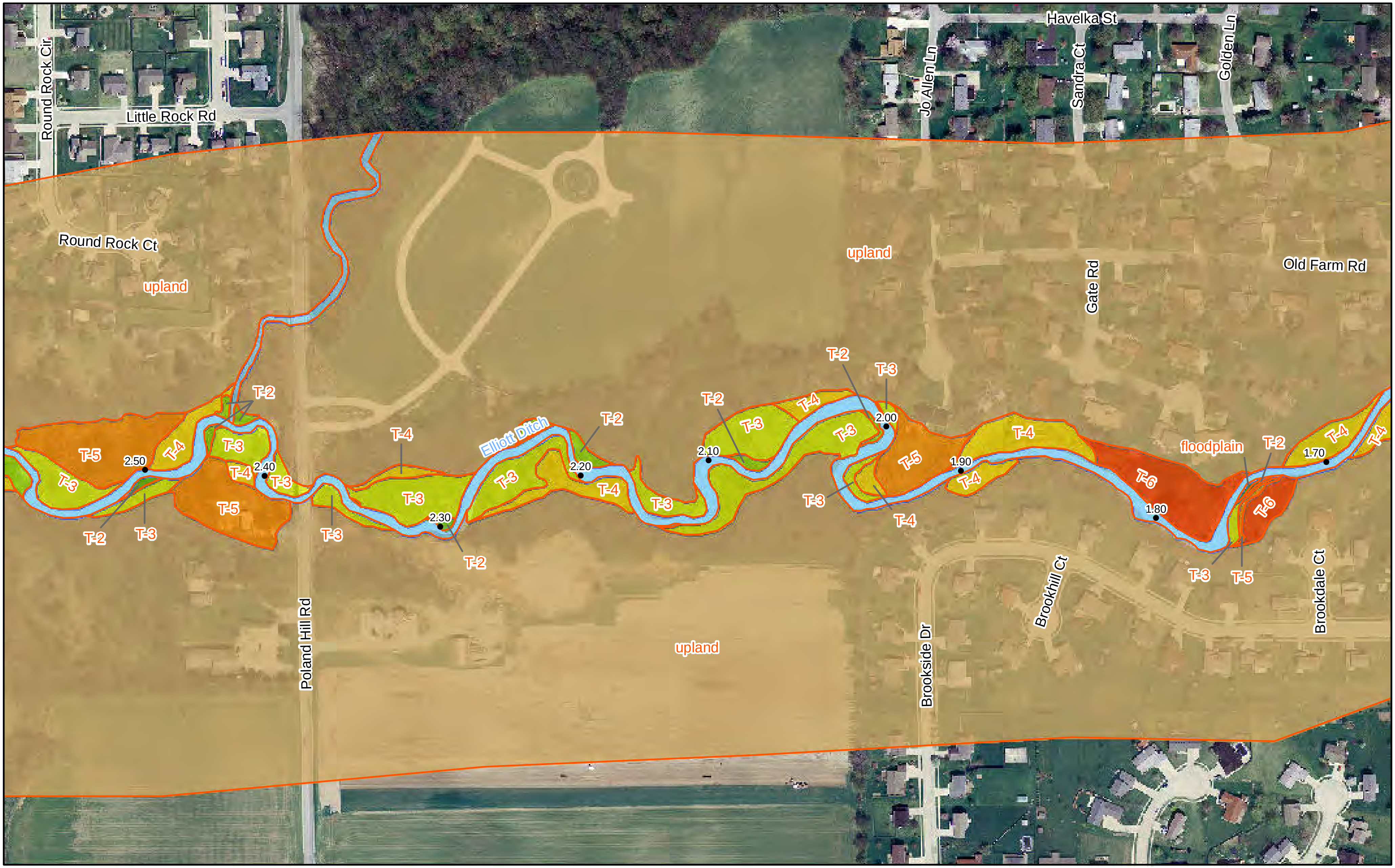
GEOMORPHIC SURFACES - Elliott Ditch

• Milepost
Geomorphic Surface Boundary

Geomorphic Surface

stream	T-1	T-5	depression
floodplain	T-2	T-6	oxbow
	T-3	T-7	anthropogenic
	T-4		upland



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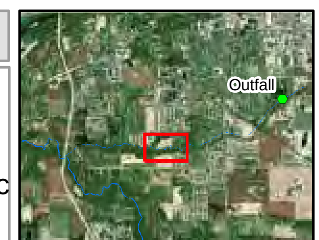
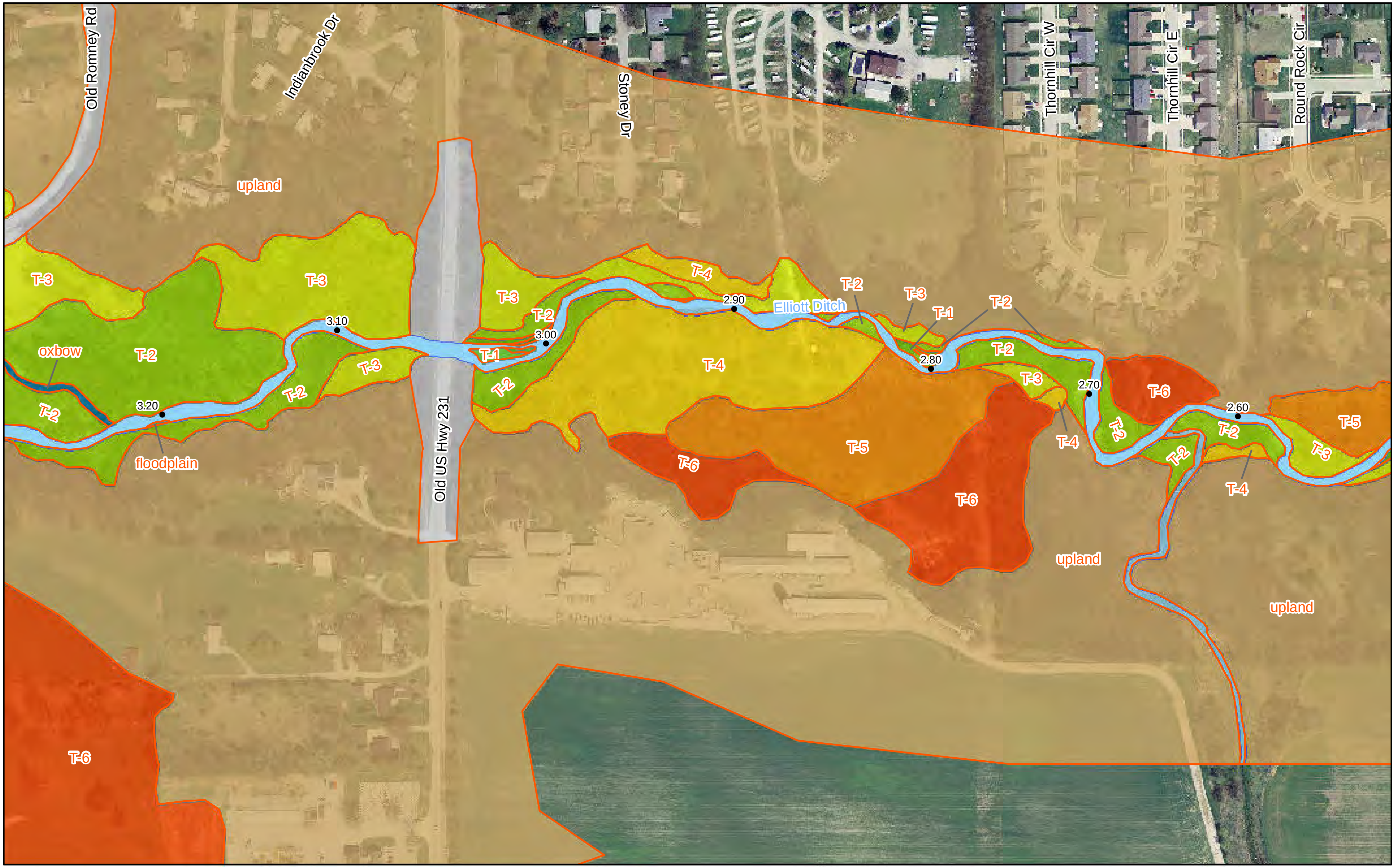
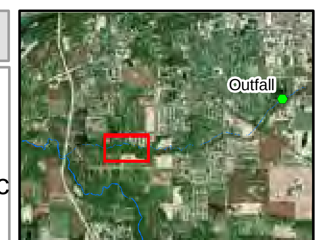
GEOMORPHIC SURFACES - Elliott Ditch

• Milepost
Geomorphic Surface Boundary

Geomorphic Surface
- stream
- floodplain
- T-1
- T-2
- T-3
- T-4
- T-5
- T-6
- T-7
- depression
- oxbow
- anthropogenic
- upland







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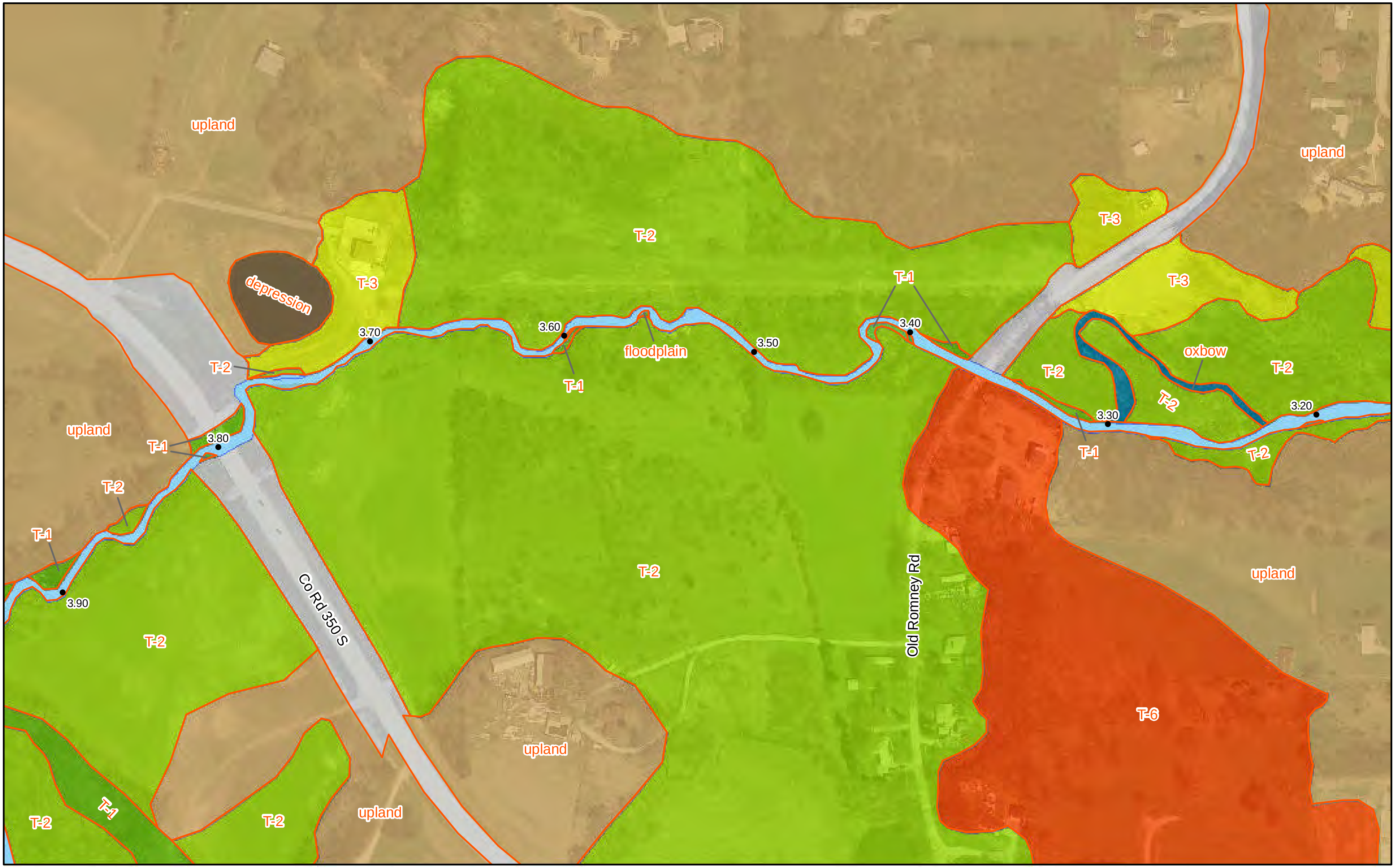
GEOMORPHIC SURFACES - Elliott Ditch

• Milepost
Geomorphic Surface Boundary

Geomorphic Surface
- stream
- floodplain
- T-1
- T-2
- T-3
- T-4
- T-5
- T-6
- T-7
- depression
- oxbow
- anthropogenic
- upland



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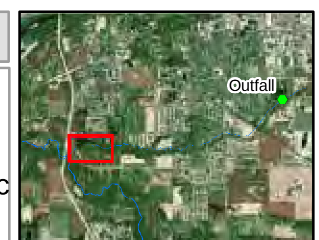
GEOMORPHIC SURFACES - Elliott Ditch

• Milepost	**Geomorphic Surface**	T-1	T-5	depression
Geomorphic Surface Boundary	stream	T-2	T-6	oxbow
	floodplain	T-3	T-7	anthropogenic
		T-4		upland



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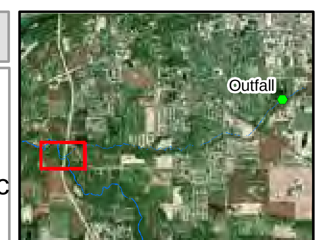
GEOMORPHIC SURFACES - Elliott Ditch

• Milepost

Geomorphic Surface Boundary

Geomorphic Surface

- stream
- floodplain
- T-1
- T-2
- T-3
- T-4
- T-5
- T-6
- T-7
- depression
- oxbow
- anthropogenic
- upland

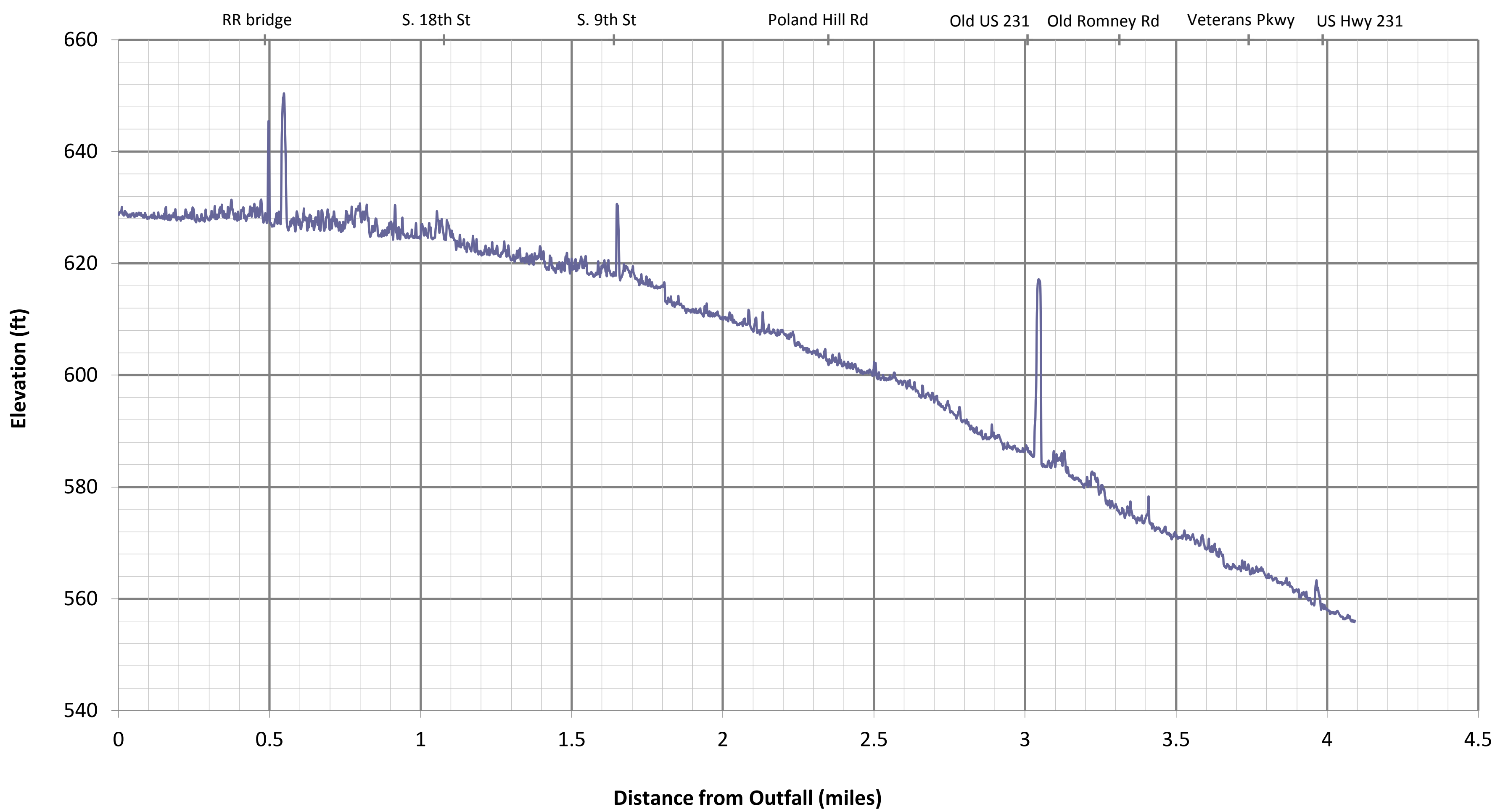


Appendix A

Figure 4

Longitudinal Profile

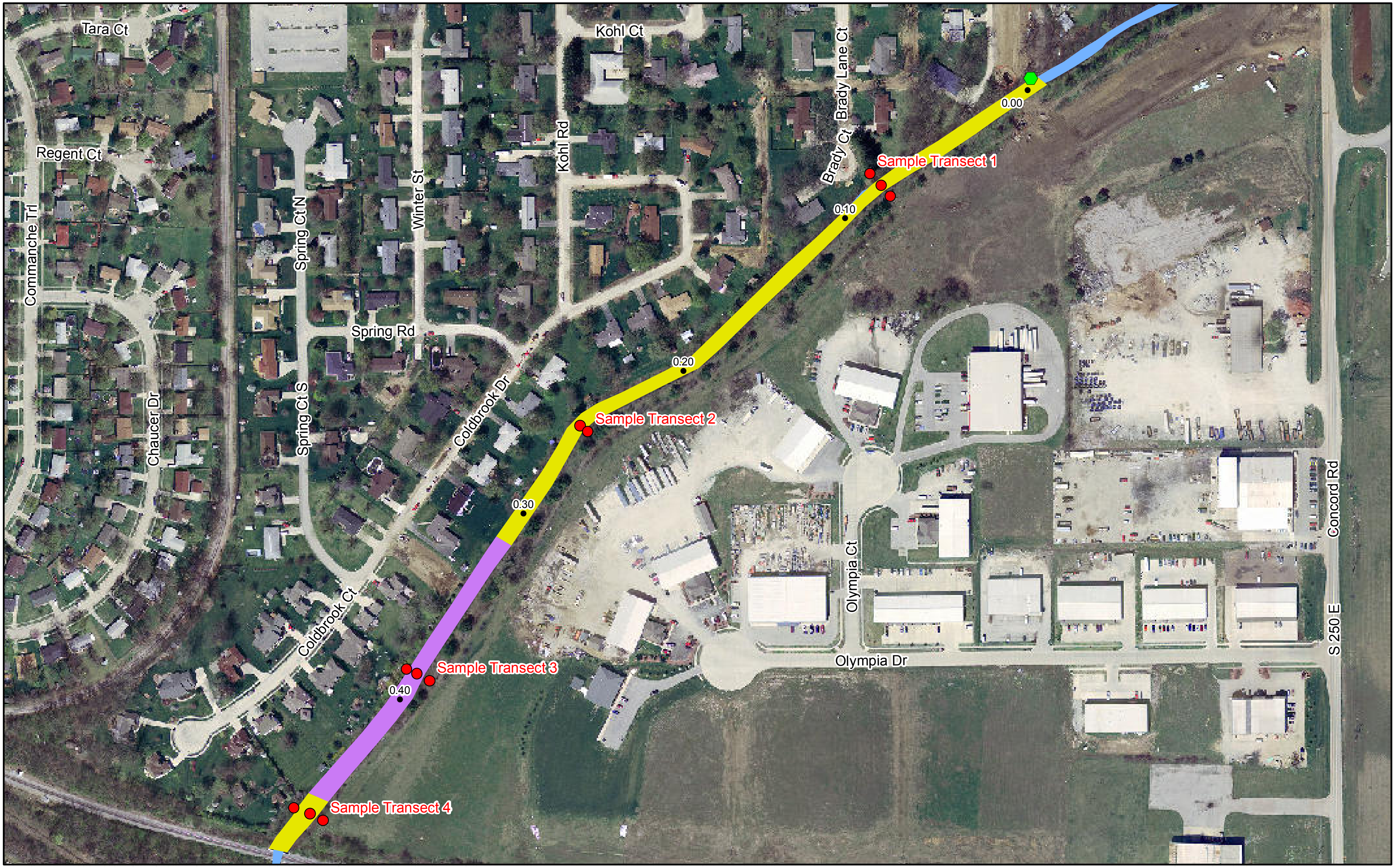
Elliott Ditch Longitudinal Profile - *Outfall 001 to Confluence with Wea Creek*



Appendix A

Figure 5

Example Proposed Sample Locations and Erosion/Deposition Surfaces



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630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
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Fax: (920) 457-2357

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N 0 150 300 Feet
SCALE = 1:3,690

PROPOSED SAMPLE LOCATIONS & EROSION/DEPOSITION SURFACES - Elliott Ditch

- Outfall 001
- Milepost
- Proposed Sample Location
- Deposition Surface
- Erosion Surface

Appendix A

Figure 6

Anchor Sample Stations and Geomorphic Surfaces

Tetra Tech, Inc.
630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

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File Path: F:\Alcoa Elliott Ditch\GIS\AlcoaElliottDitch.mxd

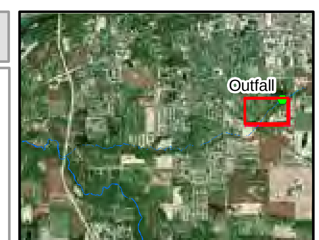
N 0 150 300 Feet
SCALE = 1:3,690

ANCHOR SAMPLE STATIONS & GEOMORPHIC SURFACES - Elliott Ditch

Outfall 001
Anchor Sample Station (approx. location)
Milepost
Geomorphic Surface Boundary

Geomorphic Surface

stream
floodplain
T-1
T-2
T-3
T-4
T-5
T-6
T-7
depression
oxbow
anthropogenic
upland



Tetra Tech, Inc.
630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

ANCHOR SAMPLE STATIONS & GEOMORPHIC SURFACES - Elliott Ditch

Anchor Sample Station (approx. location)
Milepost
Geomorphic Surface Boundary

Geomorphic Surface

stream	T-1	T-5	depression
floodplain	T-2	T-6	oxbow
	T-3	T-7	anthropogenic
	T-4		upland

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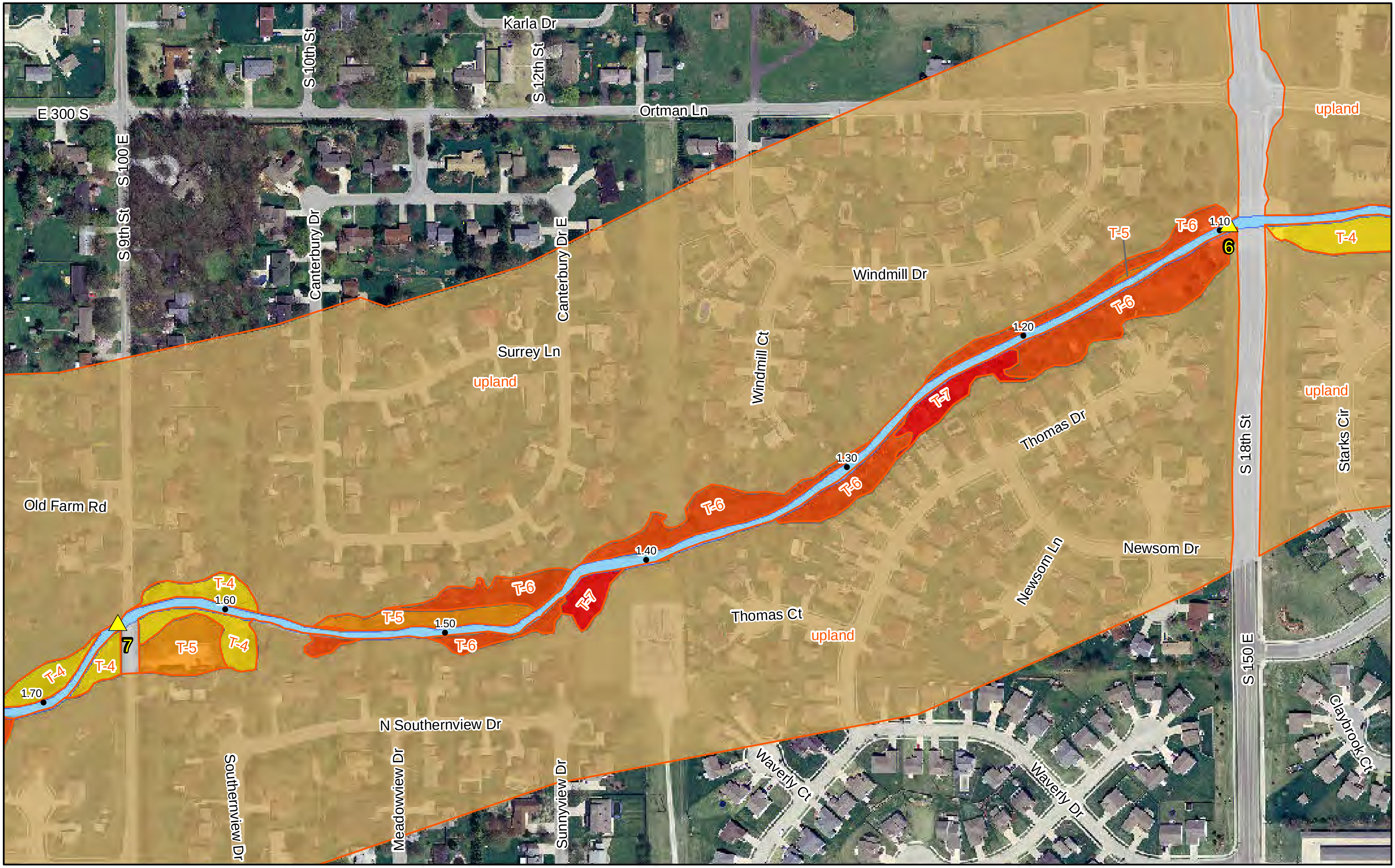

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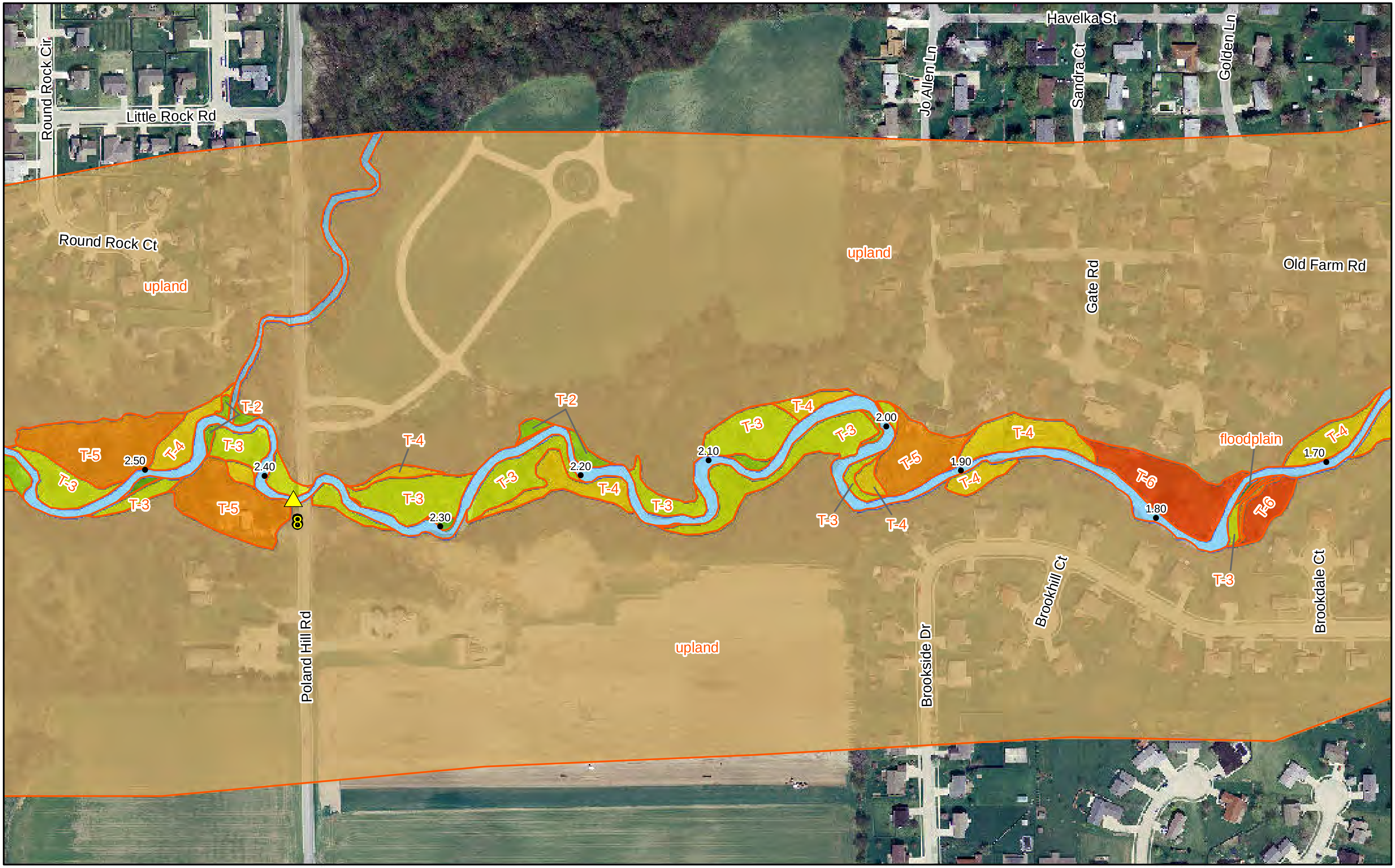
ANCHOR SAMPLE STATIONS & GEOMORPHIC SURFACES - Elliott Ditch

Anchor Sample Station (approx. location)
Milepost
Geomorphic Surface Boundary

Geomorphic Surface
stream
floodplain
T-1
T-2
T-3
T-4
T-5
T-6
T-7
depression
oxbow
anthropogenic
upland



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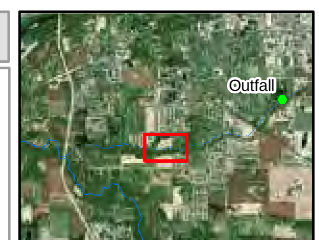
SCALE = 1:3,690

ANCHOR SAMPLE STATIONS & GEOMORPHIC SURFACES - Elliott Ditch

- Anchor Sample Station (approx. location)
- Milepost
- Geomorphic Surface Boundary

Geomorphic Surface

	T-1	T-5	depression
stream	T-2	T-6	oxbow
floodplain	T-3	T-7	anthropogenic
	T-4		upland



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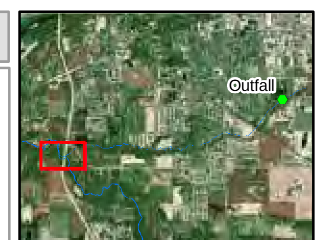
SCALE = 1:3,690

ANCHOR SAMPLE STATIONS & GEOMORPHIC SURFACES - Elliott Ditch

Anchor Sample Station (approx. location)
Milepost
Geomorphic Surface Boundary

Geomorphic Surface

stream	T-1	T-5	depression
floodplain	T-2	T-6	oxbow
	T-3	T-7	anthropogenic
	T-4		upland



Appendix B

Photographs

Photo 1: Two outfall culverts on RDB. These outfalls are located on transect 1 at Outfall 001.

Photo 2: Looking upstream from transect 12. Bank height on LDB (right side of photo) is ~ 10 feet. Top of the bank on LDB is the upland.

Photo 3: Looking upstream at active railroad bridge between transects 12 and 13. Stream bed consists of sand, gravel and cobbles. Poured concrete floor under bridge arches is completely exposed on RDB side bridge arch.

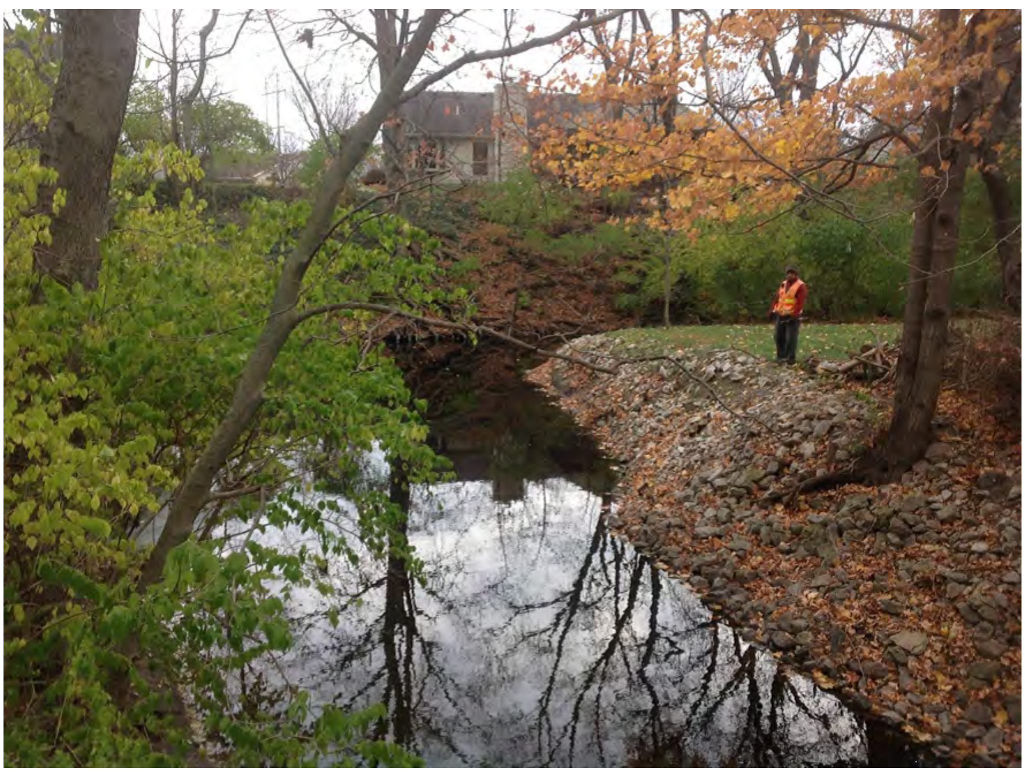


Photo 4: Looking downstream at transect 35. Person is standing on T-6. House in background is sitting on the upland.

Photo 5: Looking at LDB on transect 48. The bare sand in the foreground is the floodplain surface. The T-1 surface is covered with forbs and has flood debris (garbage) and leaf litter. The T-2 surface is in background and is covered by trees and shrubs.

Photo 6: Looking at upstream side of meander bend near transect 60. The cobble surface is the floodplain. A small T-1 is visible where the clump of brown vegetation is located. The T-2 surface is marked by the trees and shrubs on the left of the photo.

Photo 7: Looking at RDB near transect 62. ATV is parked on T-3 surface. The brown vegetation marks the T-2 surface and the T-1 surface is marked by the green vegetation by the edge of the channel.

Photo 8: Looking downstream near transect 39. Point bar in foreground has T-1 (bare gravel & leaf litter), T-2 (single tree), T-3 (exposed tree roots). Flood debris (garbage) is visible on the T-2 surface on the right of the photo. The house is sitting on the upland surface.

Photo 9: Looking at LDB near transect 25. Gravel surface in foreground is the floodplain. The trampoline is on the T-6 and the houses are located on the upland surface.

Photo 10: Looking upstream near transect 65. The sand and gravel surface in the middle of the photo is the floodplain. The T-1 is located on the right of the photo at one end of the protruding log. The T-2 is covered by trees and shrubs on both sides of the channel.

Photo 11: Old wooden bridge pylons and debris under the 9th Street Bridge.

APPENDIX II

FIELD SAMPLING PLAN – ELLIOTT DITCH (TETRATECH CES)

FIELD SAMPLING PLAN

Elliott Ditch

Lafayette, Tippecanoe County, Indiana

Prepared for:
Alcoa
3131 Main Street
Lafayette, IN 47905

Prepared by:
Tetra Tech, INC.
630 Riverfront Drive
Sheboygan, WI 53081

February 2, 2016

FIELD SAMPLING PLAN

Elliott Ditch
Lafayette, Tippecanoe County, Indiana

Prepared for:
Alcoa
3131 Main Street
Lafayette, IN 47905

Prepared by:
Tetra Tech, INC.
630 Riverfront Drive
Sheboygan, WI 53081

Prepared by: ____ Date:
Dave Richardson, Technical Manager
Tetra Tech, Inc.

Reviewed by:____Date:
Robert Prezbindowski, Project Manager
Alcoa

Reviewed by: ____ Date:
Don Stilz, Senior Environmental Manager
Indiana Department of Environmental Management

Approved by: ____ Date:
Jean Greensley, Remedial Project Manager
USEPA Region 5 TSCA

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

LIST OF ABBREVIATIONS AND ACRONYMS

ALO	Alcoa's Lafayette Operations
C	Degrees Celsius
COC	Chain of Custody
FSP	Field Sampling Plan
GPS	Global Positioning System
HASP	Health and Safety Plan
IDEM	Indiana Department of Environmental Management
mg/kg	Milligram per kilogram
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NRCS	Natural Resource Conservation Service
oz	Ounces
PCBs	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
ppm	Parts per Million
PRP	Potentially Responsible Party
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RPM	Remedial Project Manager
SOP	Standard Operating Procedure
TSCA	Toxic Substances Control Act
Tt	Tetra Tech
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture Soil Classification System
USEPA	United States Environmental Protection Agency

1. INTRODUCTION

Elliott Ditch is a tributary to Wea Creek, which is a tributary to the Wabash River, downstream of Lafayette, Indiana (Figure 1). In addition to its base flow, Elliott Ditch receives wastewater discharges through an outfall (Outfall 001) from Alcoa's Lafayette Operations (ALO). These discharges include treated sanitary and industrial process water, as well as storm water. The distance from the outfall to the Wabash River is 7.5 miles. The distance from the outfall to the Elliott Ditch and Wea Creek confluence is 4.1 miles. This Field Sampling Plan (FSP) is focused on the area from the outfall (Milepost 0.0) to Milepost 1.59, the end of the channelized portion of Elliott Ditch.

Tetra Tech performed a geomorphology and depositional pattern assessment of Elliott Ditch (between Alcoa's Outfall 001 and Wea Creek) and the surrounding floodplain in Lafayette, Indiana in 2013 and 2014. Assessment work proceeded, over this period, on an iterative basis. In 2013, preliminary geomorphic surface mapping (desktop) was conducted to evaluate the depositional/erosional pattern in the channel and surrounding floodplain. Field work included a detailed survey of the upstream 0.5 mile of Elliott Ditch and the 100-year floodplain to complete detailed channel profiles. In 2014, the desktop geomorphic surfaces were field confirmed and edited to reflect the field conditions.

The objective of this FSP is to support a site conceptual model to understand the distribution of potential PCB impacts in Elliott Ditch and the adjacent floodplain caused by historical releases from Alcoa's storm water outfall. This objective will be met by poling and GPS readings to define the horizontal and vertical extent of fine grained deposits in-channel, sediment sampling to characterize the sediment profile, soil sampling to characterize the soil profile and sediment and soil analytical samples to determine the presence/absence and concentration of PCBs.

The purpose of this FSP is to describe site-specific tasks that will be performed in support of the stated objectives. The FSP will reference the Quality Assurance Project Plan (QAPP) for generic tasks common to all data collection activities including routine procedures for sampling and analysis, sample documentation, equipment decontamination, sample handling, data management, assessment, and data review. Any deviations or modifications to the approved FSP will be documented using Table 1: FSP Revision Form.

1.1. Problem Definition

Polychlorinated Biphenyls (PCBs) are present in the Elliott Ditch watershed from the Alcoa Outfall to the County Road 350 South Bridge based on sediment samples collected by Anchor QEA in 2004 and 2010. The PCB concentrations range from <1 ppm to 27 ppm at sample locations. The horizontal and vertical extent of the PCB concentrations are currently not understood within the channel or floodplain.

The natural processes of a flowing stream develop a pool and riffle system which means the channel gradient will alternate from a relatively steeper gradient (riffle) to a relatively shallower gradient (pool). The lengths of a stream's pool and riffle system are affected by a number of stream characteristics including; channel width, channel bed type, floodplain width, water velocity, sediment load, and sinuosity. The pool and riffle system is unique to each stream and also variable within a single stream. An effective sampling strategy requires an understanding of the pool and riffle system for the given stream.

The fate and transport of PCBs is dictated by their affinity to adsorb to silt and clay size particles in the stream system. The silt and clay size particles stay in suspension in a stream until the velocity drops to near zero for a number of hours. The silt and clay particles can be re-suspended with an increase in water velocity. Since PCBs adsorb to sediment, the PCB deposition pattern corresponds to the deposition of the fine-grained sediments. Within the pool and riffle system, the silts and clays typically deposit in the pools (shallower stream gradient) and not within the riffles.

The stream's geomorphic and anthropogenic characteristics define the depositional patterns within the channel and on the adjacent floodplain. Streams are linear features that vary longitudinally (pool and riffle system), vertically due to varying water depths, and horizontally within the channel (thalweg vs. point bars) and on the floodplain due to elevation changes and historic stream development (floodplain and terraces). A fluvial environment like Elliott Ditch is not homogeneous, therefore,, a biased sampling approach based on an understanding of the silt and clay (fine-grained) deposition pattern is the most effective approach to define the horizontal and vertical extent of contamination.

1.2 Project Management

The following personnel will be involved in planning and/or technical activities.. Each will receive a copy of the approved FSP. A copy of the FSP will also be retained in the site file.

Personnel	Title	Organization	Phone Number	Email
Robert Prezbindowski	Alcoa Project Manager	Alcoa	(865) 977-3811	Robert.Prezbindowski@alcoa.com
Dave Richardson	Senior Fluvial Geomorphologist	Tetra Tech	(920) 634-5531	Dave.Richardson@tetratech.com
Heather Phelan	Tetra Tech Project Manager	Tetra Tech	(920) 857-8422	Heather.Phelan@tetratech.com
Don Stilz	Senior Environmental Manager	Indiana Dept. of Env. Management	(317) 232-3409	DSTILZ@ idem.IN.gov
Jean Greensley	Geologist	USEPA Region V	(312) 353-1171	Greensley.Jean@epa.gov

2. PROJECT DESCRIPTION

2.1 Site Location and Background

Elliott Ditch is located in the Wabash River Basin in Tippecanoe County, IN, and flows west into Wea Creek, a tributary of the Wabash River. The streams of the Wabash River Basin formed in glacial outwash deposited during the Pleistocene epoch. During the Pleistocene, various glaciations leveled plains and filled in valleys, resulting in a gently undulating plain. As glaciers receded, meltwater streams cut drainage ways and stream valleys that drain toward the Wabash River. The streams draining the Wea Plains (which includes Elliott Ditch), were formed after glaciers receded from the area. Generally, the topography of the area is relatively unchanged by stream development since glaciation, as most streams are typically shallow and have gently sloping gradients. Glacial landforms (e.g. kames, eskers, swales, etc.) are plentiful (USDA, 1958).

Review of the aerial photographs provided by Alcoa reveals that Elliott Ditch formed sometime before 1939 since the Ditch is clearly visible in the 1939 aerial photo. The 1939 aerial suggests that at least part of Elliott Ditch originated as a naturally formed stream that was later modified by human activity. The stream appears to be free flowing and naturally meandering along the western portion of the stream in 1939. Some channelization may have occurred prior to the photo because the stream channel appears abnormally straight where Elliott Ditch crosses the railway.

Elliott Ditch is a tributary to Wea Creek, which is a tributary to the Wabash River, just downstream of Lafayette, Indiana (Figure 1). In addition to its base flow, Elliott Ditch receives wastewater discharges through an outfall (Outfall 001) from Alcoa's Lafayette Operations (ALO). These discharges include treated sanitary and industrial process water, as well as storm water. The distance from the outfall to the Wabash River is 7.5 miles. The distance from the outfall to the Elliott Ditch and Wea Creek confluence is 4.1 miles. This FSP is focused on the area from the outfall (Milepost 0.0) to Milepost 1.59, the end of the channelized portion of Elliott Ditch (Figure 2).

The geomorphic surface mapping completed for Elliott Ditch suggests that Elliott Ditch has eight distinct reaches (erosional/depositional regimes):

- Reach 1: Outfall 001 to downstream of the railroad bridge (Transects 1-14)
- Reach 2: Transect 14 to the South 18th Street Bridge (Transect 19)
- Reach 3: South 18th Street Bridge to upstream of the 9th Street Bridge (Transects 19-30)
- Reach 4: South 9th Street Bridge (Transect 30) to Transect 39, located north of Brookside Drive
- Reach 5: Transect 39 to Transect 50 (located downstream of Poland Hill Road)
- Reach 6: Transect 50 to Transect 60 (located downstream of the Old Romney Road Bridge)
- Reach 7: Transect 60 to Transect 64 (located upstream of US Highway 231 South Bridge)
- Reach 8: Transect 64 to Transect 66 (Elliott Ditch –Wea Creek confluence)

This FSP is focused on Reaches 1 – 3 or the upstream 1.59 miles downstream of Outfall 001 (Figure 3).

2.2 Target Analyte - PCBs

Samples of fish, water, and sediment collected in the 1980s from Elliott Ditch and Wea Creek indicated that PCBs were present in these media. In response to these findings, Alcoa pursued two approaches to reducing PCB levels in fish from Elliott Ditch and Wea Creek: in-stream remediation and source reduction. In 1990, Alcoa remediated sediments in the first mile (to the 18th Street Bridge). Then, in the late 1990s, Alcoa instituted a wastewater management program, which significantly reduced flow to Outfall 001 through removal of non-contact cooling water. To further reduce PCB loadings to Elliott Ditch, Alcoa began to treat its dry weather discharge to Elliott Ditch using canister filter systems in January 2000. In 2007, Alcoa developed and implemented a Natural Media Filtration treatment process. These actions have reduced PCB loadings from Outfall 001 by at least tenfold (Anchor QEA 2009).

PCBs are present in the Elliott Ditch watershed from the Alcoa Outfall to the County Road 350 South Bridge based on sediment samples collected by Anchor QEA in 2004 and 2010. The PCB concentrations range from <1 ppm to 27 ppm at sample locations. The distribution of the PCB concentrations are currently not well understood within the channel or floodplain.

3. INVESTIGATION STRATEGY

The soil and sediment investigation for Elliott Ditch is designed with geomorphic principals which dictate the strategy for sample location and sample intervals. The first step is using fluvial geomorphology to define the erosional and depositional patterns for Elliott Ditch and its floodplain. This process started as a desktop review of aerial photographs and topographic maps to determine preliminary geomorphic surfaces on the Elliott Ditch floodplain. The desktop review was supplemented with a field survey to verify and review the preliminary mapping. The boundaries were documented in the field using a GPS. The results of the geomorphic mapping were used to develop the sample transects and sample locations perpendicular to the stream. The distance between transects varies based on the complexity of the local fluvial geomorphology. The geomorphic surfaces represent areas of similar depositional or erosional characteristics and these surfaces are important in the interpretation of the field sampling results.

A second step of the investigation strategy is the use of geomorphic characteristics of Elliott Ditch to determine the area of investigation. The Elliott Ditch area of investigation includes the channel and the floodplain and terrace surfaces up to the upland boundary. The in-channel area includes the parts of the ditch that have deposits of silt and clay because PCBs absorb to these particle sizes. In the overbank areas, flood deposits on the floodplain and terraces during and after the time of release are subject to PCB deposition.

After the geomorphic surface mapping was field confirmed, a broad review of Elliott Ditch and the geomorphic surfaces allowed reaches to be mapped based on the similarity of geomorphic setting, anthropogenic features, and/or stream/floodplain characteristics. For example, the 2016 FSP area was selected based on the portion of Elliott Ditch that was anthropogenically straightened, Reaches 1 – 3. This part of the ditch is relatively straight, incised, and has limited geomorphic surface development. Although there will be some variability, the deposition pattern for Reaches 1 – 3 will be similar.

A third criteria of the investigation strategy is to determine what portion of the channel and overbank could be remediated in a single field season. Rivers and streams flow continuously so conducting an investigation that will not be remediated within a short period of time may alter the original deposition pattern if a significant flood event impacts the watershed. The objective is to investigate an area and define the depositional pattern during one field season, remediate the investigated area the following field season and investigate the next downstream portion of the stream while the remediation is being conducted on the adjacent upstream segment.

The sample locations are selected in depositional areas to define the concentration and extent of the target analyte. An important part of the sampling strategy is to sample in areas that are not depositional to prove they do not include the target analyte. This approach allows for a confirmation of the erosional surfaces and a confidence that the fluvial geomorphology of the stream is accurate. The sampling strategy is designed to allow for iterative sample locations to be incorporated into the FSP based on data obtained during the field work and from the analytical results. For example, if the lab results from a sample location at the end of the sample transect (away from the channel) contains PCBs above the target cleanup level, an additional sample location(s) may be added to define the horizontal extent.

In order to fully understand the spatial distribution of PCBs within the investigation area we must also define the vertical extent of PCBs. Target sample depths have been defined for each sample location based on the NRCS Soil Survey mapping. The soil survey provides the typical profile thickness to the parent material or C horizon. The target depths are conservative to attempt to obtain a clean horizon with only one sampling mobilization to a location. Although a longer soil profile will be collected and logged, the sample selection and laboratory analysis will be iterative based on the soil profile characteristics. For example, a soil profile may be sampled into the C horizon but during the logging it is decided to only submit the A horizon for lab analysis. If the A horizon contains PCBs above the target cleanup level, the B horizon will be submitted. If the B horizon has a concentration below the target cleanup level, the vertical boundary has been defined and the C horizon will not be submitted for analysis.

Sample intervals will vary based on the thickness of the soil horizon/sediment layer. The focus of this investigation is to understand the deposition pattern and the best way to accomplish this is to sample specific soil horizons or sediment layers regardless of their thickness. Soil horizons/sediment layers form under specific conditions which creates a unique horizon/layer. A change in conditions means a change in the horizon/layer. An exception to this sampling approach will be made if a horizon/layer is greater than 12 inches thick, the horizon/layer will be sampled by its top half and bottom half to gain a detailed understanding of the vertical extent of contamination.

The horizon/layer based sampling provides a context of the geomorphic and pedogenic (soil profile) environment and it is easier to characterize the PCB distribution.

The fluvial geomorphology approach is beneficial to determine where PCBs are located in Elliott Ditch and its floodplain but more importantly, why the deposits are located where they are. In any investigation, a limited number of sample locations are collected to characterize a large area. It is important to have a scientific way to interpolate or extrapolate data from where it was collected to the other areas of the project.

4. PROPOSED SCHEDULE

Upon verbal approval of the FSP, the QAPP and Health and Safety Plans will be prepared. The FSP field work can begin after snow melt and the spring flooding period. The preliminary start date based on flow conditions is mid-May 2016.

The results of the field work and chemical analysis will be prepared in a report and submitted for review by Indiana Department of Environmental Management (IDEM) and United States Environmental Protection Agency (USEPA) Region 5 by October 1, 2016.

5. FIELD PROCEDURES AND SAMPLE COLLECTION

In-channel sediment samples and overbank soil samples will be collected to determine if PCBs are present in the sediment of Elliott Ditch and adjacent overbank soils of various geomorphic surfaces. The proposed sampling locations are depicted on Figure 4**.**

5.1 In-Channel Poling

In-channel poling will be conducted to define the volume and extent of soft sediment within the channel. The term ‘poling’ refers to procedure by which a pole that is marked with unit length graduations is used to measure soft sediment thickness on the bed of a waterbody. A metal pole marked with 0.1-foot graduations is advanced vertically through the river bed sediment to document the material present (i.e., soft, hard, granular, etc.) and to determine the overall soft material thickness (depth to refusal). The pole is extended downward through the soft sediment using manual force only until resistance inhibits additional advancement. Poling data will be obtained by or supervised by personnel with experience in poling methods.

The occurrence of PCBs in sediment is most probable within depositional areas of Elliott Ditch. Poling locations will be selected based on field observations of possible depositional areas. Poling will be conducted throughout the channel length and width to define the horizontal extent of soft sediment. The boundaries of the soft sediment will be defined using the poling and documented with GPS coordinates. The volume of the soft sediment for a given area will be determined by measuring the soft sediment thickness over the extent of the soft sediment area. Soft sediment thickness will be defined as the difference in elevation between the top of sediment and the depth of refusal (bottom of sediment). Poling data will be evaluated prior to sediment sampling to refine in-channel sampling locations, determine the proper length of core to be used at each location, and to assess potential sample recovery.

Global Positioning System (GPS) coordinates, water depth, advancement depth, soft sediment thickness, sediment type, geomorphic setting, and presence/absence of aquatic vegetation will be documented at each location.

5.2 Sample Locations

Sediment and soil cores will be collected at the locations described in Table 3. Cores will be advanced to the target depth unless prevented by refusal. Overbank soil sample locations have been pre-selected based on desktop and field geomorphic surface mapping. Soil sample locations were chosen to be representative of the various geomorphic surfaces encountered. Geomorphic surfaces represent unique fluvial environments and typically represent different relative heights above the stream surface (Figure 5). In-channel sample locations were selected based on channel morphology and geomorphic setting (e.g., meander bend, pool) observed during the 2014 topographic survey of Elliott Ditch. Poling data, described in the previous section, will be used to refine the exact location of in-channel sample locations prior to sediment sampling.

Exact sediment and soil sampling locations will be determined in the field based on accessibility and geomorphic features which may indicate the location of PCB deposition.

5.3 In-Channel Sediment Sampling

Sediment core sampling will be conducted using a piston corer, check valve sampler, or Russian Peat Borer (discrete interval sampler). The location, date-time, sample advancement length from the sediment surface, sediment core recovery length, and percent recovery will be documented.. The target depth for each location will be based on the poling results as described in Section 4.1. The project target for sample recovery is 80 percent. If the initial sampling does not obtain at least 80 percent recovery, additional attempts will be made using the equipment and methods determined most appropriate by the Field Manager or his/her designee in the field.

Sediment sampling and decontamination procedures for each sampling device are described in Tetra Tech SOPs in Attachment A. Specific procedures for sediment sampling are listed below:

- Coordinates of the sampling location will be recorded using a geographic position system (GPS) receiver with sub-meter accuracy.
- A tape measure or pole with minimum graduations of 0.1 foot attached to a 6-inch diameter disc will be used to determine the water depth prior to sampling. In the event of deep/swift water, a lead line will be used to determine the water depth.

- The core sampler will be advanced to the target depth and retracted. The core sample retrieved is capped on the bottom and removed from the core sampler.
- The core sample is then capped on top and labeled with the location, date, time, and sample recovery lengths
- The core sample is stored in an upright position and then transferred to the processing area.
- The cores will be cut open and placed on a designated logging table.
- The cores will then be logged by a field geomorphologist using the methods described in the Sediment Logging SOP found in Attachment A.
- Laboratory-provided glass jars will be filled with sediment for PCB analysis. Sediment samples will be collected based on the sediment layers and may vary in length.
- Sample jars will be labeled using the nomenclature outlined in Section 5.1.

Field team members will wear a new pair of disposable nitrile gloves prior to the collection of each sample. The sediment sampling equipment will be decontaminated after collection of each core interval by washing in an Alconox solution and rinsing with distilled water.

The table below summarizes the container and analytical requirements for sediment sampling.

Sample Collection Equipment

- Laboratory-provided sample containers
- Plastic spoons

Container and Analytical Requirements List

Matrix	Containers (Numbers, Size, and Type)	Analytical Parameter	Analytical Method	Preservation Requirements	Holding Time
Sediment	One 8 oz glass jar	PCBs	SW846-8082	Cool to 4°C	6 Months

5.4 Overbank Soil Sampling

Soil sampling will be conducted at 33 locations in 13 transects using a soil recovery auger or sampling tube. A soil recovery auger or soil sampling tube will be used to collect soil in one-foot cores for soil profile description and laboratory analysis. The location, date, time, advancement depth, and recovered interval are documented.

Soil sampling and decontamination procedures for the soil recovery auger or soil sampling tube are described in Tetra Tech SOPs in Attachment A**.** Specific procedures for soil sampling are summarized below:

- Coordinates of the sampling location will be recorded using a geographic position system (GPS) receiver with sub-meter accuracy.
- A soil recovery auger or soil sampling tube capable of taking a one-foot sample equipped with a liner will be used to collect samples at each location. The first sample will be collected from the surface to a depth of 12 inches. The next sample will be collected by inserting the soil recovery auger into the boring created by the first sample, the sample will be collected at a depth of 12 – 24 inches below the ground surface. The soil recovery auger or soil sampling tube will be decontaminated between each sample or multiple augers/sampling tubes will be used at a location and the equipment decontaminated after sampling at a location is complete.
- The soil core liners will be capped at both ends. The location, date, time, and sample interval will be labeled on the core and the cores will be stored in an upright position and transported to the processing area.
- The cores will be cut open and placed on a designated logging table.
- The lithology for each boring will be classified by a field geomorphologist in accordance with the Unified Soil Classifications System (USCS) and United States Department of Agriculture Soil Classification System (USDA).
- Laboratory-provided glass jars will be filled with soil for PCB analysis. Soil samples will be collected in based on the soil horizons. If the A horizon is 12 inches thick or more, the horizon will be split into a 0 - 6 inch interval and a 6 – 12 inch interval. The overbank

deposition will be from flood deposits so a thick A horizon may require a tighter sampling interval.

- Sample jars will be labeled using the nomenclature outlined in Section 5.1.

Field team members will wear a new pair of disposable nitrile gloves prior to the collection of each sample. The soil recovery auger or soil sampling tube will be decontaminated after collection of each core interval by washing in an Alconox solution and rinsing with distilled water.

The table below summarizes the container and analytical requirements for soil sampling.

Sample Collection Equipment

- Laboratory-provided sample containers
- Plastic spoons

Container and Analytical Requirements List

Matrix	Containers (Numbers, Size, and Type)	Analytical Parameter	Analytical Method	Preservation Requirements	Holding Time
Soil	One 8 oz glass jar	PCBs	SW846-8082	Cool to 4°C	6 Months

6. SAMPLING PROCEDURES

This section describes the project-specific sample nomenclature, management of investigative-derived waste, decontamination, custody procedures and other standard operating procedures.

6.1 Sample Nomenclature

All samples for analysis, including QC samples, will be given a unique sample identification (ID). The sample numbers will be recorded in the field tablet (or similar), on the sample jars, and on the COC paperwork. The sample ID will be used to track field data and laboratory analytical results, as well as presentation of analytical data in memoranda and reports. Tetra Tech will assign each sample a unique identification based on the nomenclature outlined below.

<u>Project ID Code</u>

ED = Elliott Ditch

<u>Four-Digit Milepost Code</u>

Nearest milepost (XX.XX) of sample location.

Examples:

- 01.22
- 00.15

<u>Sample Location</u>

Sample location will consist of an in-channel sediment (SD) or overbank soil (SL) code followed by a two-digit numerical identifier (XX). Numerical identifiers will be ordered from north to south and west to east when possible.

Examples:

- SD02
- SL05

<u>Two-Digit Sample Start Depth</u>

Indicates the sample start depth to the nearest 10th of a foot (X.X).

Examples:

- 0.5
- 2.3

<u>Sample End Depth</u>

Indicates the sample end depth to the nearest 10th of a foot (X.X).

Examples:

- 1.1
- 2.0

<u>QA/QC Code</u>

If applicable, the following QA/QC codes will be included in the sample ID:

- FD = Field duplicate
- MS = MS/MSD

Sample IDs will be constructed in the following sequence: project identification code, four-digit milepost code, the sample location, sample start depth, sample end depth, and the QA/QC code, if applicable.

Example sample IDs:

- In-channel sediment sample 01 collected at milepost 2.4 from 1.2 to 1.9 feet would be "ED-02.40-SD01-1.2-1.9"
- Overbank field duplicate soil sample 03 collected at milepost 0.11 from 0.0 to 0.7 feet would be "ED-00.11-SL03-0.0-0.7-FD"

6.2 Management of Investigative-Derived Wastes

The field activities described in this FSP will generate investigative-derived wastes (IDW) consisting of water from decontamination of the equipment, used personal protective equipment, and sample core liners. There may also be excess soil and sediment, although it is anticipated that the majority of the soil and sediments collected will be transferred into the sample containers and delivered to the analytical laboratory. The wastes will be placed in appropriate containers and labeled with the waste type, the generation date and the generator information. Waste specific testing will be conducted, if appropriate. The volume of the IDW generated will be minimized to the least extent possible.

6.3 Decontamination Procedures

Effective decontamination procedures are required to prevent potential cross contamination. The decontamination procedures are in accordance with approved procedures. All equipment that comes into contact with potentially contaminated media will be decontaminated. Disposable sampling equipment will be used when applicable. Such equipment will be removed from protective packaging immediately before use and will be discarded after use. Reusable sampling equipment that is in direct contact with the media to be sampled will be decontaminated before each use. Decontamination will be conducted as follows:

1. Remove all visible contaminants (solids) using a non-phosphate laboratory detergent (e.g., Alconox).

2. Rinse with distilled or deionized water.

3. All water will be discarded into appropriate containers and disposed of properly.

6.4 Sample Handling, Tracking, and Custody Procedures

Sample custody must be strictly maintained and carefully documented each time the sample material is collected, transported, received, prepared, and analyzed. Custody procedures are necessary to ensure the integrity of the samples. Samples collected during the field investigation must be traceable from the time the samples are collected until disposal and/or storage, and their derived data are used in the final report. Sample custody is defined as (1) being in the sampler's possession; (2) being in the sampler's view, after being in the sampler's possession; (3) being locked in a secured container, after being in the sampler's possession; and (4) being placed in a designated secure area.

Field custody procedures will be implemented for each sample or sediment core collected. The Tetra Tech Team member performing the sampling, as overseen by the Project Quality Manager or designee, will be responsible for the care and custody of the samples or cores until they are properly transferred or dispatched. To ensure the integrity of the samples, the samples are to be maintained in a designated, secure area and/or be custody sealed in the appropriate containers prior to shipment.

6.5 Sampling SOPs

The following SOPs will be used during the site evaluation, if applicable for the site conditions:

- SOP – Check Valve Sampling
- SOP – Piston Core Sampling
- SOP – Russian Peat Borer Sampling
- SOP – Soil Recovery Auger
- SOP – Poling
- SOP – Sediment Logging
- SOP – Soil Logging

6.6 Soil/Sediment Core Processing

Soil and sediment core analytical sampling will occur in a dedicated on-land sampling area. Cores will be collected in 0 to 4-foot sections for sediment locations and 1 foot sections for soil locations (filled to the desired depth based on the requirements for that location). The cores will be capped and stored upright on the sampling vessel prior to transport to the sampling area. This will maintain the integrity of the core section, ensure minimal disturbance during transport, and allow safe handling.

All cores collected on a given day will be transported to the sampling area during or at the end of the day's activities. The core sections not logged and sampled the day they are collected will be stored upright overnight in a cooler in the building for subsequent processing. At that time, each core section will be split longitudinally and logged by Tetra Tech trained logging personnel. Sediment samples will be collected from the appropriate intervals (as specified in the applicable planning documents), homogenized, and placed in the proper containers for shipment to the laboratory.

7. LABORATORY INFORMATION

Investigative samples will be delivered by a courier or shipped under chain of custody to the laboratories.

7.1 Measurement and Performance Criteria

Generic measurement and performance criteria will be used. These criteria will ensure that data are sufficiently sensitive, precise, accurate, and representative to support site decisions. The criteria are summarized below.

- Sensitivity–Sensitivity is the ability of the method or instrument to detect the contaminant of concern and other target analytes at the level of interest. For this project, the laboratory quantitation limits are below the site action levels for PCBs as required.

- Accuracy–Accuracy is a measure of the agreement between an observed value and an accepted reference value. It is a combination of the random error (precision) and systematic error (bias), which are due to sampling and analytical operations. Accuracy is determined by percent recovery calculations of laboratory QC samples.

- Precision–Precision is a measure of the closeness of agreement among individual measurements. Precision is determined by relative percent difference (RPD) and/or standard deviation calculations for laboratory duplicate samples.

- Completeness–Completeness is a measure of the amount of valid data obtained compared to the amount of data that was planned to be collected. Completeness is project specific but is generally around 90 percent.

- Representativeness–Representativeness is a measure of the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Simply, this is the degree to which samples represent the conditions for which they were taken.

- Comparability–Comparability is a measure of the degree to which one data set can be compared with another. Some conditions of comparability of data sets are as follows: standardized sampling and analysis, consistency of reporting units, and standardized data format.

7.2 Data Quality Objectives

Data quality objectives address requirements that include when, where, and how to collect samples; the number of samples; and the limits on tolerable error rates. These steps should periodically be revisited as new information about a problem is learned.

Analytical sampling results for total PCBs will be compared to the EPA's Removal Management Levels (RMLs) residential and industrial criteria (based on a Hazard Quotient (HQ) of 3 for non-carcinogens chemical contaminants. RMLs are risk-based, although not necessarily protective for long term exposures, concentrations derived from standardized equations combining exposure assumptions with toxicity data from the Superfund program's hierarchy. RMLs are generic. In other words, they are calculated without site-specific information (e.g., the time- frame over which individuals may have been exposed to site contaminants). RMLs help identify areas, contaminants, and conditions where a removal action may be appropriate. Sites where contaminant concentrations fall below RMLs, are not necessarily “clean,” and further action or study may be warranted. In addition, sites with contaminant concentrations above the RMLs may not necessarily warrant a removal action dependent upon such factors as background concentrations, the use of site-specific exposure scenarios or other program considerations. This data will help determine the risk to the immediate community and the environment.

8. QUALITY CONTROL ACTIVITES

The following sections describe the field and laboratory quality control procedures.

8.1 Field Quality Control

QC samples will be collected for sediment and soil samples to evaluate the field sampling and decontamination methods, and the overall reproducibility of the laboratory analytical results. Specifically, QC samples will be collected at the following frequencies:

- Field duplicate samples
  - 1 per 10 investigative samples

- Matrix spike/matrix spike duplicate samples
  - 1 per 20 investigative samples

Field duplicate samples will be collected from the homogenized sample removed from the same disposable polycarbonate core tube as its associated investigative sample. Field duplicate samples will be processed, stored, packaged, and analyzed by the same methods as the investigative samples. Sample nomenclature specific to QC samples is listed in Section 5.1. Corrective actions may include resampling, reassessment of the laboratory's methods, and/or the addition of data qualifiers to laboratory results.

8.2 Analytical Quality Control

QC for analytical procedures will be performed at the frequency described in the laboratory SOPs. In addition, method-specific QC requirements will be used to ensure data quality.

8.3 Performance Evaluation Samples

Performance evaluation samples will not be used in this site assessment.

8.4 Documentation, Records, and Data Management

The laboratories will be expected to provide analytical results in electronic data deliverable (EDD) and report formats, with QA/QC data included for a Level II data report (case narrative, investigated data results summary, and QC sample summary results). Laboratory-generated data will be imported to a project database for mapping, reporting, and archival activities. Laboratory reports and data validation reports will be archived in the project file.

8.5 Data Validation Requirements

Analytical and QA/QC data will be reviewed to determine if the data are usable or require additional qualification. A data validation report will be produced for each discrete report received from each laboratory.

8.6 Data Analysis

The data collected from the field and laboratory analysis will be provided for statistical analysis of the data. The data will be reviewed to determine the likely spatial extent of elevated PCB concentrations.

9.0 REFERENCES

Anchor QEA 2009. *Final Draft Phase IV Report for Elliott Ditch/Wea Creek Investigation*

USDA. 1958. “Soil Survey of Tippecanoe County, Indiana.” Washington, D.C.

TABLES

Table 1
FSP Revision Form

Site: Elliott Ditch

Date	Revision Number	Proposed Change to FSP/QAPP	Reason for Change of Scope/Procedures	FSP Section Superseded	Requested By	Approved By

Table 2
Sampling and Analysis Summary

Site: Elliott Ditch

Matrix	Analytical Parameters	Number of Sampling Locations	Number of Samples[1]	Number of Field Duplicates	Number of MS/MSDs	Number of Blanks (Trip, Field, Equip. Rinsate)[2]	Total Number of Samples to Lab
Soil	Total PCBs	33	99	10	5	0	114
Sediment	Total PCBs	13	39	4	2	1	46

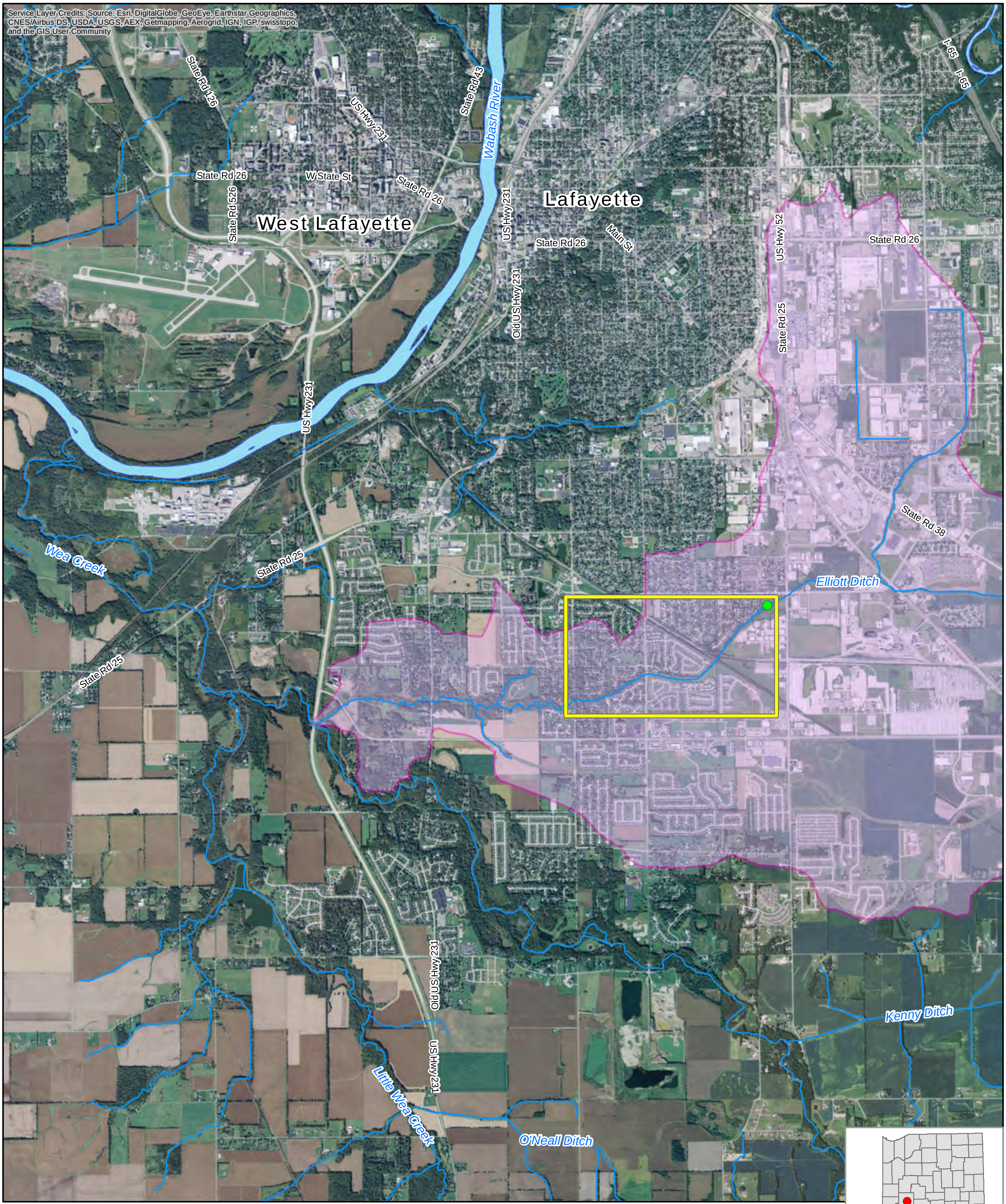
Notes:
[1] Number of samples estimated via the assumption of 3 sediment/soil layers per coring location.
[2] Core tubes are single use disposable. A equipment rinsate sample will be collected if the piston sampler is used to collect sediment cores.

MS/MSD – Matrix Spike/Matrix Spike Duplicate

Table 3. Sample Identification and Justification Summary

Location ID	Reach	Primary Sampler	Latitude	Longitude	Target Core Depth	Geomorphic Position	Justification
ED-00.08-SD02	1	Check Valve/Piston Corer/Russian Peat Borer	40.3799	-86.86106	4 ft	In-channel	Possible area of depostioin due to bank armoring
ED-00.08-SL01	1	Auger/Core Sampler	40.37997	-86.86115	2 ft	Upland	Verify the absence on RDB upland
ED-00.08-SL03	1	Auger/Core Sampler	40.37982	-86.86098	2 ft	Levee	Possible man-made levee on LDB
ED-00.08-SL04	1	Auger/Core Sampler	40.37963	-86.86074	2 ft	Upland swale	Spatial coverage on lower LDB surface
ED-00.25-SD01	1	Check Valve/Piston Corer/Russian Peat Borer	40.37834	-86.86362	4 ft	In-channel	Inside of the meader bend (depostional surface)
ED-00.25-SL02	1	Auger/Core Sampler	40.3783	-86.86355	2 ft	Levee	Inside of the meader bend on levee should be realtively untouched by stream erosion
ED-00.25-SL03	1	Auger/Core Sampler	40.37812	-86.8633	2 ft	Upland swale	Spatial coverage on lower LDB surface
ED-00.39-SD02	1	Check Valve/Piston Corer/Russian Peat Borer	40.37673	-86.86501	4 ft	In-channel	Upstream end of depostional area (implied by a fine-grain bed type)
ED-00.39-SL01	1	Auger/Core Sampler	40.37676	-86.8651	2 ft	Upland	RDB bank is ~ 0.5 ft lower in elevation than LDB which would cause flood waters to naturally flow towards the RDB
ED-00.39-SL03	1	Auger/Core Sampler	40.37669	-86.8649	2 ft	Levee	Possible man-made levee on LDB
ED-00.39-SL04	1	Auger/Core Sampler	40.37657	-86.86459	2 ft	Upland swale	Spatial coverage on lower LDB surface
ED-00.47-SD02	1	Check Valve/Piston Corer/Russian Peat Borer	40.37583	-86.86592	4 ft	In-channel	Downstream of the depostional area (implied by coarse-grain bed type)
ED-00.47-SL01	1	Auger/Core Sampler	40.37586	-86.86606	2 ft	Upland	The channel banks are lower than upstream and RR bridge downstream may cause ponding during flooding
ED-00.47-SL03	1	Auger/Core Sampler	40.37578	-86.86581	2 ft	Levee	The channel banks are lower than upstream and RR bridge downstream may cause ponding during flooding
ED-00.47-SL04	1	Auger/Core Sampler	40.37566	-86.86548	2 ft	Upland swale	Spatial coverage on lower LDB surface
ED-00.51-SD02	1	Check Valve/Piston Corer/Russian Peat Borer	40.37526	-86.86635	4 ft	In-channel	In-channel location near original Anchor location (Possible petroleum sheen observed during topo survey)
ED-00.51-SL01	1	Auger/Core Sampler	40.37531	-86.86651	2 ft	Upland	Characterize upland
ED-00.51-SL03	1	Auger/Core Sampler	40.37523	-86.86624	2 ft	Upland	Characterize upland (possible dredge spoils pile on LDB)
ED-00.60-SD02	2	Check Valve/Piston Corer/Russian Peat Borer	40.37426	-86.86753	4 ft	In-channel	Pool - soft sediment observed during topographic survey
ED-00.60-SL01	2	Auger/Core Sampler	40.37433	-86.86762	2 ft	Upland	Verify the absence on RDB of the upland
ED-00.60-SL03	2	Auger/Core Sampler	40.37421	-86.86746	2 ft	T-4	Furthest upstream T-4 surface within study area. Deposition on the T-4 surface is possible after large flood events.
ED-00.72-SD03	2	Check Valve/Piston Corer/Russian Peat Borer	40.37314	-86.86914	4 ft	In-channel	In-channel location is upstream of knickpoint where soft sediment was noted.
ED-00.72-SL01	2	Auger/Core Sampler	40.37326	-86.86918	2 ft	Upland	Verify the absence on RDB of the upland
ED-00.72-SL02	2	Auger/Core Sampler	40.37317	-86.86915	2 ft	Floodplain	Small floodplain surface on inside meander may have deposited fine grain sediment
ED-00.72-SL04	2	Auger/Core Sampler	40.3731	-86.86912	2 ft	T-4	Deposition on the T-4 surface is possible after large flood events
ED-00.82-SD02	2	Check Valve/Piston Corer/Russian Peat Borer	40.37315	-86.87107	4 ft	In-channel	Pool - soft sediment observed during topographic survey
ED-00.82-SL01	2	Auger/Core Sampler	40.37324	-86.87104	2 ft	Upland	Verify the absence on RDB of the upland
ED-00.82-SL03	2	Auger/Core Sampler	40.3731	-86.87114	2 ft	Depression	Man-made depression due to outfall may collect fine grain sediment during flooding
ED-00.82-SL04	2	Auger/Core Sampler	40.37298	-86.87106	2 ft	T-4	Deposition on the T-4 surface is possible after large flood events
ED-01.03-SD02	2	Check Valve/Piston Corer/Russian Peat Borer	40.37371	-86.87484	4 ft	In-channel	Deposition on inside menader bend possible
ED-01.03-SL01	2	Auger/Core Sampler	40.37379	-86.87479	2 ft	Upland	Verify the absence on RDB of the upland
ED-01.03-SL03	2	Auger/Core Sampler	40.37356	-86.87493	2 ft	T-4	Deposition on the T-4 surface is possible after large flood events
ED-01.14-SD02	3	Check Valve/Piston Corer/Russian Peat Borer	40.37327	-86.87695	4 ft	In-channel	Downstream of concrete channel section, possible deposition area
ED-01.14-SL01	3	Auger/Core Sampler	40.37334	-86.87708	2 ft	T-7	Furthest upstream T-7 surface within study area
ED-01.14-SL03	3	Auger/Core Sampler	40.37323	-86.87686	2 ft	T-6	Furthest upstream T-6 surface within study area
ED-01.24-SD02	3	Check Valve/Piston Corer/Russian Peat Borer	40.37261	-86.87859	4 ft	In-channel	In-channel near the inside of meander bend
ED-01.24-SL01	3	Auger/Core Sampler	40.37272	-86.87857	2 ft	T-6	Characterize T-6 surface on outside meander bend
ED-01.24-SL03	3	Auger/Core Sampler	40.37258	-86.87854	2 ft	T-7	Characterize T-7 surface on inside of slight meander bend
ED-01.39-SD02	3	Check Valve/Piston Corer/Russian Peat Borer	40.37153	-86.88094	4 ft	In-channel	In-channel near sand bar
ED-01.39-SL01	3	Auger/Core Sampler	40.37163	-86.881	2 ft	T-6	Located in shallow depression on T-6 surface
ED-01.39-SL03	3	Auger/Core Sampler	40.37148	-86.88091	2 ft	T-1	Furthest upstream T-1 surface in study area
ED-01.39-SL04	3	Auger/Core Sampler	40.37141	-86.88088	2 ft	Upland	Verify the absence on LDB of the upland
ED-01.49-SD03	3	Check Valve/Piston Corer/Russian Peat Borer	40.37102	-86.88256	4 ft	In-channel	Channel width increases possibly causing depostional area
ED-01.49-SL01	3	Auger/Core Sampler	40.37118	-86.88255	2 ft	T-7	Characterize T-7 surface
ED-01.49-SL02	3	Auger/Core Sampler	40.37111	-86.88255	2 ft	T-6	Characterize T-6 surface
ED-01.49-SL04	3	Auger/Core Sampler	40.37092	-86.88255	2 ft	T-6	Characterize T-6 surface

FIGURES



Tetra Tech, Inc.
630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

N
0 0.5 1 Miles
1:50,000

Figure 1 - Site Location Map
Elliott Ditch - Lafayette, Tippecanoe County, Indiana

Alcoa Outfall 001
River or Stream
Site Boundary
Elliott Ditch Watershed

Drawn By: MEB Date Created: 1/12/2016 Last Revised: 1/20/2016 Approved By: DBR Document Name: AlcoaElliottDitchSiteLocation.mxd File Path: F:\Alcoa Elliott Ditch\GIS\AlcoaElliottDitchSiteLocation.mxd

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630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

N

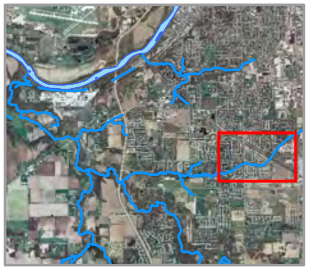
0 625 1,250 Feet

1:8,500

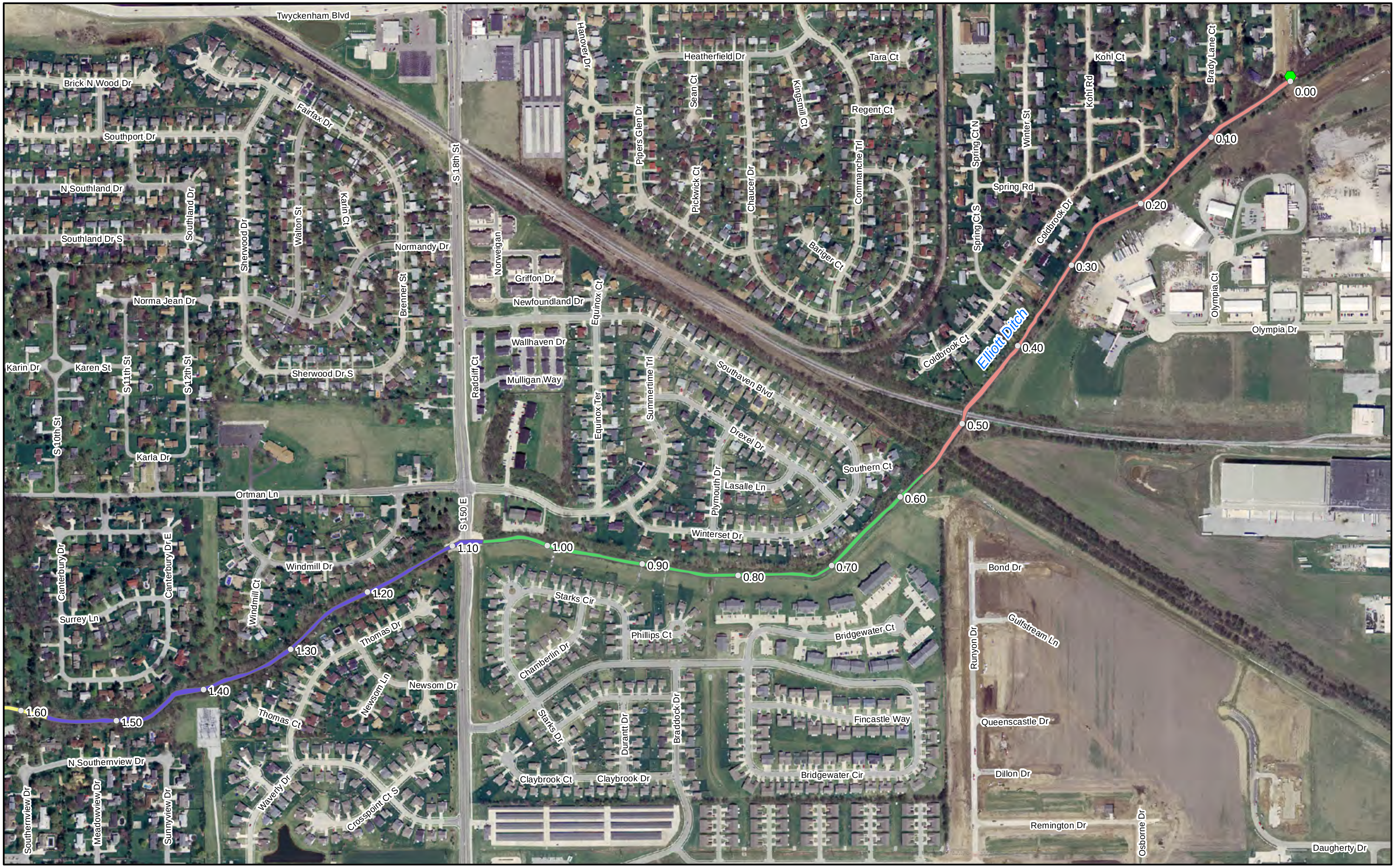
Figure 2 - Site Overview Map

Elliott Ditch - Lafayette, Tippecanoe County, Indiana

- Proposed Sample Location
- Milepost
- Alcoa Outfall 001



Drawn By: MEB Date Created: 1/12/2016 Last Revised: 1/19/2016 Approved By: DBR Document Name: AlcoaElliottDitchSiteOverview.mxd File Path: F:\Alcoa Elliott Ditch\GIS\AlcoaElliottDitchSiteOverview.mxd



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Sheboygan, WI 53081
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N

0 625 1,250 Feet

1:8,500

Figure 3 - Stream Reaches

Elliott Ditch - Lafayette, Tippecanoe County, Indiana

Milepost

Alcoa Outfall 001

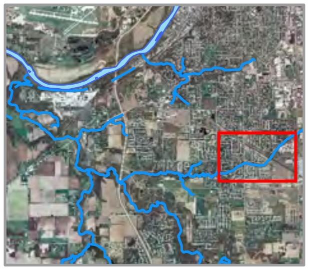
Stream Reach

Reach 1

Reach 2

Reach 3

Reach 4



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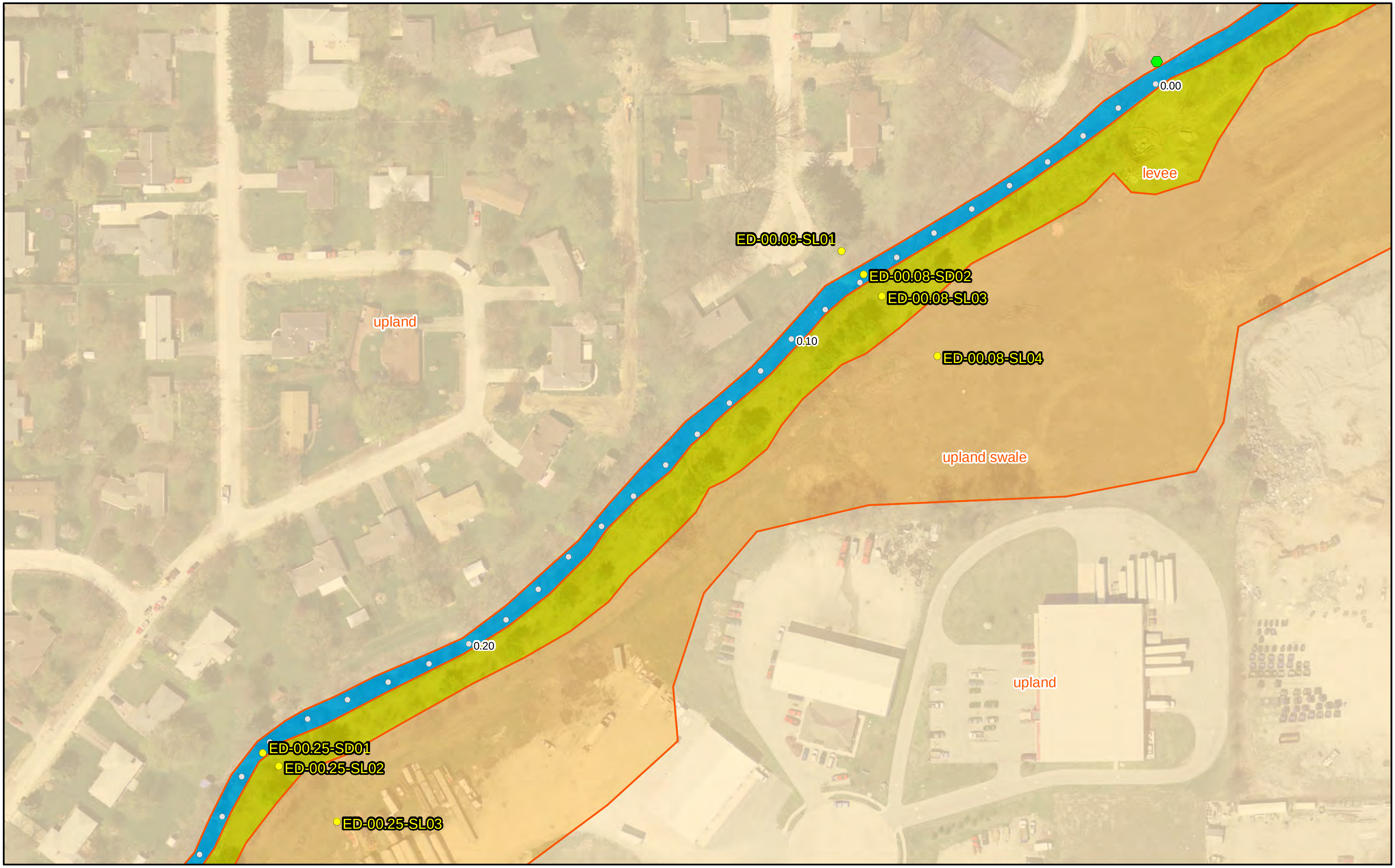

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630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

N 0 120 240 Feet
1:1,850

Figure 4 - Proposed Sample Locations & Geomorphic Surfaces
Elliott Ditch - Lafayette, Tippecanoe County, Indiana

- Milepost
- Proposed Sample Location
- Alcoa Outfall 001
- Geomorphic Surface Boundary

Geomorphic Surface
- stream
- levee
- upland swale
- upland

Drawn By: MEB Date Created: 6/17/2013 Last Revised: 1/20/2016 Approved By: DBR Document Name: AlcoaElliottDitchGeoSurfaces.mxd File Path: F:\Alcoa Elliott Ditch\GIS\AlcoaElliottDitchGeoSurfaces.mxd

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Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

N

0 120 240 Feet

1:1,850

Figure 4 - Proposed Sample Locations & Geomorphic Surfaces

Elliott Ditch - Lafayette, Tippecanoe County, Indiana

Milepost

Proposed Sample Location

Geomorphic Surface Boundary

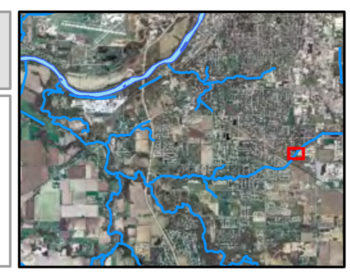
Geomorphic Surface

stream

levee

upland swale

upland



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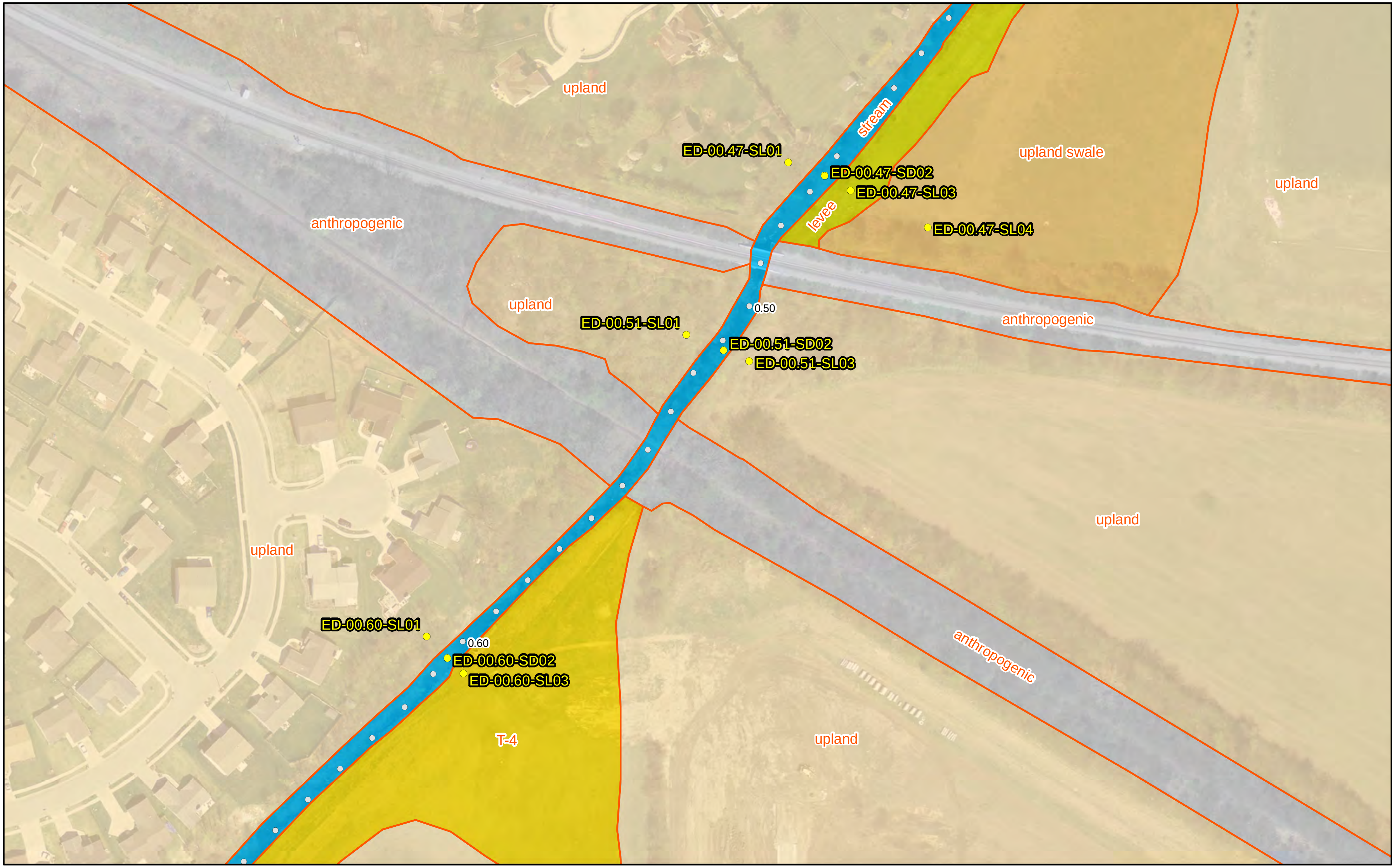

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630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
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Figure 4 - Proposed Sample Locations & Geomorphic Surfaces

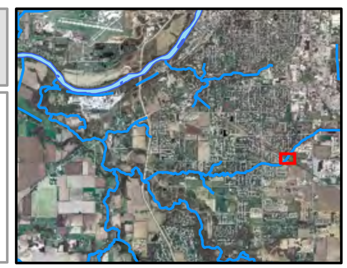
Elliott Ditch - Lafayette, Tippecanoe County, Indiana

Milepost
Proposed Sample Location
Geomorphic Surface Boundary

Geomorphic Surface

stream
T-4
anthropogenic
levee
upland swale
upland

N
0 120 240 Feet
1:1,850



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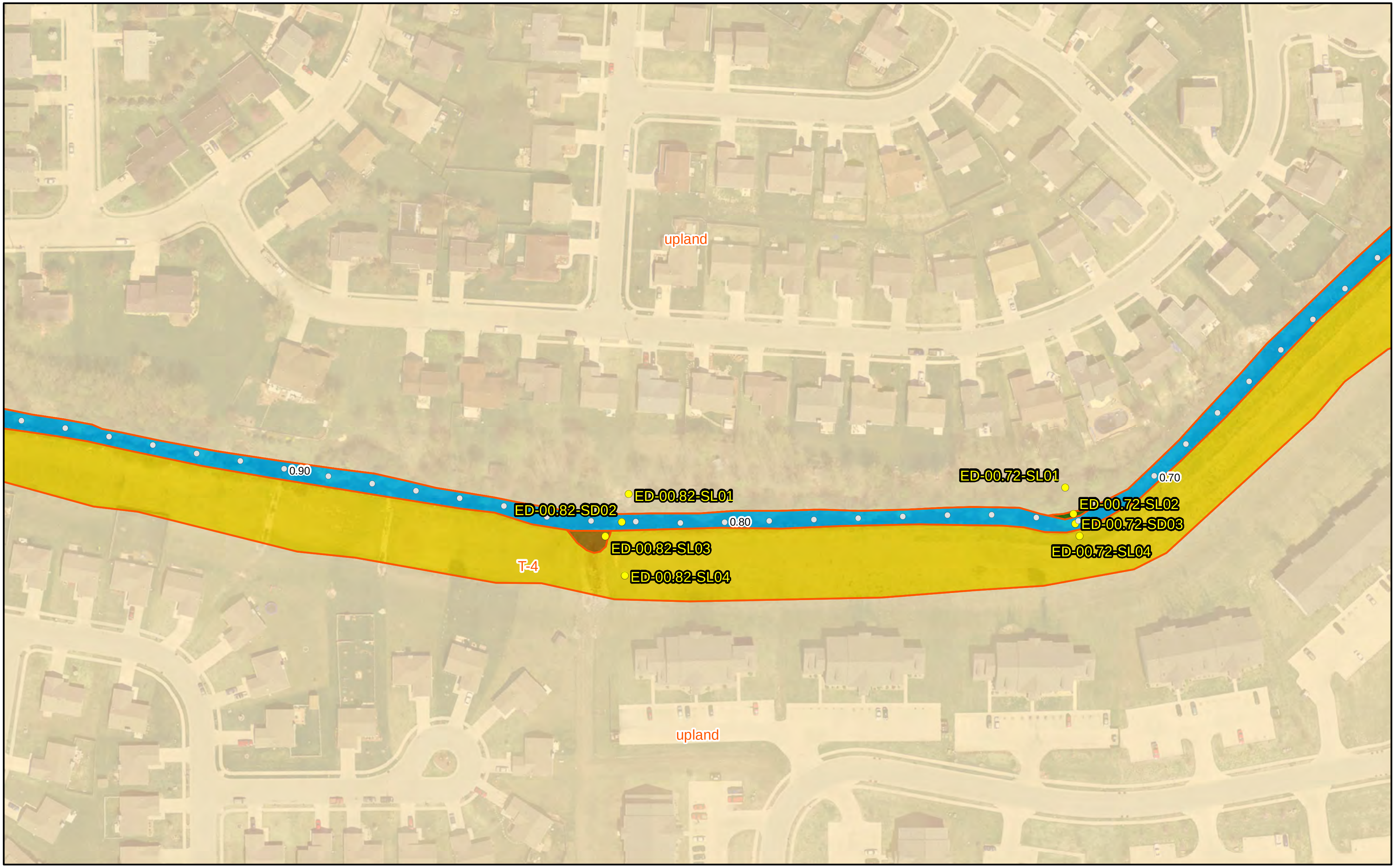

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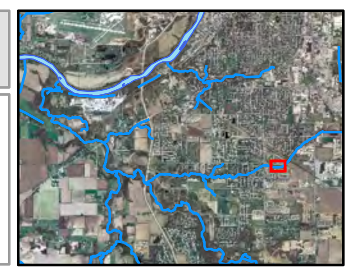
Fax: (920) 457-2357

N
0 120 240 Feet
1:1,850

Figure 4 - Proposed Sample Locations & Geomorphic Surfaces
Elliott Ditch - Lafayette, Tippecanoe County, Indiana

Milepost
Proposed Sample Location
Geomorphic Surface Boundary

Geomorphic Surface
stream
floodplain
T-4
depression
upland



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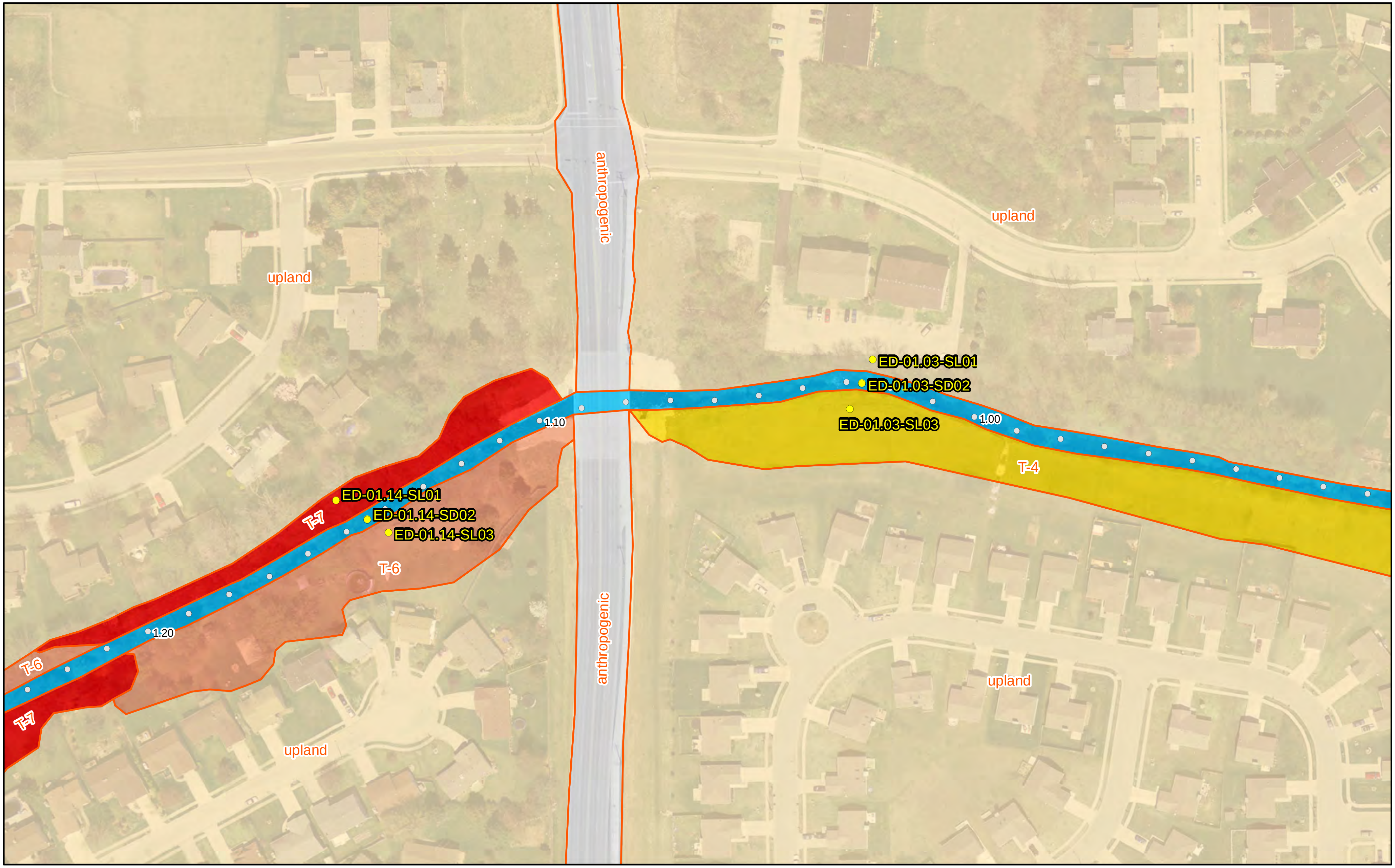

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630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
Tel: (920) 452-7962
Fax: (920) 457-2357

N
0 120 240 Feet
1:1,850

Figure 4 - Proposed Sample Locations & Geomorphic Surfaces

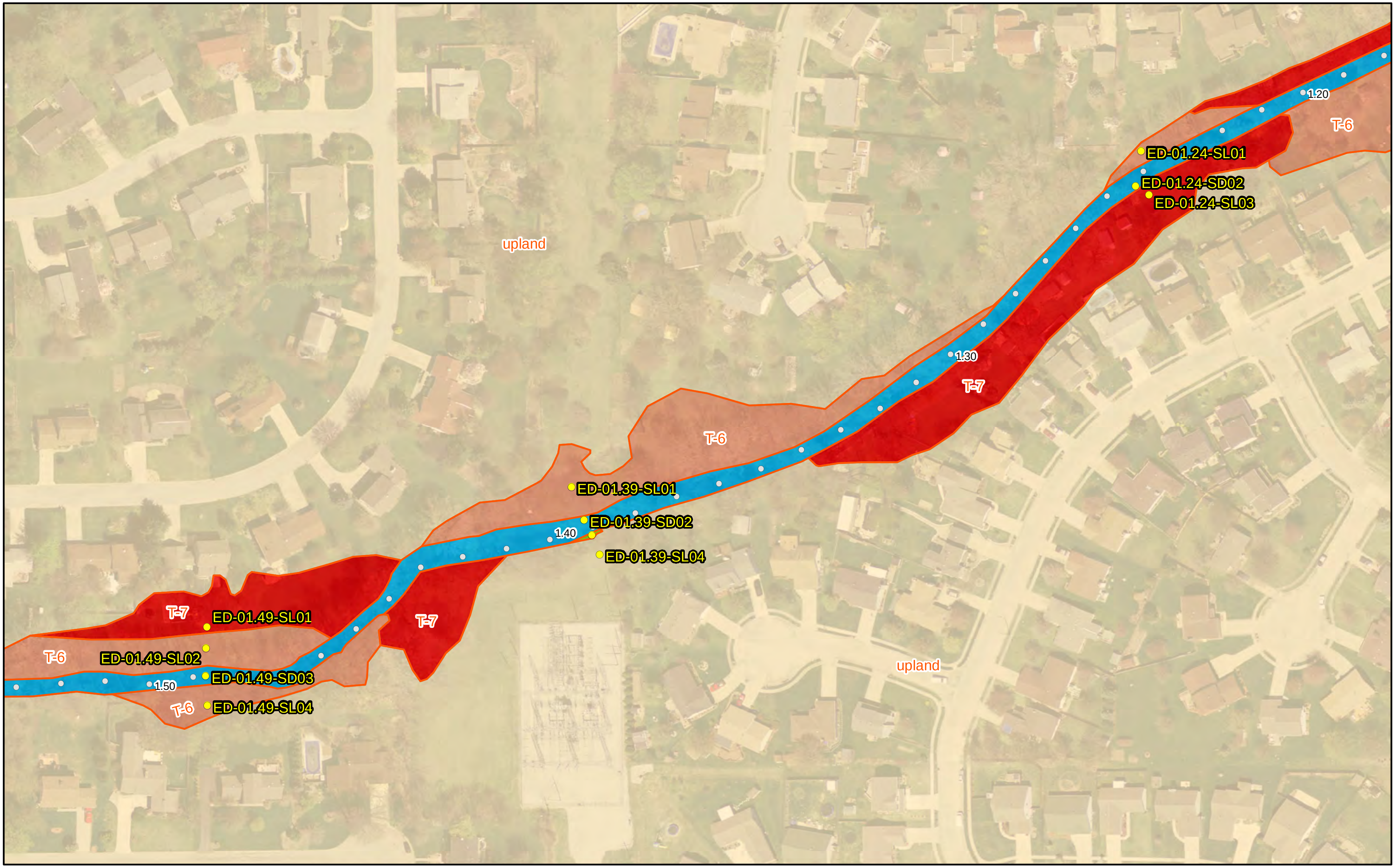
Elliott Ditch - Lafayette, Tippecanoe County, Indiana

- Milepost
- Proposed Sample Location
- Geomorphic Surface Boundary

Geomorphic Surface

- stream
- T-4
- T-6
- T-7
- anthropogenic
- upland

Drawn By: MEB Date Created: 6/17/2013 Last Revised: 1/20/2016 Approved By: DBR Document Name: AlcoaElliottDitchGeoSurfaces.mxd File Path: F:\Alcoa Elliott Ditch\GIS\AlcoaElliottDitchGeoSurfaces.mxd



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630 Riverfront Drive, Suite 100
Sheboygan, WI 53081
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N
0 120 240 Feet
1:1,850

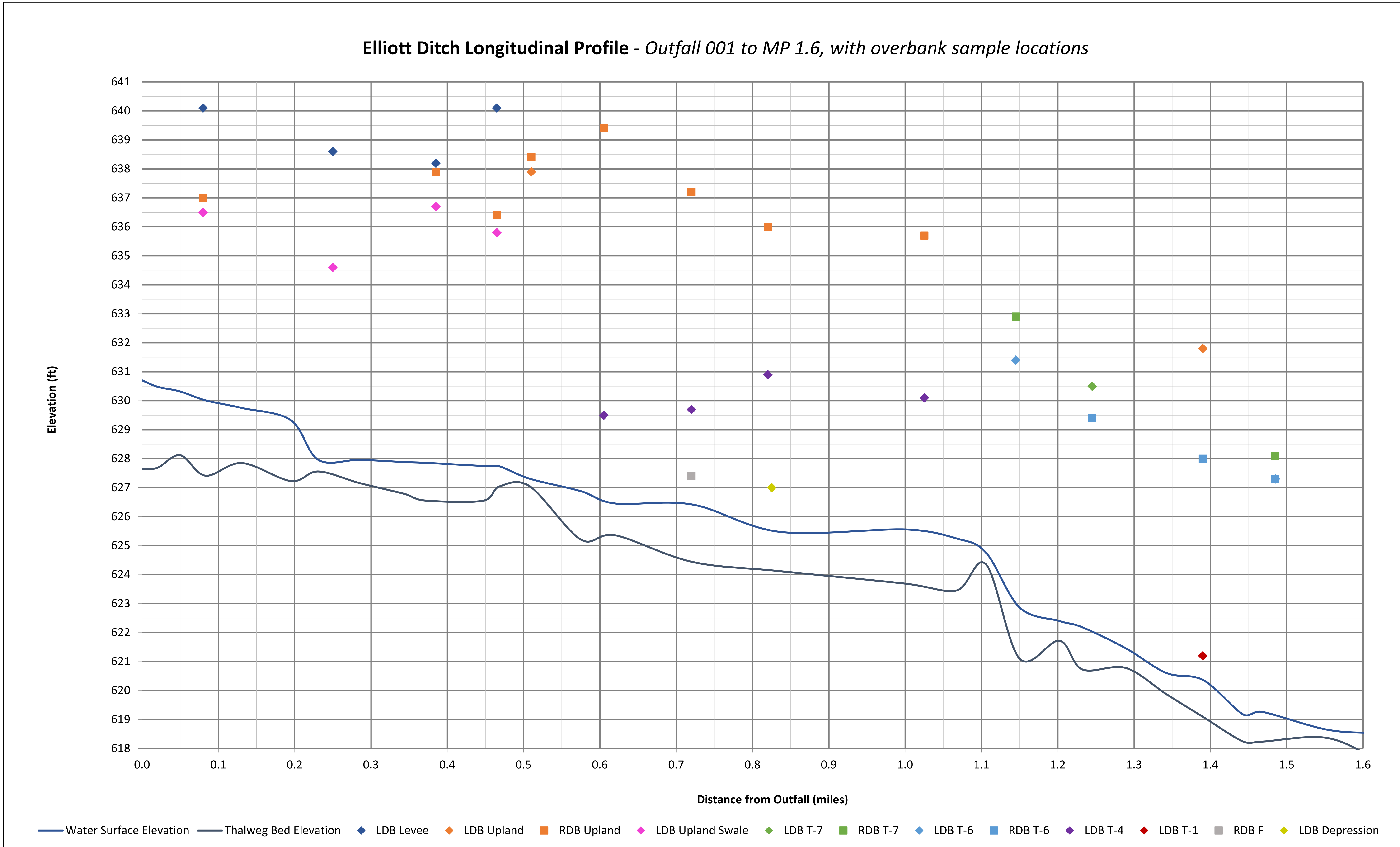
Figure 4 - Proposed Sample Locations & Geomorphic Surfaces

Elliott Ditch - Lafayette, Tippecanoe County, Indiana

Milepost
Proposed Sample Location
Geomorphic Surface Boundary

Geomorphic Surface
stream
T-1
T-6
T-7
upland

Drawn By: MEB Date Created: 6/17/2013 Last Revised: 1/20/2016 Approved By: DBR Document Name: AlcoaElliottDitchGeoSurfaces.mxd File Path: F:\Alcoa Elliott Ditch\GIS\AlcoaElliottDitchGeoSurfaces.mxd



Elliott Ditch Longitudinal Profile - Outfall 001 to MP 1.6, with overbank sample locations
Elevation (ft)
641
640
639
638
637
636
635
634
633
632
631
630
629
628
627
626
625
624
623
622
621
620
619
618
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
Distance from Outfall (miles)
Water Surface Elevation
Thalweg Bed Elevation
LDB Levee
LDB Upland
RDB Upland
LDB Upland Swale
LDB T-7
RDB T-7
LDB T-6
RDB T-6
LDB T-4
LDB T-1
RDB F
LDB Depression

ATTACHMENT A

STANDARD OPERATING PROCEDURE
CHECK VALVE SAMPLING

Elliott Ditch

Lafayette, IN

Prepared by:
Tetra Tech CES, Inc.

Prepared for:
Tetra Tech CES, Inc.
Elliott Ditch Sampling Plan

January 2016

ACRONYM LIST

GPS	Global Positioning System
NAD	North American Datum
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
RTK	Real Time Kinematic
SHSP	Site Health and Safety Plan
SOP	Standard Operating Procedure

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to establish a standard procedure for the collection of sediment core samples using a check valve core sampler. Procedures are described for the collection of soft sediments and fine-grained sands. This SOP should be consulted during the preparation of any plan requiring procedures for sediment sample collection using a check valve core sampler.

2.0 SUMMARY OF METHOD

A tape measure or pole with minimum graduations of 0.1 feet attached to a 6-inch diameter disc is used to determine the depth from the water surface to sediment surface prior to sampling. In the event of deep/swift water, a lead line will be permissible to determine the depth from the water surface to sediment surface. The check valve sampler is advanced to the specified depth and retracted. The core sample retrieved is capped on the bottom and removed from the check valve sampler. The core sample is then capped on top, labeled and stored upright in a rack. The location, date-time, sample advancement length from the sediment surface, sediment core recovery length, and percent recovery are documented using the data collector (e.g., Leica Viva) or alternative documentation method. The project target for sample recovery is 80 percent. If the initial sampling does not obtain at least 80 percent recovery, additional attempts will be made using the equipment and methods determined most appropriate by the Field Manager or his/her designee in the field.

3.0 SAFETY

All work must be performed under the approved Site Health and Safety Plan (SHSP) for the project. The SHSP identifies proper personal protective equipment (PPE) and potential site/work hazards. Daily safety meetings will be conducted before work begins.

4.0 APPARATUS AND EQUIPMENT

- Vessel (sampling platform) that complies with U.S. Coast Guard regulations with a minimum of 3 anchors or two anchoring spuds
- PPE specified in the SHSP
- Tape measure, lead line, and/or pole with minimum graduations of 0.1 feet attached to disc to determine depth from water surface to sediment surface
- Check valve sampler
- Core tubes (typically about 3-inch diameter) with end caps
- Core rack used to store sediment cores vertically
- Electronic data storage unit for core collection documentation
- Nut driver and/or Phillips screwdriver
- Duct and/or electrical tape
- Permanent marker/paint pen to label core liners
- Real Time Kinematic (RTK) Global Positioning System (GPS) or equivalent, with horizontal accuracy of ± 1 meter

5.0 PROCEDURES

5.1 Sample Location Positioning

Positioning for sampling will be achieved using an RTK GPS, or equivalent, that is capable of locating stations with an accuracy and repeatability of ±1 meter.

5.2 Depth from Water Surface to Sediment Surface

A tape measure, pole with minimum graduations of 0.1 feet attached to a disc, or lead line will be used to determine the depth from the water surface to sediment surface prior to sampling. The depth to sediment from the water surface is used to establish a reference for sample advancement.

5.3 Core Sample Collection

1. Add the depth that the sample core will be advanced into the sediment to the measured depth to sediment from the water surface. Mark the total depth with tape on the sample rod or tube after the sample tube is connected to the check valve. Use this mark as a reference for depth of advancement from the water surface.

2. Advance the sampler into the sediment surface slowly to the specified depth. Rotate sampler to shear core sample from sediment column. Retract the sampler.

3. Cap the bottom of the core. Remove the core from the sampler. Cap the top of core. Place duct tape over the core caps. Use permanent marker to denote the top of the core with the location identification (ID), date, time, and sample recovery length/sample advancement length and store it in an upright position.

4. Record location, date, time, core sample advancement length, sample recovery length, and percent recovery ([sample recovery length /sample advancement length] x 100) in electronic data collection device or using alternative documentation method.

Note: The project target for sample recovery is 80 percent. Excess sediment that is not used in the processed sample will be discarded into the appropriate waste container. A core barrel will be reused at the same sample location but will not be reused at another sample location unless it is decontaminated.

STANDARD OPERATING PROCEDURE
PISTON CORE SAMPLING

Elliott Ditch

Lafayette, IN

Prepared by:
Tetra Tech CES, Inc.

Prepared for:
Tetra Tech CES, Inc.
Elliott Ditch Sampling Plan

January 2016

ACRONYM LIST

GPS	Global Positioning System
NAD	North American Datum
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
RTK	Real Time Kinematic
SHSP	Site Health and Safety Plan
SOP	Standard Operating Procedure

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) establishes standards for collecting sediment samples using a piston core sampling device. Procedures are described for the collection of soft sediments and fine-grained sands. This SOP should be consulted during the preparation of any plan requiring procedures for sediment sample collection using a piston core sampler.

A piston core device can be used to collect sediment samples for polychlorinated biphenyl (PCB) analysis. This device can be used to collect continuous, undisturbed, surface sediment samples up to 7 feet long (depending on the type of underlying deposit), in water depths up to approximately 32 feet.

2.0 SUMMARY OF METHOD

The techniques and tools for sampling soft sediment with a core tube depend on river current, depth of water, substrate characteristics, and the objective of the sampling program. Once a sampling location is determined, the sampling vessel is anchored or spudded in place using at least three anchors or two spuds. Typically, the boat is anchored with the front or back facing directly into the wind or current, whichever exerts a stronger force on the sampling vessel.

A sub-meter accuracy reference surface location will be obtained at each sample location using Real Time Kinematic Global Positioning System (RTK GPS) equipment and recorded.

The reference surface elevation will be used to establish the depth-to-sediment surface at each sample location. Sampling and depth–to-sediment surface measurements will be conducted by experienced personnel who can differentiate the water/sediment surface interface using methods described in this SOP. Prior to sampling, a surveyor's rod, graduated pole (marked with minimum 0.1 foot graduations and attached to a 6-inch diameter disc), or lead line will be used to determine the vertical distance from the reference surface to the sediment surface. This distance, plus the target sample depth, will be marked on the sampler core tube or on the aluminum rod attached to the piston sampler head.

The sampling device will be slowly lowered into the water just below the surface. This slow motion will allow the tube to be completely filled with water, eliminating any vacuum effect that can occur. After the core tube has filled with water, it will be lowered completely to the marked depth. The pull rope or cable that is attached to the piston core will be pulled gently up towards the surface of the water/sampling platform until it is taut and then it will be attached to an anchor point such as a sampling vessel or sampling platform with the use of a t-bar. Once the pull rope or cable has been attached, the sampler rod will be first advanced/pushed and if required driven with a 10 pound drive hammer into the substrate until refusal or until the target depth has been reached. When performed, the distance the core tube is driven/hammered will be noted in the daily field log sheet. Once the piston core is pushed to refusal or desired depth, the depth of core advancement will be measured and recorded.

Upon retrieval of the core tube, the bottom of the core sample will be capped underwater. Two holes will be drilled in the core tube between the top of the sediment and the bottom of the piston, with the bottom hole no closer than 0.5 inch from the top of the captured sediment. Water will be allowed to drain. The thickness of the sediment recovered in the core tube will be measured and recorded, and the contents of the core tube will be described and documented in the daily field logs. The sampling head and piston will then be removed from the core tube. After the water has drained from the core, an end cap will be placed on top of the core tube with the sample location, date, time, total advancement, and recovery noted. Both the top and bottom end caps should be taped at this time using either duct or electrical tape. The sample core tube will then be placed upright in a storage rack and all data will be recorded in the daily field logs and also in the Leica Viva or equivalent system.

The percent recovery (recovered sediment length/tube advancement length x 100) will be determined by measuring the sediment length in the recovered core and comparing that value to the distance the core was advanced. The recovery must be equal to or greater than 80 percent. If the required recovery is not reached on the first attempt, the first core should be saved and the location should be resampled (following the listed procedures). If the second attempt results in a greater recovery than the first attempt, and there is a recovery of 80 percent or greater, the first core will be brought back to the processing area and properly disposed of.

After each attempt, the sampler will be decontaminated following the procedures outlined below:

- Remove all visible contaminants (solids) using a brush and a non-phosphate laboratory detergent (e.g., Alconox).
- Rinse with distilled or deionized water.

3.0 SAFETY

All work must be performed under the approved Site Health and Safety Plan (SHSP) for the project. The SHSP identifies proper personal protective equipment (PPE) and potential site/work hazards. Daily safety meetings will be conducted before work begins.

4.0 APPARATUS AND EQUIPMENT

- Vessel (sampling platform) that complies with U.S. Coast Guard regulations with a minimum of three anchors or two anchoring spuds.
- PPE specified in the SHSP
- Tape measure, lead line, or graduated pole with minimum graduations of 0.1 foot and 6-inch diameter disc to determine water depth
- Pole to measure soft sediment thickness with minimum graduations of 0.1foot
- Piston core sampler
- Plastic core tubes (3-inch outside diameter) with end caps
- Core rack to store sediment cores vertically
- Duct tape
- Electrical tape
- Permanent marker/paint pen to label core tubes
- Measuring tape to measure sample recovered

- Real Time Kinematic (RTK) Global Positioning System (GPS) or equivalent, with horizontal accuracy of ± 1 meter
- Truck with core rack to transport sediment cores vertically
- T-bar
- Nut driver and/or Phillips screwdriver
- Alconox
- Deionized water
- Aluminum sampling rod, length as needed per field conditions
- Scrub brushes
- Garden sprayer

5.0 PROCEDURES

5.1 Sample Location Positioning

Positioning for sample collection will be achieved using an RTK GPS, or equivalent, that is capable of locating stations with an accuracy and repeatability of ±1 meter.

5.2 Water and Sediment Surface Elevations

A reference surface elevation will be established for all vertical measurements using the boat deck or water surface. The elevation for the reference elevation will be obtained with RTK GPS. If the boat deck is the reference surface elevation, the water surface elevation will be documented once before daily sampling is initiated and once after completion of sampling. The water surface elevation will be obtained by measuring (tape or equivalent) the vertical distance from the boat deck to the water surface. The sediment surface elevation will be determined using the reference surface elevation prior to collection of each sample. A surveyor’s rod, graduated pole, lead line, or tape measure (secondary) will be used to measure vertical distance from the reference surface to the sediment surface. The measuring device will have minimum graduations of 0.1 foot and will be attached to a 6-inch diameter disc. The measurement of the depth from the reference elevation (water surface or boat deck) to sediment surface will be conducted by experienced personnel that are capable of establishing the interface between the water and sediment surface. Sample advancement will be done by taping the piston core sampler rod to indicate the advancement depth from the established reference. The significant figures used to record measurements will be dependent on conditions. Data should be reported within the precision of measurement that is possible at the time of measurement considering wave action, boat stability, or other factors. Work should be conducted when the precision of measurement is at least 0.1 foot so all measurements can be documented accordingly. All data will be documented in an electronic database and/or field forms.

5.3 Sample Collection

The sample collection method is as follows:

1. If the boat deck is the reference surface elevation, measure (tape or equivalent) the vertical distance from the boat deck to the water surface before and after daily sampling to obtain the water surface elevation.

2. Mark the sum of the measured distance (result of step 1) and the target sample depth (below the sediment bed) on the sampler core tube or on the aluminum rod attached to the piston sampler head using colored electrical tape.

3. Slowly lower the sampling device to just below the surface of the water (leaving the pull rope or cable attached to the piston core on the deck of the boat) to allow the tube to be completely filled with water, eliminating any vacuum effect that can occur.

4. Lower sampler to the marked depth.

5. Gently pull the pull rope or cable that is attached to the piston core up towards the surface of the boat until it is taut. Attach the rope or cable to the T-bar that is stabilized on the boat or sampling platform.

6. The sampler rod will be first advanced/pushed by hand, and if required, driven with a 10 pound drive hammer into the substrate until refusal or until the target depth has been reached. When performed, note the distance the core tube is advanced/driven on the daily field log sheet.

7. Measure and record the depth of core advancement once the piston core is pushed to refusal or desired depth. Retrieve the sample, place the bottom cap, and wipe free any sediment that remains on the core tube exterior and bring sampler/core tube to the deck of the sampling boat.

8. Drill two holes in the core tube between the top of the sediment and the bottom of the piston, with the bottom hole no closer than 0.5 inches from the top of the captured sediment.

9. Drain water from the core tube.

10. Remove the sampling head and piston from the core tube.

11. Place an end cap on top of the core tube and note the sample ID, date, time, total advancement, and recovery.

12. Record in the daily field log: 1) the measurement of the thickness of the sediment recovered in the core tube, 2) a description of the sediment composition, and 3) the percent recovery (recovered sediment length/tube advancement length x 100) for each core while on the sampling vessel by measuring the sediment length in the recovered core and comparing that value to the distance the core was advanced. Note: The project target for sample recovery is 80 percent.

    - If the required recovery is not reached on the first attempt, save the first core, off-set from the original sample position, and resample the location following the listed procedures.

    - If the second attempt results in a greater recovery than the first attempt, and the recovery is 80 percent or greater, the first core will be brought back to the processing facility and properly disposed of.

    - If the required recovery is not reached on the second attempt, off-set again and resample the location using a different sampling device.

13. Place upright in a storage rack and record all data in the daily field logs and also in the Leica Viva or equivalent system.

14. Decontaminate the piston with Alconox solution and rinse with deionized water.

15. Collect rinsate sample as required (see project QAPP) by pouring deionized water over and into the top of the decontaminated sampler and collecting the rinsate with a glass jar.

5.4 Sampler Decontamination and Field Quality Control Sampling

The sampler decontamination process for non-disposable sampling equipment is described below:

1. Remove all visible contaminants (solids) using a non-phosphate laboratory detergent (e.g., Alconox).

2. Rinse with distilled or deionized water.

6.0 REFERENCES

Tetra Tech EC, Inc. (Tetra Tech), Anchor QEA, L.L.C., J.F. Brennan, and Stuyvesant Projects Realization, Inc. 2013a. Quality Assurance Project Plan for Remedial Action of Operable Units 2, 3, 4, and 5 Lower Fox River and Green Bay Site Brown, Outagamie, and Winnebago Counties, Wisconsin. Prepared for Lower Fox River Remediation LLC. May 2013.

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STANDARD OPERATING PROCEDURE
POLING MEASUREMENTS TO ESTIMATE SOFT SEDIMENT THICKNESS

Elliott Ditch
Lafayette, IN

Prepared by:
Tetra Tech CES, Inc.

Prepared for:
Tetra Tech CES, Inc.
Elliott Ditch Sampling Plan

January 2016

ACRONYM LIST

GPS	global positioning system
NAD	North American Datum
PPE	personal protective equipment
QAPP	Quality Assurance Project Plan
RTK	Real Time Kinematic
SHSP	Site Health and Safety Plan
SOP	Standard Operating Procedure

1.0 SCOPE AND APPLICATION

Poling is conducted to define soft sediment thickness in areas where soft sediment is present. The soft sediment thickness is based on the difference in elevation from the top of sediment to the depth of refusal. Poling data will be evaluated prior to sediment sampling to refine in-channel sampling locations, determine the proper length of core to be used at each location, and to assess potential sample recovery. Poling data will also be used to support design delineation. This standard operating procedure (SOP) describes the procedures and methods that will be used to estimate soft sediment thickness using poling measurements.

2.0 SUMMARY OF METHOD

The term 'poling' refers to the procedure by which a pole that is marked with unit length graduations is used to measure soft sediment thickness on the bed of a waterbody. A metal pole marked with 0.1-foot graduations and with a base probe (minimum 1-foot length by 1-inch diameter) is advanced vertically through the river bed sediment to document the material present (i.e., soft, hard, granular, etc.) and to determine the overall soft material thickness (depth to refusal). The pole is extended downward through the soft sediment using manual force only until resistance inhibits additional advancement. Poling data will be obtained by or supervised by personnel with experience in poling methods.

3.0 SAFETY

All work must be performed under the approved Site Health and Safety Plan (SHSP) for the project. The SHSP identifies proper personal protective equipment (PPE) and potential site/work hazards. Daily safety meetings will be conducted before work begins.

4.0 APPARATUS AND EQUIPMENT

- Vessel (sampling platform) that complies with U.S. Coast Guard regulations with a minimum of three anchors or two anchoring spuds. (Note: If conditions warrant, hovering using engine power against current or wind forces may be substituted for an anchoring system).
- Personal protective equipment specified in the SHSP
- Tape measure and/or rod with maximum graduations of tenths of feet attached to a 6-inch diameter disc, to determine the distance from either the water surface or the sampling platform to the sediment surface
- Metal pole with maximum graduations of tenths of feet with a base probe of minimum 1-foot length by 1-inch diameter
- Maps and field forms
- Real Time Kinematic (RTK) GPS, or equivalent, with +/- 1 meter horizontal accuracy
- Database available on portable computer (or optional field log book)

5.0 PROCEDURES

5.1 Sample Location Positioning

Positioning for sampling will be achieved using an RTK GPS, or equivalent, that is capable of locating stations with an accuracy and repeatability of ±1 meter.

5.2 Poling Data Collection

Poling data should be obtained or supervised by personnel with experience in poling methods. A 6-inch diameter disc attached to a tape measure or rod with maximum 0.1 foot graduations will be used by experienced/qualified personnel capable of detecting the sediment surface (mudline). The measurement will be from the water surface or boat deck reference elevation to the top of sediment to determine the vertical distance to the sediment surface. A pole with maximum 0.1-foot graduations and a base probe (minimum 1-foot length by 1-inch diameter) will be used to advance vertically through the river bed sediment to document the material present with a soft push, using arm strength only, and a hard push using arm strength and body weight. A soft [S] push is defined as the depth of penetration to refusal achieved using one hand (arm strength only). A hard [H] push is defined as the additional depth of penetration to refusal achieved by the same sampler using two hands (arm strength plus body weight). The overall [O] push is the combined total of the soft and hard push [S+H=O]. A qualified individual will conduct the poling and estimate the type of material (e.g., soft sediment, sand, gravel, rocks, rip rap, till, etc.) probed with the pole during advancement and observation of material present on the pole upon retrieval. The following data will be recorded in an electronic data collection device and/or on a field form for each poling location:

- Surface water elevation (reference method dependent);
- Vertical distance from the water surface to the sediment surface;
- Probing depth measurements or vertical distance from the water surface to refusal (S, H, and O); and estimated type of material present.

STANDARD OPERATING PROCEDURE
RUSSIAN PEAT BORER

Elliott Ditch

Lafayette, IN

Prepared by:
Tetra Tech CES, Inc.

Prepared for:
Tetra Tech CES, Inc.
Elliott Ditch Sampling Plan

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ACRONYM LIST

GPS	Global Positioning System
NAD	North American Datum
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
RTK	Real Time Kinematic
SHSP	Site Health and Safety Plan
SOP	Standard Operating Procedure

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to establish a standard procedure for the collection of sediment samples using a Russian Peat Borer Sampler. The Russian Peat Borer Sampler is a discrete interval sampler that collects sediment using a lateral in-place collection technique, as opposed to traditional core sample collection through the face of the advancing core (EPA 1999). The sampler is used to obtain samples for specified intervals and/or to support traditional core sampling methods when sample recovery or disturbance may influence sample integrity.

2.0 SUMMARY OF METHOD

The Russian Peat Borer (RPB) Sampler collects sediment/peat by rotating the core barrel around the sampler core axis to obtain a discrete interval sample. Sampling and measuring the depth to the sediment surface should be conducted by qualified and experienced personnel who can differentiate the water/sediment surface interface using the methods described in this SOP.

A reference surface elevation (boat deck or water surface) will be obtained at each sample location using Real Time Kinematic Global Positioning System (RTK GPS) equipment, or equivalent, and recorded. If the boat deck is the reference surface elevation, the water surface elevation will be obtained by measuring (tape or equivalent) the vertical distance from the boat deck to the water surface before and after daily sampling.

The reference surface elevation will be used to establish the depth to the sediment surface at each sample location. Prior to sampling, a surveyor's rod, pole, or tape measure (marked, at a minimum, in tenths of feet graduations and attached to a 6-inch diameter disc) will be used to determine the distance from the reference elevation to the sediment surface. Because the water provides almost no resistance to the dropping of the rod (due to the rod's weight), the rate of advancement must be controlled so that detection of the minimal resistance provided by the sediment surface is possible. This distance (e.g., depth), plus the target sample depth, will then be marked on the RPB Sampler, which will be lowered through the water column slowly to the marked depth.

Once at the required sediment depth, the sampler rod will be rotated to initiate the sampling while the pivotal cover plate supports the cutting action of the bore. As the sampler is turned, the edge of the bore will longitudinally cut a semi-cylindrical shaped sample until the cover plate encloses an interval of relatively undisturbed sediment.

After the sampler is retrieved and placed on the deck of the boat/sampling platform, the sediment will be removed from the sampler by rotating the cover plate to displace captured sediment. The sample will be photographed and sampled in 0.5-foot intervals (three sample intervals with 1.65-feet length collection chamber). The 0.5-foot sample intervals of all targeted intervals sampled with the RPB will be placed in labeled quart-size plastic bags. All samples from a given location will be stored in a labeled gallon-size plastic bag. For each sample location, the date-time, location coordinates, reference surface elevation (boat deck or water surface), vertical distance from reference elevation to sediment surface, sample advancement length from the sediment surface, target interval, and sediment sample length (intervals) will be documented on an electronic data collection device (e.g. tablet computer) and/or on field forms.

3.0 SAFETY

All work must be performed under the approved Site Health and Safety Plan (SHSP) for the project. The SHSP identifies proper personal protective equipment (PPE) and potential site/work hazards. Daily safety meetings will be conducted before work begins.

4.0 APPARATUS AND EQUIPMENT

The following equipment is recommended to perform discrete sampling with the RPB Sampler:

- Boat (sampling platform) that complies with U.S. Coast Guard regulations with a minimum of three anchors or two anchoring spuds
- PPE specified in the SHSP
- Pole, surveyor's rod, or tape measure (secondary) with maximum 0.1-foot graduations attached to a disc (6-inch diameter) to determine depth from boat deck or water surface to sediment surface
- Tape measure with maximum 0.1-foot graduations
- RPB Sampler
- Quart- and gallon-size plastic bags
- Permanent marker to label sample bags
- Electronic data storage unit for core collection documentation
- Electrical tape
- White board and dry erase markers
- Digital camera
- RTK GPS equipment with horizontal accuracy of ± 1 meter

5.0 PROCEDURES

5.1 Sample Location Positioning

Positioning for sampling will be achieved using an RTK GPS, or equivalent, that is capable of locating stations with an accuracy and repeatability of ±1 meter.

5.2 Water and Sediment Surface Elevations

A reference surface elevation will be established for all vertical measurements using the boat deck or water surface. The elevation for the reference elevation will be obtained with RTK GPS, or equivalent. If the boat deck is the reference surface elevation, the water surface elevation will be documented once before daily sampling is initiated and once after completion of sampling. The water surface elevation will be obtained by measuring (tape or equivalent) the vertical distance from the boat deck to the water surface. The sediment surface elevation will be determined using the reference surface elevation prior to collection of each sample. Vertical distance measurement from the reference to the sediment surface will be done with a surveyor's rod, pole, or tape measure (secondary), all with maximum graduations of 0.1 foot and attached to a 6-inch diameter disc. The measurement of the depth from the reference elevation (water surface or boat deck) to sediment surface will be conducted by qualified and experienced personnel who are capable of establishing the interface between the water and sediment surface. The RPB rod will be taped to indicate the advancement depth from the established reference. The significant figures used to record measurements will be dependent on conditions. Data should be reported within the precision of measurement that is possible at the time of measurement considering wave action, boat stability, or other factors. Work should be conducted when the precision of measurement is at least 0.1 foot so all measurements can be documented accordingly. All data will be documented on an electronic data collection device (e.g. tablet computer) and/or on field forms.

5.3 Sample Collection

The sample collection method is as follows:

1. Add the planned core length to the measured water depth (reference point [water surface or boat deck] to top of sediment). Mark this length with tape on the sample rod from the bottom of the sample core chamber and use this measurement for depth of advancement from the reference.

2. Advance the sampler into the sediment surface slowly to the specified depth. Rotate the sampler to capture the sample. Retract the sampler.

3. Place a clean barrier on the deck, then keeping the sampler horizontal at the boat's deck, rotate the cover plate to open the sampler and extrude the sample. Evaluate sample profile and/or characteristics to verify sampler performance and identify intervals that may not represent in-situ sediment (e.g., slough). Replace any samplers that do not function properly. Resample any sample intervals that do not represent the in-situ sediment. Do not retain the misrepresentative samples.

4. Label white board with date, core sample location identification (ID), and depth interval. Place white board next to the sample and photograph. The photo will be used to assist in sample characterization.

5. Sample in 0.5-foot intervals (site sampler includes 1.65-foot length collection chamber that accommodates three sample intervals) and place all samples from the target interval sampled into labeled (sample ID, depth interval, date) quart-size plastic bags. Transfer the sample from the sampler to the container bag using clean spoons (cohesive sediment) or clean nitrile gloves (non-cohesive sediment) for each sample interval. Place all samples in a 5-gallon bucket for storage on the sampling vessel and transportation to the processing facility.

6. For each sample location, record the following in electronic data collection unit and/or field forms:

    - Date and time

    - Core sample ID and coordinates (note distance [feet] sample was offset from location if additional sampling is required)

    - Depth from reference surface elevation (boat deck or surface water) to the top of the sediment

    - Sample advancement depth from reference surface

    - Target depth interval and collected sample length associated with target depth interval

    - Deliver samples to processing facility for characterization, if required, and processing/packaging for shipment to laboratory.

5.4 Sampler Decontamination and Field Quality Control Sampling

The sampler decontamination process for non-disposal sampling equipment is described below:

1. Remove all visible contaminants (solids) using a non-phosphate laboratory detergent (e.g., Alconox).

2. Rinse with distilled or deionized water.

REFERENCES

U.S. Environmental Protection Agency (EPA). 1999. Innovative Technology Verification Report, Sediment Sampling Technology, Aquatic Research Instruments, Russian Peat Borer. EPA/600/R-01/010.

STANDARD OPERATING PROCEDURE
SEDIMENT LOGGING

Elliott Ditch

Lafayette, IN

Prepared by:
Tetra Tech CES, Inc.

Prepared for:
Tetra Tech CES, Inc.
Elliott Ditch Sampling Plan

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1 SCOPE AND APPLICATION

This Standard Operating Procedure for Sediment Logging is intended for use specifically during field activities.

2 SUMMARY OF METHOD

The purpose of the Standard Operating Procedure (SOP) is to provide a step-by step process for describing in-channel sediments using United States Department of Agriculture (USDA) and Unified Soil Classification System (USCS) official descriptors. Boring logs are to be completed using either hard copy hand written or an electronic data logging form (Figure 1). Hard-copy print-outs (Figure 2) from the electronic data logging system will be archived as a backup to the electronic data. A project-specific paper data form (Figure 3) will be used only in the event that electronic data collection is unavailable. At a minimum, sediment will be described using the steps outlined below. For each step, approved descriptors (USDA and/or USCS) have been listed in bold type, followed by official descriptions. Logging of sediments will be done prior to sampling unless otherwise specified in the approved Work Plan, Sampling and Analysis Plan, and/or Quality Assurance Project Plan. Additional sediment characteristics may be included at the direction and approval of the Field Manager.

Following this Standard Operating Procedure ensures that sediment logging procedures are scientifically defensible and meet the task-specific data quality objectives identified in the specific Work Plan. It provides specific quality assurance and quality control mechanisms that validate the information that is collected, and ensure it is useable to all study participants.

3 COMMENTS

Reusable sampling and processing equipment that comes into contact with sediments must be decontaminated prior to reuse in accordance with section 5.3 Decontamination Procedures, of the Field Sampling Plan.

4 SAFETY

All work must be performed under an approved health and safety plan (HASP). The HASP identifies proper personnel protective equipment (PPE) and identifies potential site hazards. Daily safety tailgate meetings must take place before fieldwork begins.

5 APPARATUS AND EQUIPMENT

5.1 Personal protective equipment specified in the Health and Safety Plan

5.2 Core liner cutter.

5.3 Full-spectrum fluorescent lighting, if access to natural sunlight is not available.

5.4 Stainless steel utensils or appropriate disposable utensils.

5.5 Electronic data logging computer or tablet (e.g. iPad).

5.6 For back up in the event the appropriate software and/or computer are not available, use the paper Sediment Logging Form (Figure 3) and waterproof ink pens.

5.7 Disposable non-powdered nitrile gloves.

5.8 Calibrated measuring stick.

5.9 Decontamination equipment (see section 5.3 of the Field Sampling Plan)

6 REAGENTS

6.1 Distilled water.

6.2 Tap water

6.3 Non-phosphate cleaner (e.g., Alconox, or equivalent)

7 SEDIMENT LOGGING PROCEDURE

7.1 Prepare the sediment core for description by cutting the plastic liner lengthwise. Use only an approved cutting device with Kevlar or heavy leather gloves.

7.2 Remove the upper half of the cut plastic liner, leaving the sediment exposed and resting in the bottom half of the liner.

7.3 Using approved nitrile gloves and stainless steel utensils, inspect the sediment under natural sunlight or full-spectrum light to determine the natural layers that are present across the core. Do not include thin laminations, bedding planes, varves, or other thin sedimentary structures as individual layers. Group these features into layers according to overall pattern.

7.4 For each layer, list the sediment logger (person describing the sediment), data entry technician (even if the same as the sediment logger), the layer number (number layers sequentially starting with 1 at the surface), the interval (range of depth below the surface for that layer), and any gap in the sample (difference between the distance the core was pushed and the amount of sediment recovered).

7.5 For each layer, describe the characteristics listed below.

a. *Sediment Color*

Sediment color should be described using an approved Munsell Soil Color Chart. Whenever possible, describe color under natural sunlight. If this is not feasible, use only strong, full-spectrum light at close range. While wearing nitrile gloves, place a small amount of sediment behind the chart apertures until the closest match is found to a chart color chip. Record the hue, value, and chroma of the closest match.

i. Hue (Munsell Color, 2000)
   1. **10YR**
   2. **7.5YR**
   3. **2.5Y**
   4. **5Y**
   5. **5YR**
   6. **2.5YR**
   7. **10R**
   8. **5PB**
   9. **10B**
   10. **10BG**
   11. **5BG**
   12. **10G**
   13. **5G**
   14. **10GY**
   15. **10Y**
   16. **N**

ii. Value (Munsell Color, 2000)
   1. **8**
   2. **7**
   3. **6**
   4. **5**
   5. **4**

6. **3**
7. **2.5**
8. **2**

iii. Chroma (Munsell Color, 2000)

1. **0**
2. **1**
3. **2**
4. **3**
5. **4**
6. **6**
7. **8**

b. *Second sediment color* (if applicable; same hue, value, and chroma categories as above)

c. *Texture*

i. USDA Texture (Schoeneberger et al., 2002)

USDA texture should be estimated by hand texturing. Fine earth texture classes from the textural triangle (Figure 4) should be used. Sand, loamy sand, and sandy loam categories can be further subdivided based on the dominant size of the sand fraction. Absence of a modifier implies a "medium" size.

1. **Gravel –** only used if sample is 90+ % gravel
2. **Coarse sand**
3. **Sand**
4. **Fine sand**
5. **Very fine sand**
6. **Loamy coarse sand**
7. **Loamy sand**
8. **Loamy fine sand**
9. **Loamy very fine sand**
10. **Coarse sandy loam**
11. **Sandy loam**
12. **Fine sandy loam**
13. **Very fine sandy loam**
14. **Loam**
15. **Silt loam**
16. **Silt**
17. **Sandy clay loam**
18. **Clay loam**
19. **Silty clay loam**
20. **Sandy clay**
21. **Silty clay**

22. **Clay**

ii. USCS Texture (ASTM, 1985)

USCS texture should be estimated by hand texturing and a 2-letter code should be chosen to describe the texture. The first letter refers to the size fraction of the dominant particle: G = gravel, S = sand, M = silt, C = clay, O = organic. The second letter is a modifier of the dominant particle size: P = poorly graded (well sorted/uniform particle size), W = well graded (poorly sorted/diversified particle size), H = high plasticity, L = low plasticity. Pt is used for sediment that is almost entirely organic.

1. **GP**
2. **GW**
3. **GM**
4. **GC**
5. **SP**
6. **SW**
7. **SM**
8. **SC**
9. **ML**
10. **MH**
11. **CL**
12. **CH**
13. **OL**
14. **OH**
15. **Pt**

d. Structure

Structure denotes the tendency for a soil or sediment to break, upon pressure being applied, into aggregates resulting from pedogenic processes (Figure 5). To determine structure, apply pressure to an appropriately sized block of sediment placed between the thumb and forefinger. After the block ruptures or deforms, determine which of the 9 structure types the resulting peds most resemble. Determine the appropriate grade by observing in situ peds in the liner. Single grain and massive types always have a grade of structureless.

i. Type (Schoeneberger et al., 2002)

1. **Granular –** small polyhedrals, with curved or very irregular faces
2. **Angular blocky –** polyhedrals with faces that intersect at sharp angles (planes)
3. **Subangular blocky –** polyhedrals with sub-rounded and planar faces, lack sharp angles

4. **Platy –** flat and tabular-like units (not common; must be due to pedogenesis; do not confuse with sedimentary structure)
5. **Wedge –** elliptical, interlocking lenses that terminate in acute angles, bounded by slickensides; not limited to vertic materials (not common)
6. **Prismatic –** vertically elongated units with flat tops (not common)
7. **Columnar –** vertically elongated units with rounded tops which are commonly "bleached" (not common)
8. **Single grain –** no structural units; entirely noncoherent (e.g. loose sand)
9. **Massive –** no structural units; material is a coherent mass (not necessarily cemented)

ii. Grade (Schoeneberger et al., 2002)

1. **Structureless –** no discrete units observable in place or in hand sample
2. **Weak –** units are barely observable in place or in a hand sample
3. **Moderate –** units well-formed and evident in place or in a hand sample
4. **Strong –** units are distinct in place (undisturbed soil), and separate cleanly when disturbed

e. *Plasticity*

Plasticity is the degree to which reworked sediment can be permanently deformed without rupturing. To determine plasticity mix a small amount of sediment with an amount of water sufficient to give the sediment its maximum plasticity. If too much water is added, more sediment can be added. Make a roll of sediment 4cm long and evaluate it using the criteria below.

i. Class (Schoeneberger et al., 2002)

1. **Non-plastic –** will not form a 6mm diameter roll, or if formed, can't support itself if held on end
2. **Slightly plastic –** 6mm diameter roll supports itself; 4mm diameter roll does not
3. **Moderately plastic –** 4mm diameter roll supports itself, 2mm diameter roll does not
4. **Very plastic –** 2mm diameter roll supports its weight

f. *Density (Optional)*

Density describes the degree of firmness for coarse-grained sediments. Official density determination uses the Standard Penetration Test, in a field setting. When describing sediment in a lab setting, an estimate of the density should be made using undisturbed sediment in the plastic liner. Density should only be described for sediments in which the USCS texture is GW, GP, GM, GC, SW, SP, SM, or SC. For other textures, consistency should be used.

i. Class
   1. **Very Loose** (0-4 SPT)
   2. **Loose** (5-10 SPT)
   3. **Medium Dense** (11-30 SPT)
   4. **Dense** (31-50 SPT)
   5. **Very Dense** (>50 SPT)

g. *Consistency (Optional)*

Consistency describes the degree of firmness for intact fine-grained sediments. Official consistency determination uses the Standard Penetration Test, in a field setting. When describing sediment in a lab setting, an estimate of the consistency should be made using undisturbed sediment in the plastic liner. Consistency should only be described for fine-grained sediments.

i. Class
   1. **Very Soft** (<2 SPT)
   2. **Soft** (2-4 SPT)
   3. **Firm** (5-15 SPT)
   4. **Hard** (16-30 SPT)
   5. **Very Hard** (>30 SPT)

h. *Roots*

Describe the quantity and size class of roots per unit area. The area in which to assess root quantity is based on the size of the roots being assessed. For very fine and fine roots, record the average quantity from 3 to 5 units of 1cm by 1cm. For medium and coarse roots, record the average quantity from 3 to 5 units of 10cm by 10cm. For very coarse roots, the appropriate unit area is 1m by 1m. Because of limited sample size when describing sediment from a core sample, very coarse root quantity should be estimated.

i. Quantity (Schoeneberger et al., 2002)
   1. **Few** - <1 per area
   2. **Common** – 1 to <5 per area
   3. **Many** - ≥5 per area

ii. Size (Schoeneberger et al., 2002)
   1. **Very fine** - <1mm
   2. **Fine** – 1 to <2mm

3. **Medium –** 2 to <5mm
4. **Coarse –** 5 to <10mm
5. **Very Coarse** - ≥10mm

i. Rock fragments

Estimate rock fragment percentage by volume. Use a ruler to estimate the average rock fragment size for the entire layer. If multiple size classes are present, use the largest size class, unless the smaller size class has more than twice the percentage by volume of the larger (e.g. 30% fine gravel and 20% coarse gravel, choose "35-60% coarse gravel"; 40% fine gravel and 10% coarse gravel, choose "35-60% fine gravel"). Use comparison samples if available.

i. Quantity (Schoeneberger et al., 2002)
1. **<15%** - no texture adjective added to USDA texture
2. **15 to <35%** - use adjective for appropriate size (e.g. gravelly)
3. **35 to <60%** - use "very" with the appropriate size adjective (e.g. very gravelly)
4. **60 to <90%** - use "extremely" with the appropriate size adjective (e.g. extremely gravelly)
5. **≥90%** - no modifier; use the appropriate noun for the dominant size class (e.g. gravel)

ii. Size (Schoeneberger et al., 2002)
1. **fine gravel –** >2 to 5mm diameter
2. **medium gravel –** >5 to 20mm diameter
3. **coarse gravel –** >20 to 75mm diameter
4. **cobbles –** >75 to 250mm diameter

iii. Angularity
1. **angular** (fragments have sharp edges and relatively planar sides with unpolished surfaces)
2. **subangular** (fragments are similar to angular description but with rounded edges)
3. **subrounded** (fragments have nearly planar sides but well-rounded corners and edges)
4. **rounded** (fragments have smoothly curved sides and no edges)

j. Shells

Note the presence of shells or shell fragments in the layer.

k. Plant fragments

Note the presence of plant fragments in the layer.

l. Wood

Note the dominant wood type if wood is found in the layer. Do not include roots here. Secondary wood types that are deemed important should be listed in the comments section. Estimate the percentage of the layer that is composed of the dominant wood type using the increments listed below.

i. Type

1. **wood –** wood in a generally natural state, any color but black
2. **black wood –** wood that is black, but unburned, inside and out
3. **burned wood –** visibly burned wood
4. **sawdust –** fine wood shavings, either dispersed or clumped together
5. **wood chips –** non-naturally cut small wood pieces
6. **wood pulp –** fibrous, ground wood used in making paper
7. **charcoal –** compressed carbon residue of burned wood

ii. Quantity

1. **<5%**
2. **10%**
3. **20%**
4. **30%**
5. **40%**
6. **50%**
7. **60%**
8. **70%**
9. **80%**
10. **90%**
11. **95%**
12. **100%**

m. Odor

Note any odor detected from the layer after the core has been cut open. Use the wafting method to avoid overexposure to strong chemicals. If the odor is strong and is easily detected without wafting, it may indicate a hazard. Leave the logging area immediately until proper equipment (PID, etc.) can be utilized to verify, monitor, and/or mitigate the risk. Because certain volatile compounds are only released during mixing, an odor may not be detectable until a layer is being composited during sampling. Pay specific attention during this step of the sampling process and adjust the sediment description accordingly.

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i. Type

1. **Petrochemical**
2. **Sulfur**
3. **Other**

ii. Amount

1. **Slight –** odor is barely detectable, even at close range
2. **Moderate –** odor is detectable when wafting from the proper distance
3. **Strong –** odor permeates after the core liner is cut open and/or during mixing of the sediment; no wafting is needed to detect the odor.

n. *Sublayers*

Sublayers are thin but distinct bands of sediment within the larger layer. A layer may be composed of many sublayers, in a repeating pattern, or it may be generally uniform but with a few thin bands that differ from the rest of the layer in regards to certain major characteristics, like texture or color. These thin bands should not be separated as individual layers but should be noted and described here. Sublayers include characteristics such as varves, sedimentary structures, thin bedding planes, or stratification.

i. Thickness

1. **<0.05 ft**
2. **0.05 – 0.1 ft**
3. **0.1 – 0.2 ft**
4. **0.2 – 0.5 ft**
5. **>0.5 ft**

ii. Texture

1. Same options as section c. i. (USDA texture)

iii. Color

1. Same options as section a. i, ii, and iii. (Munsell color)

o. Geomorphic Setting

If possible, note the geomorphic setting of the layer in its natural state, based on the characteristics already described. Choose one of the three options below. If none apply, leave this section blank.

i. **Till**

ii. **Lacustrine**

iii. **Sand/gravel bed**

7.6 For each layer, after describing the characteristics above, note any additional remarks. These can be elaborations on characteristics already mentioned or notable layer characteristics that do not fit in any of the categories above. Any speculative comments should be noted as internal sample remarks.

7.7 For each sample interval, fill out the appropriate lab information as listed below.

a. *Duplicate*

List whether a field duplicate sample will be collected for this interval.

b. *Grab/Composite*

Identify whether the sample for this interval is a grab sample or composite sample (intervals with field duplicates will always be composite).

c. *Matrix*

Identify the sample matrix for each sample interval. Default is 'sediment'. Other values are not common.

i. **Sediment**
ii. **Soil**
iii. **Air**
iv. **Water**

d. *# of Containers*

Identify the number of sample containers used when sampling the interval. Default is 1.

i. **1**
ii. **2**
iii. **3**
iv. **4**
v. **5**
vi. **6**
vii. **7**
viii. **8**
ix. **9**
x. **10**

e. *Priority*

Identify the lab priority for the sample interval. Methods for prioritizing of samples will be decided by the Field Manager in consultation with the lab.

i. **Urgent (1) –** Samples from this interval will receive expedited lab analysis
ii. **Standard (2) –** Samples from this interval will be analyzed according to the standard lab schedule

iii. **As able (3) –** Samples from this interval will be analyzed after all outstanding ‘urgent’ and ‘standard’ samples

iv. **As needed (4) –** Samples from this interval will not be analyzed unless determined necessary at a later date

v. **Archive (5) –** Samples from this interval will not be analyzed unless determined necessary at a later date and will be archived to allow for future chemistry analysis

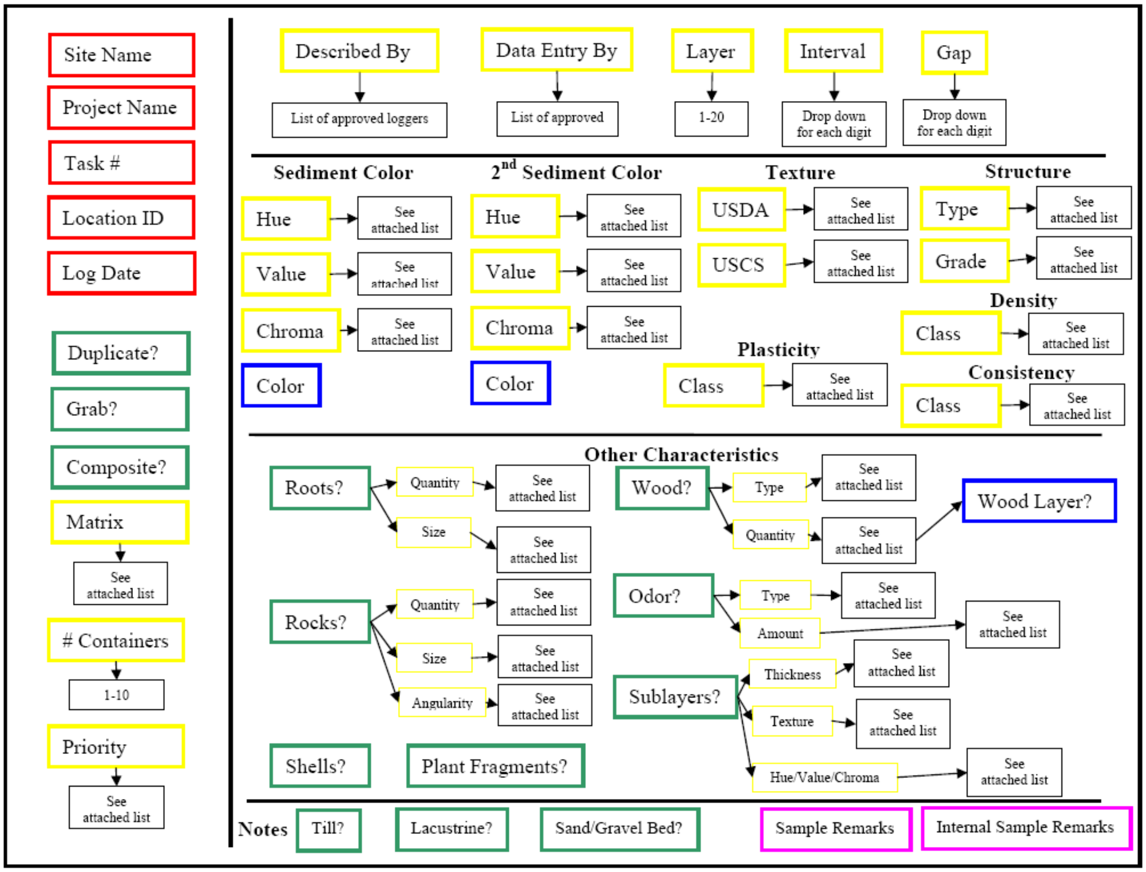
7.8 Repeat steps 7.4, 7.5, 7.6, and 7.7 for each layer until all layers have been described. If multiple samples will be collected from a single layer, or if sample intervals will not align with sediment layers, repeat step 7.7 for each sample interval, making sure to indicate prominently the sampled interval.

8 QUALITY CONTROL

8.1 Initial review of sediment logs will occur immediately after logging of a core. This review will be completed by a qualified soil scientist, geomorphologist, or geologist, with experience in the USDA and USCS systems. Changes will be noted on a paper print-out from the electronic data form. Any changes necessary will be promptly made in the electronic data form. After the changes are made, the reviewer will sign and date the paper print-out, which will be archived.

8.2 A second review of sediment logs will occur by the Field Manager, or their designee, who is independent and separate of the scientist who initially described the sediment. Once the second review is complete, sediment log data will be transferred to the project database.

9 FIGURES



Box Color	Field Type
Red	auto-populate when data form is opened
Yellow	drop-down list
Green	check box
Blue	auto-populate based on form inputs
Pink	manual entry
Black	drop-down menu contents

Yellow boxes sub to green boxes are only be available if the green box is checked (e.g. no rock fragments (unchecked) means form will not let you select drop-down quantity or size).

Figure 1. Diagram of typical electronic data collection form. “Attached list” refers to values described in this SOP.

Sediment Data Sheet

Project Name:
Project Number:
Field Location ID:
Core Type:
Field Remarks:
Northing: (ft)
Easting (ft):

Cored By:
Cored Date:
Described By:
Described Date:

Sample Depth	Layer	Priority	Physical Description	Sample Remarks	Internal Sample Remarks

Core Interval (ft)	Measured Sediment in Core (ft)	% Recovery

Reviewed By ______________________ Date ________

Page 1 of 1

Figure 2. Sample hard-copy print-out from electronic data logging system. Hard copies will be archived as a backup to the electronic system

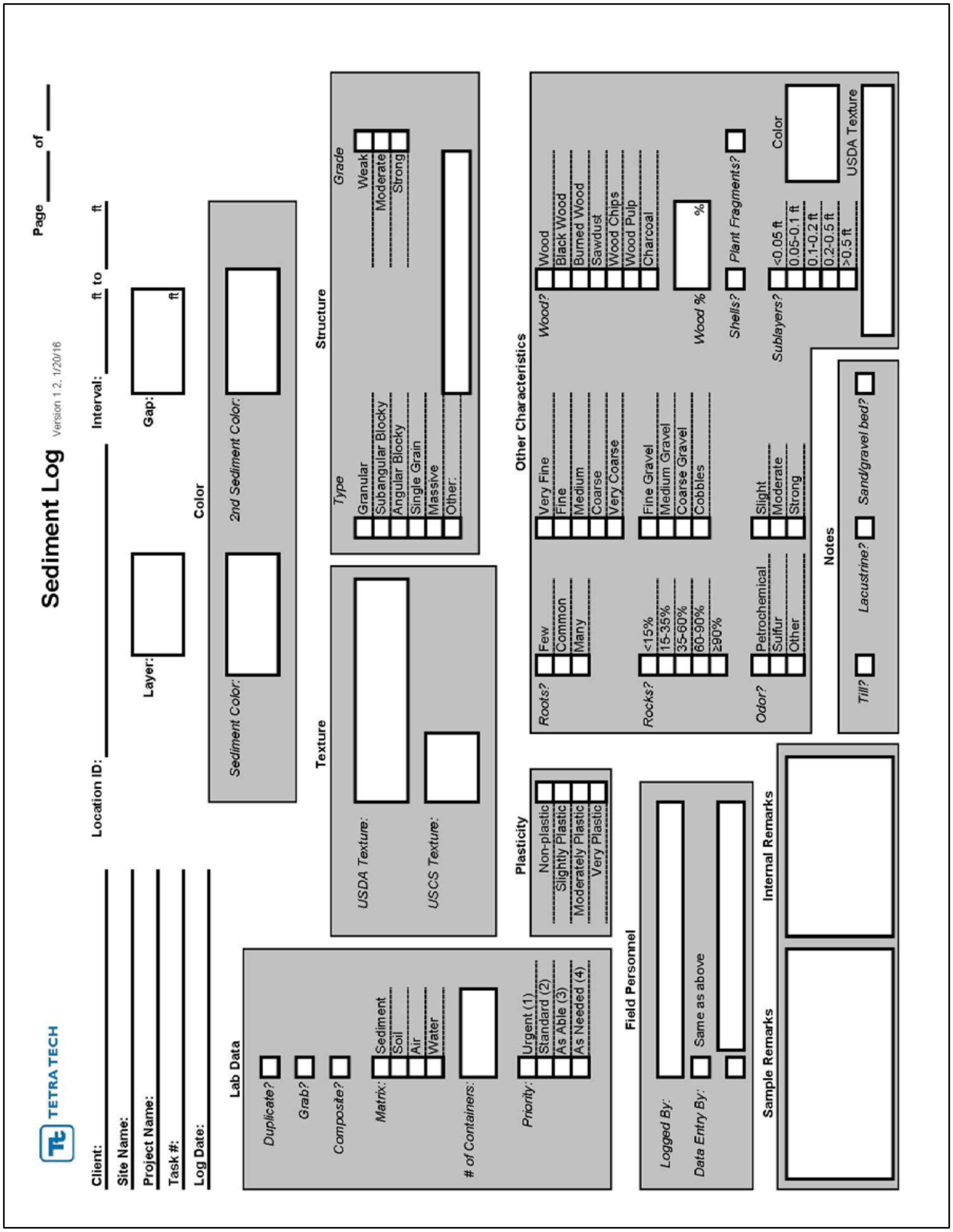


Figure 3. Sample paper sediment logging form. Paper forms will be used only if the electronic data logging system is not available.

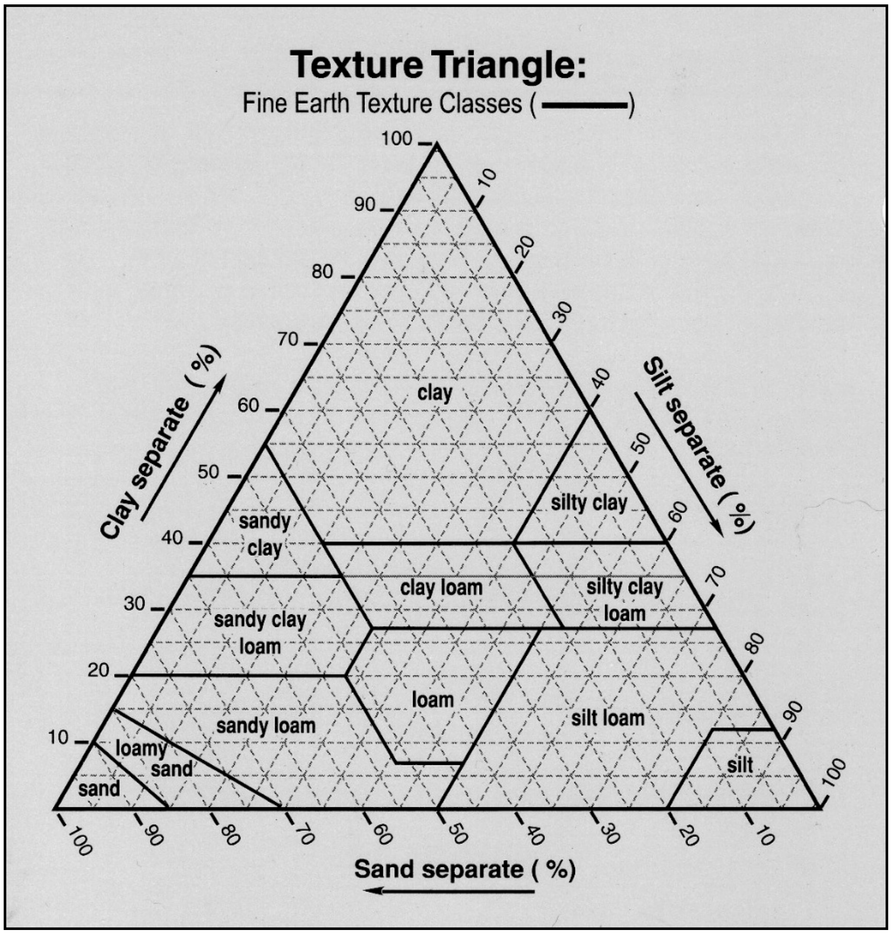


Figure 4. USDA Textural Triangle (from Schoeneberger et al., 2002).

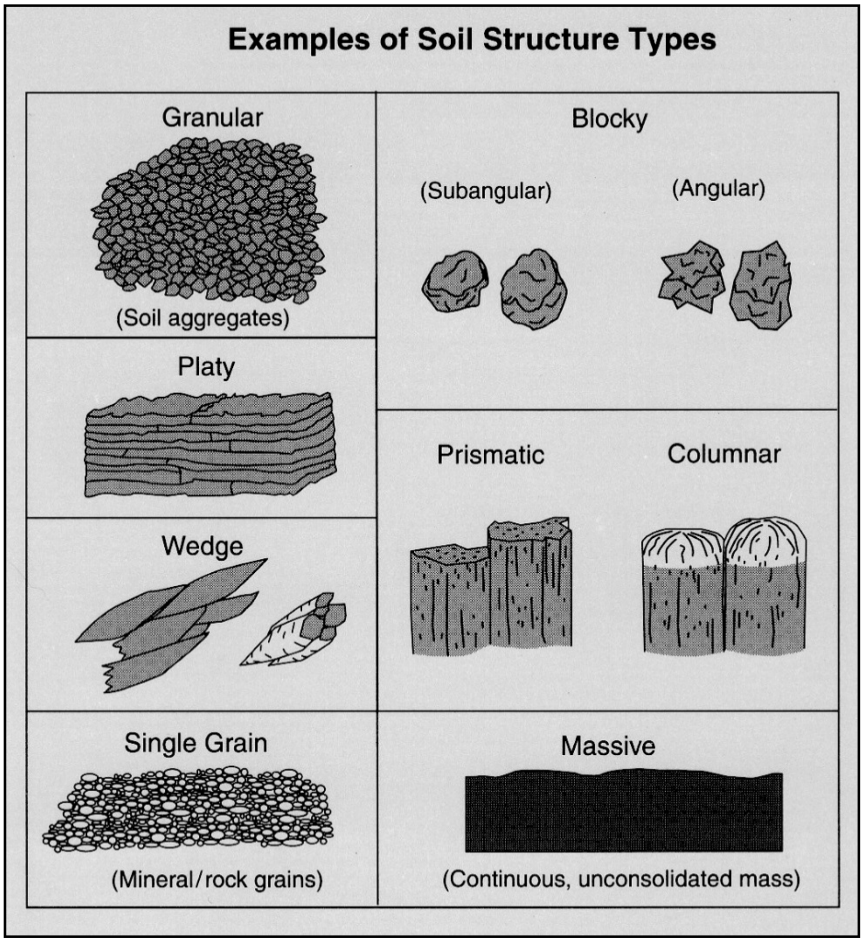


Figure 5. Examples of soil structure types (from Schoeneberger et al., 2002).

10 REFERENCES

American Society for Testing and Materials (ASTM), 1985. Classification of Soils for Engineering Purposes: Annual Book of ASTM Standards. Vol. 4 (8), 395-408.

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STANDARD OPERATING PROCEDURE
SOIL LOGGING

Elliott Ditch
Lafayette, IN

Prepared by:
Tetra Tech CES, Inc.

Prepared for:
Tetra Tech CES, Inc.
Elliott Ditch Sampling Plan

January 2016

1 SCOPE AND APPLICATION

This Standard Operating Procedure for Soil Logging is intended for use specifically during field activities.

2 SUMMARY OF METHOD

The purpose of the Standard Operating Procedure (SOP) is to provide a step-by step process for describing overbank soils using United States Department of Agriculture (USDA) and Unified Soil Classification System (USCS) official descriptors. Boring logs are to be completed using either hard copy hand written or an electronic data logging form (Figure 1). Hard-copy print-outs (Figure 2) from the electronic data logging system will be archived as a backup to the electronic data. A project-specific paper data form (Figure 3) will be used only in the event that electronic data collection is unavailable. At a minimum, soil will be described using the steps outlined below. For each step, approved descriptors (USDA and/or USCS) have been listed in bold type, followed by official descriptions. Logging of soils will be done prior to sampling unless otherwise specified in the approved Work Plan, Sampling and Analysis Plan, and/or Quality Assurance Project Plan. Additional soil characteristics may be included at the direction and approval of the Field Manager.

Following this Standard Operating Procedure ensures that soil logging procedures are scientifically defensible and meet the task-specific data quality objectives identified in the specific Work Plan. It provides specific quality assurance and quality control mechanisms that validate the information that is collected, and ensure it is useable to all study participants.

3 COMMENTS

Reusable sampling and processing equipment that comes into contact with soil must be decontaminated prior to reuse in accordance with section 5.3 Decontamination Procedures, of the Field Sampling Plan.

4 SAFETY

All work must be performed under an approved health and safety plan (HASP). The HASP identifies proper personnel protective equipment (PPE) and identifies potential site hazards. Daily safety tailgate meetings must take place before fieldwork begins.

5 APPARATUS AND EQUIPMENT

5.1 Personal protective equipment specified in the Health and Safety Plan

5.2 Core liner cutter.

5.3 Full-spectrum fluorescent lighting, if access to natural sunlight is not available.

5.4 Stainless steel utensils or appropriate disposable utensils.

5.5 Electronic data logging computer or tablet (e.g. iPad).

5.6 For back up in the event the appropriate software and/or computer are not available, use the paper Soil Logging Form (Figure 3) and waterproof ink pens.

5.7 Disposable non-powdered nitrile gloves.

5.8 Calibrated measuring stick.

5.9 Decontamination equipment (see section 5.3 of the Field Sampling Plan)

6 REAGENTS

6.1 Distilled water.

6.2 Tap water

6.3 Non-phosphate cleaner (e.g., Alconox, or equivalent)

7 SOIL LOGGING PROCEDURE

7.1 Prepare the soil core for description by cutting the plastic liner lengthwise. Use only an approved cutting device with Kevlar or heavy leather gloves.

7.2 Remove the upper half of the cut plastic liner, leaving the soil exposed and resting in the bottom half of the liner.

7.3 Using approved nitrile gloves and stainless steel utensils, inspect the soil under natural sunlight or full-spectrum light to determine the natural layers that are present across the core. Do not include thin laminations, bedding planes, varves, or other thin sedimentary structures as individual layers. Group these features into layers according to overall pattern.

7.4 For each layer, list the sediment logger (person describing the sediment), data entry technician (even if the same as the sediment logger), the horizon (use only official taxonomic designations from Soil Survey Staff, 1999), the interval (range of depth below the surface for that layer), and any gap in the sample (difference between the distance the core was pushed and the amount of soil recovered).

7.5 For each layer, describe the characteristics listed below.

a. *Soil Color*

Soil color should be described using an approved Munsell Soil Color Chart. Whenever possible, describe color under natural sunlight. If this is not feasible, use only strong, full-spectrum light at close range. While wearing nitrile gloves, place a small amount of sediment behind the chart apertures until the closest match is found to a chart color chip. Record the hue, value, and chroma of the closest match.

i. Hue (Munsell Color, 2000)

1. **10YR**
2. **7.5YR**
3. **2.5Y**
4. **5Y**
5. **5YR**
6. **2.5YR**
7. **10R**
8. **5PB**
9. **10B**
10. **10BG**
11. **5BG**
12. **10G**
13. **5G**
14. **10GY**
15. **10Y**
16. **N**

ii. Value (Munsell Color, 2000)

1. **8**
2. **7**
3. **6**
4. **5**
5. **4**
6. **3**
7. **2.5**
8. **2**

iii. Chroma (Munsell Color, 2000)
1. **0**
2. **1**
3. **2**
4. **3**
5. **4**
6. **6**
7. **8**

b. *Second soil color* (if applicable; same hue, value, and chroma categories as above)

c. Texture

i. USDA Texture (Schoeneberger et al., 2002)
USDA texture should be estimated by hand texturing. Fine earth texture classes from the textural triangle (Figure 4) should be used. Sand, loamy sand, and sandy loam categories can be further subdivided based on the dominant size of the sand fraction. Absence of a modifier implies a "medium" size.

1. **Gravel –** only used if sample is 90+ % gravel
2. **Coarse sand**
3. **Sand**
4. **Fine sand**
5. **Very fine sand**
6. **Loamy coarse sand**
7. **Loamy sand**
8. **Loamy fine sand**
9. **Loamy very fine sand**
10. **Coarse sandy loam**
11. **Sandy loam**
12. **Fine sandy loam**
13. **Very fine sandy loam**
14. **Loam**
15. **Silt loam**
16. **Silt**
17. **Sandy clay loam**
18. **Clay loam**
19. **Silty clay loam**
20. **Sandy clay**
21. **Silty clay**
22. **Clay**

ii. USCS Texture (ASTM, 1985)

USCS texture should be estimated by hand texturing and a 2-letter code should be chosen to describe the texture. The first letter refers to the size fraction of the dominant particle: G = gravel, S = sand, M = silt, C = clay, O = organic. The second letter is a modifier of the dominant particle size: P = poorly graded (well sorted/uniform particle size), W = well graded (poorly sorted/diversified particle size), H = high plasticity, L = low plasticity. Pt is used for sediment that is almost entirely organic.

1. **GP**
2. **GW**
3. **GM**
4. **GC**
5. **SP**
6. **SW**
7. **SM**
8. **SC**
9. **ML**
10. **MH**
11. **CL**
12. **CH**
13. **OL**
14. **OH**
15. **Pt**

d. *Structure*

Structure denotes the tendency for a soil to break, upon pressure being applied, into aggregates resulting from pedogenic processes (Figure 5). To determine structure, apply pressure to an appropriately sized block of sediment placed between the thumb and forefinger. After the block ruptures or deforms, determine which of the 9 structure types the resulting peds most resemble. Determine the appropriate grade by observing in situ peds in the liner. Single grain and massive types always have a grade of structureless.

i. Type (Schoeneberger et al., 2002)

1. **Granular –** small polyhedrals, with curved or very irregular faces
2. **Angular blocky –** polyhedrals with faces that intersect at sharp angles (planes)
3. **Subangular blocky –** polyhedrals with sub-rounded and planar faces, lack sharp angles
4. **Platy –** flat and tabular-like units (not common; must be due to pedogenesis; do not confuse with sedimentary structure)

5. **Wedge –** elliptical, interlocking lenses that terminate in acute angles, bounded by slickensides; not limited to vertic materials (not common)
6. **Prismatic –** vertically elongated units with flat tops (not common)
7. **Columnar –** vertically elongated units with rounded tops which are commonly "bleached" (not common)
8. **Single grain –** no structural units; entirely noncoherent (e.g. loose sand)
9. **Massive –** no structural units; material is a coherent mass (not necessarily cemented)

ii. Grade (Schoeneberger et al., 2002)

1. **Structureless –** no discrete units observable in place or in hand sample
2. **Weak –** units are barely observable in place or in a hand sample
3. **Moderate –** units well-formed and evident in place or in a hand sample
4. **Strong –** units are distinct in place (undisturbed soil), and separate cleanly when disturbed

e. *Plasticity*

Plasticity is the degree to which reworked soil can be permanently deformed without rupturing. To determine plasticity mix a small amount of soil with an amount of water sufficient to give the soil its maximum plasticity. If too much water is added, more soil can be added. Make a roll of soil 4cm long and evaluate it using the criteria below.

i. Class (Schoeneberger et al., 2002)

1. **Non-plastic –** will not form a 6mm diameter roll, or if formed, can't support itself if held on end
2. **Slightly plastic –** 6mm diameter roll supports itself; 4mm diameter roll does not
3. **Moderately plastic –** 4mm diameter roll supports itself, 2mm diameter roll does not
4. **Very plastic –** 2mm diameter roll supports its weight

f. *Density (Optional)*

Density describes the degree of firmness for coarse-grained soils. Official density determination uses the Standard Penetration Test, in a field setting. When describing soil in a lab setting, an estimate of the density should be made using undisturbed soil in the plastic liner. Density should only be described for soils in which the USCS texture is GW, GP, GM, GC, SW, SP, SM, or SC. For other textures, consistency should be used.

i. Class
   1. **Very Loose** (0-4 SPT)
   2. **Loose** (5-10 SPT)
   3. **Medium Dense** (11-30 SPT)
   4. **Dense** (31-50 SPT)
   5. **Very Dense** (>50 SPT)

g. *Consistency (Optional)*

Consistency describes the degree of firmness for intact fine-grained soils. Official consistency determination uses the Standard Penetration Test, in a field setting. When describing soil in a lab setting, an estimate of the consistency should be made using undisturbed soil in the plastic liner. Consistency should only be described for fine-grained soil.

i. Class
   1. **Very Soft** (<2 SPT)
   2. **Soft** (2-4 SPT)
   3. **Firm** (5-15 SPT)
   4. **Hard** (16-30 SPT)
   5. **Very Hard** (>30 SPT)

h. *Roots*

Describe the quantity and size class of roots per unit area. The area in which to assess root quantity is based on the size of the roots being assessed. For very fine and fine roots, record the average quantity from 3 to 5 units of 1cm by 1cm. For medium and coarse roots, record the average quantity from 3 to 5 units of 10cm by 10cm. For very coarse roots, the appropriate unit area is 1m by 1m. Because of limited sample size when describing soil from a core sample, very coarse root quantity should be estimated.

i. Quantity (Schoeneberger et al., 2002)
   1. **Few** - <1 per area
   2. **Common** – 1 to <5 per area
   3. **Many** - ≥5 per area

ii. Size (Schoeneberger et al., 2002)
   1. **Very fine** - <1mm
   2. **Fine** – 1 to <2mm
   3. **Medium** – 2 to <5mm
   4. **Coarse** – 5 to <10mm
   5. **Very Coarse** - ≥10mm

i. Rock fragments

Estimate rock fragment percentage by volume. Use a ruler to estimate the average rock fragment size for the entire layer. If multiple size classes are present, use the largest size class, unless the smaller size class has more than twice the percentage by volume of the larger (e.g. 30% fine gravel and 20% coarse gravel, choose “35-60% coarse gravel”; 40% fine gravel and 10% coarse gravel, choose “35-60% fine gravel”). Use comparison samples if available.

i. Quantity (Schoeneberger et al., 2002)
1. **<15%** - no texture adjective added to USDA texture
2. **15 to <35%** - use adjective for appropriate size (e.g. gravelly)
3. **35 to <60% -** use “very” with the appropriate size adjective (e.g. very gravelly)
4. **60 to <90%** - use “extremely” with the appropriate size adjective (e.g. extremely gravelly)
5. **≥90%** - no modifier; use the appropriate noun for the dominant size class (e.g. gravel)

ii. Size (Schoeneberger et al., 2002)
1. **fine gravel –** >2 to 5mm diameter
2. **medium gravel –** >5 to 20mm diameter
3. **coarse gravel –** >20 to 75mm diameter
4. **cobbles –** >75 to 250mm diameter

iii. Angularity
1. **angular** (fragments have sharp edges and relatively planar sides with unpolished surfaces)
2. **subangular** (fragments are similar to angular description but with rounded edges)
3. **subrounded** (fragments have nearly planar sides but well-rounded corners and edges)
4. **rounded** (fragments have smoothly curved sides and no edges)

j. Shells

Note the presence of shells or shell fragments in the horizon.

k. Plant fragments

Note the presence of plant fragments in the horizon.

l. Wood

Note the dominant wood type if wood is found in the horizon. Do not include roots here. Secondary wood types that are deemed important should be listed in the comments section. Estimate the percentage of the layer that is composed of the dominant wood type using the increments listed below.

i. Type
   1. **wood –** wood in a generally natural state, any color but black
   2. **black wood –** wood that is black, but unburned, inside and out
   3. **burned wood –** visibly burned wood
   4. **sawdust –** fine wood shavings, either dispersed or clumped together
   5. **wood chips –** non-naturally cut small wood pieces
   6. **wood pulp –** fibrous, ground wood used in making paper
   7. **charcoal –** compressed carbon residue of burned wood

ii. Quantity
   1. **<5%**
   2. **10%**
   3. **20%**
   4. **30%**
   5. **40%**
   6. **50%**
   7. **60%**
   8. **70%**
   9. **80%**
   10. **90%**
   11. **95%**
   12. **100%**

m. Odor

Note any odor detected from the horizon after the core has been cut open. Use the wafting method to avoid overexposure to strong chemicals. If the odor is strong and is easily detected without wafting, it may indicate a hazard. Leave the logging area immediately until proper equipment (PID, etc.) can be utilized to verify, monitor, and/or mitigate the risk. Because certain volatile compounds are only released during mixing, an odor may not be detectable until a layer is being composited during sampling. Pay specific attention during this step of the sampling process and adjust the soil description accordingly.

.

i. Type
   1. **Petrochemical**
   2. **Sulfur**
   3. **Other**

ii. Amount
   1. **Slight –** odor is barely detectable, even at close range
   2. **Moderate –** odor is detectable when wafting from the proper distance
   3. **Strong –** odor permeates after the core liner is cut open and/or during mixing of the soil; no wafting is needed to detect the odor.

n. *Sublayers*

Sublayers are thin but distinct bands of soil within the larger horizon. A horizon may be composed of many sublayers, in a repeating pattern, or it may be generally uniform but with a few thin bands that differ from the rest of the horizon in regards to certain major characteristics, like texture or color. These thin bands should not be separated as individual horizons but should be noted and described here. Sublayers include characteristics such as varves, sedimentary structures, thin bedding planes, or stratification. They are often found in the soil parent material (C horizon) and are uncommon in the solum.

i. Thickness
   1. **<0.05 ft**
   2. **0.05 – 0.1 ft**
   3. **0.1 – 0.2 ft**
   4. **0.2 – 0.5 ft**
   5. **>0.5 ft**

ii. Texture
   1. Same options as section c. i. (USDA texture)

iii. Color
   1. Same options as section a. i, ii, and iii. (Munsell color)

o. Geomorphic Setting

If possible, note the geomorphic setting of the horizon in its natural state, based on the characteristics already described. Choose one of the three options below. If none apply, leave this section blank. Only complete this section for the soil parent material (C horizon).

i. **Till**
ii. **Lacustrine**
iii. **Sand/gravel bed**

7.6 For each horizon, after describing the characteristics above, note any additional remarks. These can be elaborations on characteristics already mentioned or notable horizon characteristics that do not fit in any of the categories above. Any speculative comments should be noted as internal sample remarks.

7.7 For each sample interval, fill out the appropriate lab information as listed below.

a. *Duplicate*

List whether a field duplicate sample will be collected for this sample interval.

b. *Grab/Composite*

Identify whether the sample interval is a grab sample or composite sample (intervals with field duplicates will always be composite).

c. *Matrix*

Identify the sample matrix for each sample interval. Default is 'soil'. Other values are not common.

i. **Soil**
ii. **Sediment**
iii. **Air**
iv. **Water**

d. *# of Containers*

Identify the number of sample containers used when sampling the sample interval. Default is 1.

i. **1**
ii. **2**
iii. **3**
iv. **4**
v. **5**
vi. **6**
vii. **7**
viii. **8**
ix. **9**
x. **10**

e. *Priority*

Identify the lab priority for the sample interval. Methods for prioritizing of samples will be decided by the Field Manager in consultation with the lab.

i. **Urgent (1) –** Samples from this interval will receive expedited lab analysis
ii. **Standard (2) –** Samples from this interval will be analyzed according to the standard lab schedule

iii. **As able (3) –** Samples from this interval will be analyzed after all outstanding ‘urgent’ and ‘standard’ samples

iv. **As needed (4) –** Samples from this interval will not be analyzed unless determined necessary at a later date

v. **Archive (5) –** Samples from this interval will not be analyzed unless determined necessary at a later date and will be archived to allow for future chemistry analysis

7.8 Repeat steps 7.4, 7.5, 7.6, and 7.7 for each horizon until all horizon have been described. If multiple samples will be collected from a single horizon, repeat step 7.7 for each sample interval, making sure to indicate prominently the sampled interval, since it will be different from the horizon interval.

8 QUALITY CONTROL

8.1 Initial review of soil logs will occur immediately after logging of a core. This review will be completed by a qualified soil scientist, geomorphologist, or geologist, with experience in the USDA and USCS systems. Changes will be noted on a paper print-out from the electronic data form. Any changes necessary will be promptly made in the electronic data form. After the changes are made, the reviewer will sign and date the paper print-out, which will be archived.

8.2 A second review of soil logs will occur by the Field Manager, or their designee, who is independent and separate of the scientist who initially described the sediment. Once the second review is complete, soil log data will be transferred to the project database.

9 FIGURES

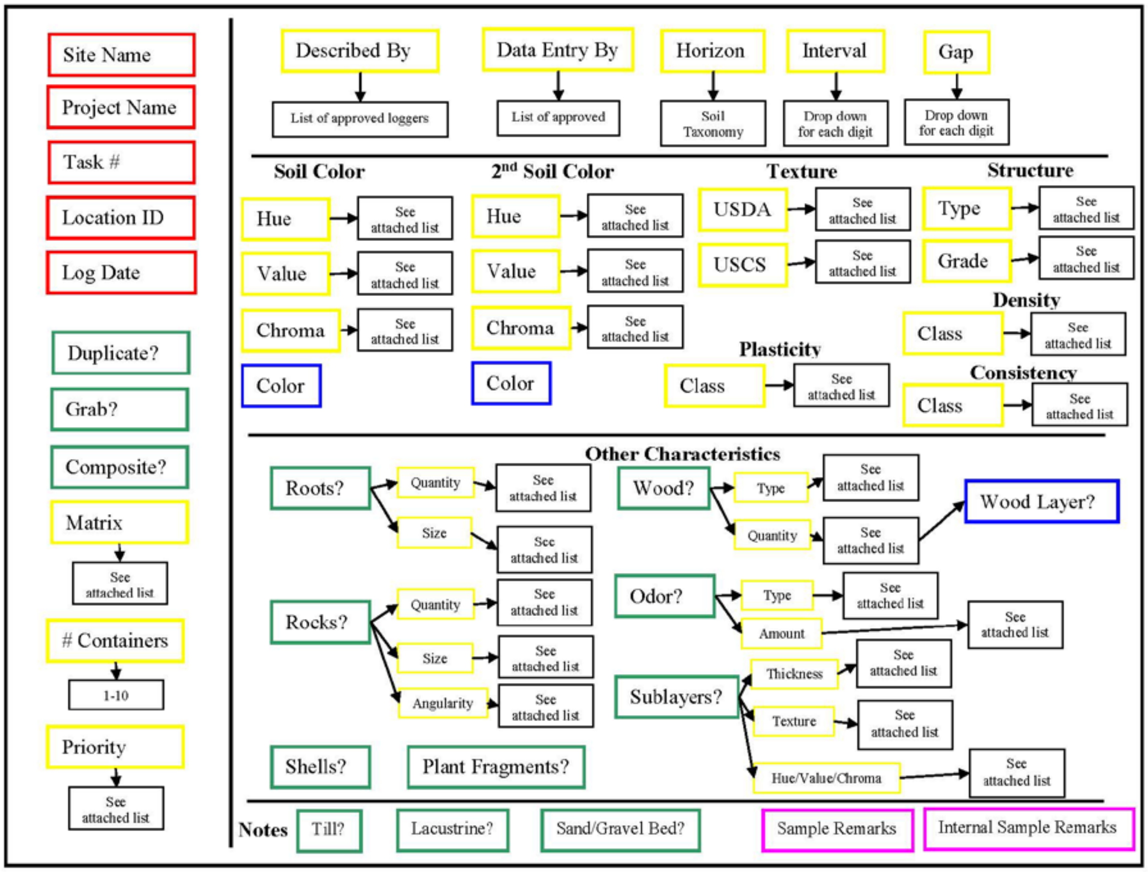

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Figure 1. Diagram of typical electronic data collection form. “Attached list” refers to values described in this SOP.

Sediment Data Sheet

Project Name:
Project Number:
Field Location ID:
Core Type:
Field Remarks:
Northing: (ft)
Easting (ft):

Cored By:
Cored Date:
Described By:
Described Date:

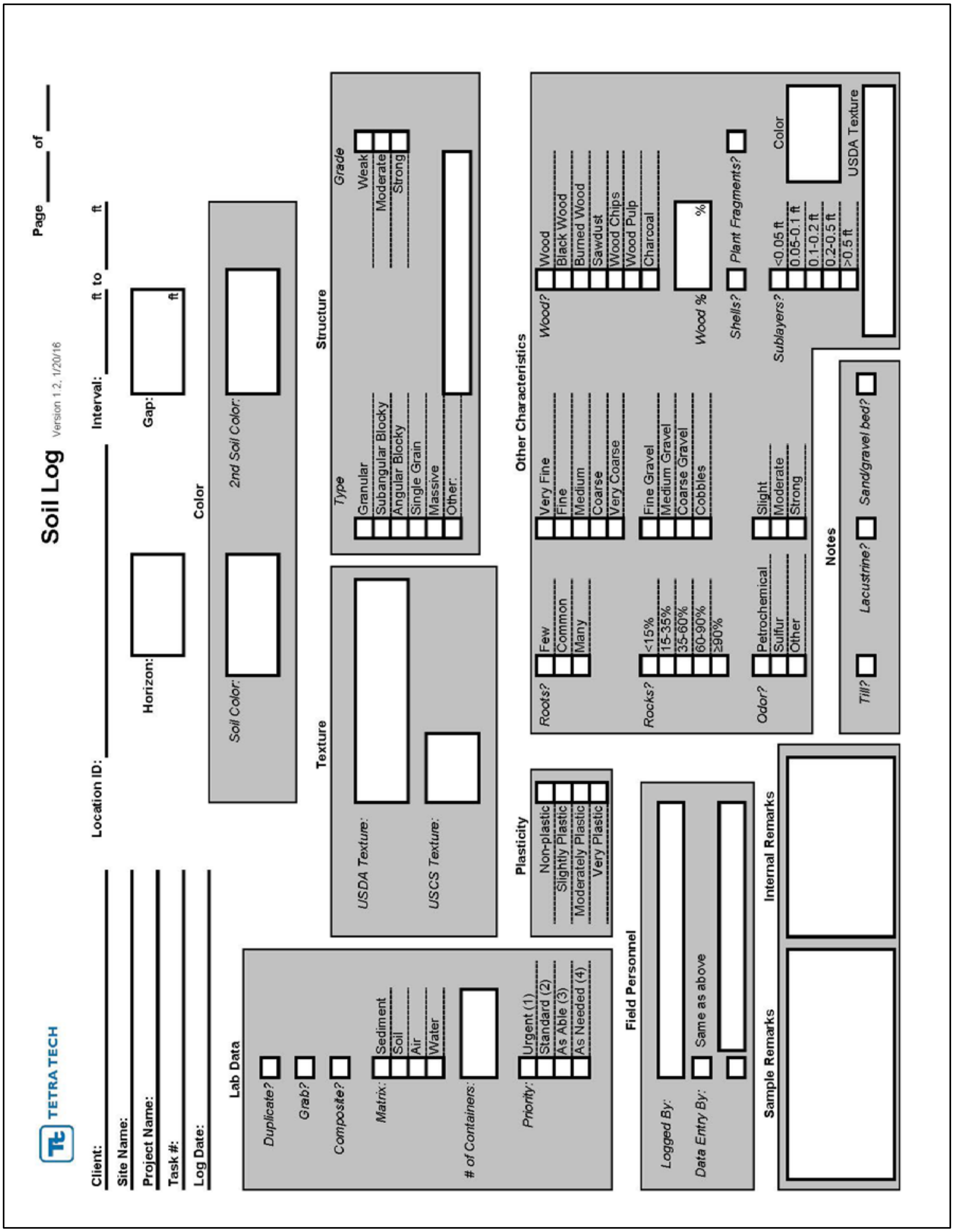
Sample Depth	Layer	Priority	Physical Description	Sample Remarks	Internal Sample Remarks

Core Interval (ft)	Measured Sediment in Core (ft)	% Recovery

Reviewed By ________________________ Date ________

Page 1 of 1

Figure 2. Sample hard-copy print-out from electronic data logging system. Hard copies will be archived as a backup to the electronic system



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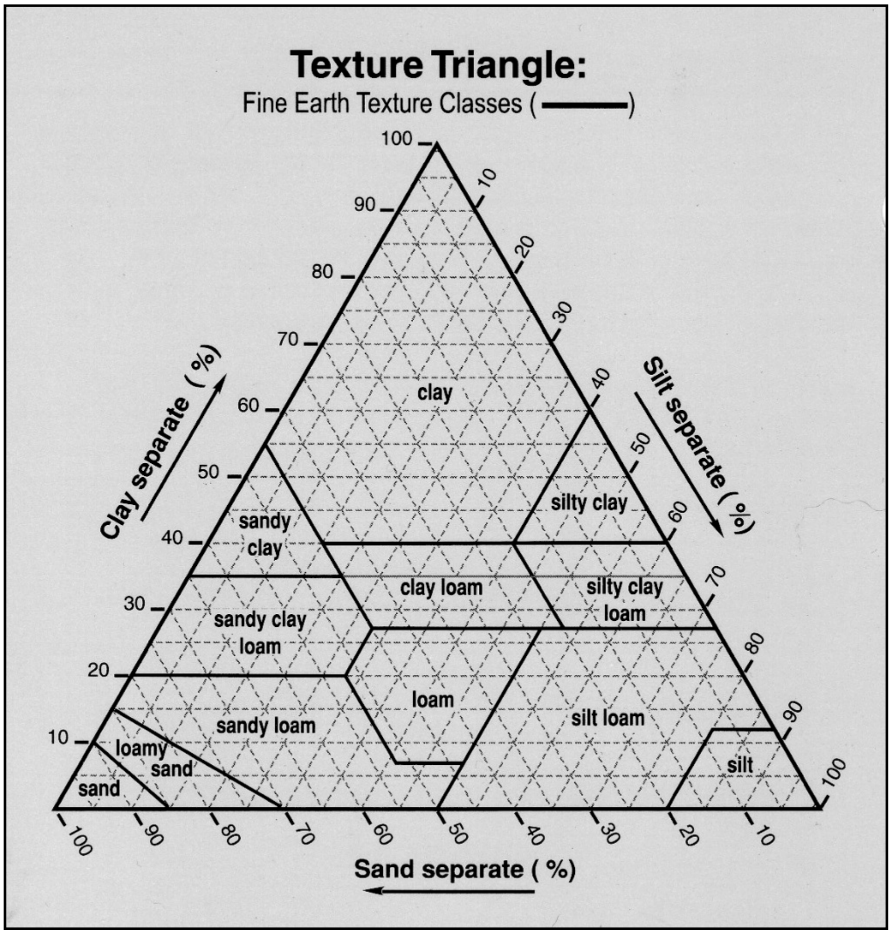

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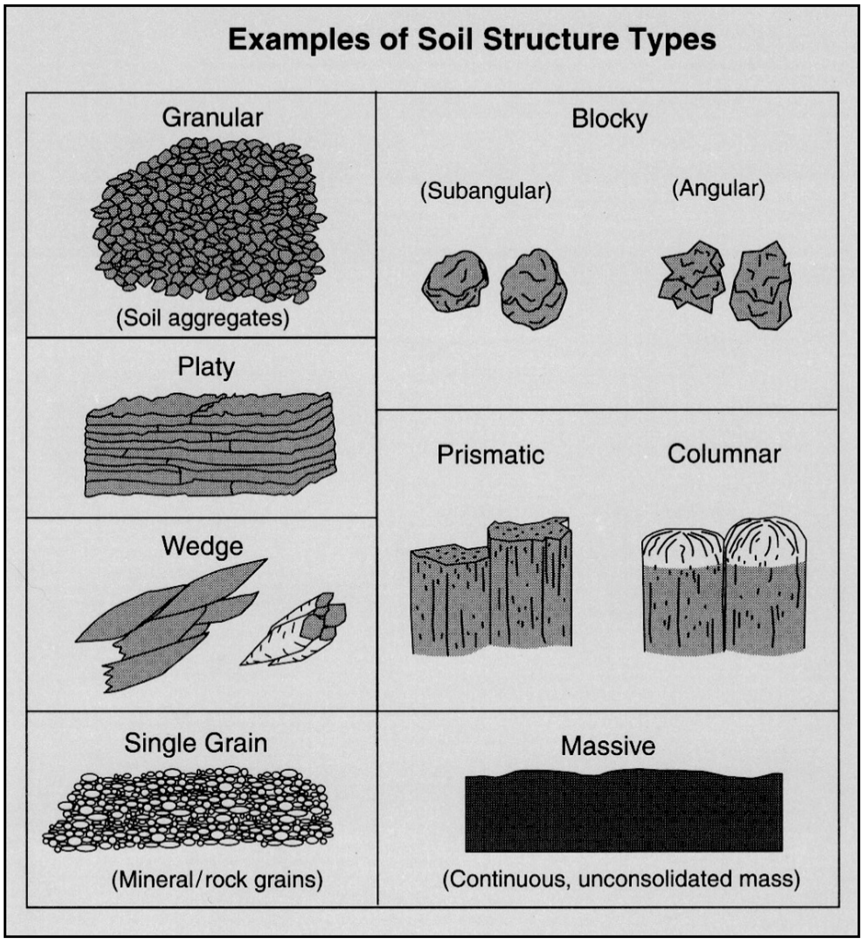

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STANDARD OPERATING PROCEDURE
SOIL RECOVERY AUGER

Elliott Ditch
Lafayette, IN

Prepared by:
Tetra Tech CES, Inc.

Prepared for:
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Elliott Ditch Sampling Plan

January 2016

ACRONYM LIST

GPS	Global Positioning System
NAD	North American Datum
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
RTK	Real Time Kinematic
SHSP	Site Health and Safety Plan
SOP	Standard Operating Procedure

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to establish a standard procedure for the collection of soil core samples using a soil recovery auger with a plastic liner. Procedures are described for the collection of soil, soft sediments, and fine-grained sands. This SOP should be consulted during the preparation of any plan requiring procedures for soil sample collection using a soil recovery auger.

2.0 SUMMARY OF METHOD

The soil recovery auger will be marked to the advancement depth and then placed on the spot to be sampled. The soil recovery auger is then spun clockwise until the advancement depth mark is level with the soil surface. To take a subsurface sample, mark the advancement depth on the soil recovery auger and then place it in the bore hole that was created by the previous sample/s. This step may be repeated to recover multiple intervals from one location. The location, date-time, and the sample advancement length from the soil surface or soil interval collected (e.g. 0.0' – 1.0') are documented using the data collector (e.g., Leica Viva) or alternative documentation method.

3.0 SAFETY

All work must be performed under the approved Site Health and Safety Plan (SHSP) for the project. The SHSP identifies proper personal protective equipment (PPE) and potential site/work hazards. Daily safety meetings will be conducted before work begins.

4.0 APPARATUS AND EQUIPMENT

- PPE specified in the SHSP
- Tape measure, lead line, and/or pole with minimum graduations of 0.1 foot attached to disc to measure the advancement depth on the soil recovery auger
- Electrical tape to mark the advancement depth on the soil recovery auger
- Soil recovery auger
- One foot plastic core liners
- Alconox
- Distilled or deionized water
- Scrub brushes
- Garden Sprayer
- Electronic data storage unit for core collection documentation
- Real Time Kinematic (RTK) Global Positioning System (GPS) or equivalent, with horizontal accuracy of ± 1 meter

5.0 PROCEDURES

5.1 Sample Location Positioning

Positioning for sampling will be achieved using an RTK GPS, or equivalent, that is capable of locating stations with an accuracy and repeatability of ±1 meter.

5.2 Soil recovery auger Sample Collection

1. Insert a plastic core liner.

2. Mark the soil recovery auger to set the advancement depth.

3. While holding the t-handle and using a clockwise motion advance the sampler into the soil surface slowly to the specified depth.

4. Without spinning, carefully remove the soil recovery auger from the soil.

5. Wearing nitrile gloves, carefully remove the plastic core liner with soil/sediment from the auger. If necessary, use a clean needle nose pliers to assist in pulling out the plastic liner.

6. Cap the core at both ends.

7. Label the core sample with sample location identification (ID), date, time, and depth interval (e.g. 0.0' – 1.0').

8. Place all samples upright in a 5-gallon bucket for storage while in the field and transportation to the processing area.

9. Record location, date, time, and depth interval into the Leica Viva or using alternative documentation method.

5.3 Decontamination

The soil recovery auger should be decontaminated after every core interval collection attempt by following the procedures outlined below:

- Remove all visible contaminants (solids) using a brush and a non-phosphate laboratory detergent (e.g., Alconox).

- Rinse with distilled or deionized water.

APPENDIX III

ELLIOTT DITCH REACHES 1 – 3 FIELD SAMPLING REPORT (CEC)

ELLIOTT DITCH
REACHES 1 – 3
FIELD SAMPLING REPORT

ARCONIC LAFAYETTE OPERATIONS
3131 EAST MAIN STREET
LAFAYETTE, INDIANA 47905

PREPARED FOR:

ARCONIC

ARCONIC INC.

MR. ROBERT PREZBINDOWSKI
TENNESSEE OPERATIONS – NORTH PLANT
2300 NORTH WRIGHT ROAD
ALCOA, TENNESSEE 37701

PREPARED BY:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
2704 CHEROKEE FARM WAY, SUITE 101
KNOXVILLE, TENNESSEE 37920
PHONE: (865) 977-9997

CEC Project 172-367.0002

AUGUST 2018

CEC
Civil & Environmental Consultants, Inc.

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1.0 INTRODUCTION

Arconic Inc. (Arconic), formerly Alcoa Inc. (Alcoa), retained Civil & Environmental Consultants, Inc. (CEC) to implement the Elliott Ditch Field Sampling Plan (FSP, Project) prepared by TetraTech CES and dated February 2, 2016. Two targeted sampling events were conducted after implementation of the FSP to collect additional data within the first 1.59 miles of Elliott Ditch. This assessed segment of Elliott Ditch includes the first three of eight reaches identified in the Elliott Ditch Geomorphic Surface Mapping and Historic Data Review (geomorphic study) prepared by TetraTech CES. The sampling study incorporated these three reaches because of their similar geomorphic nature caused by anthropogenic activities to control storm water drainage. Elliott Ditch is under the jurisdiction of the Tippecanoe County Drainage Board as a regulated drainage feature until it crosses 9th Street. The Tippecanoe County Drainage Board maintains a 75-foot easement on both sides of the ditch for maintenance activities.

As noted, this assessment focused on the first three of eight reaches. The general geomorphic nature of these three reaches, as documented in geomorphic study, is as follows:

- Reach 1 of Elliott Ditch is characterized by a relatively straight channel, steep valley walls, and no stream terraces. The geomorphology study showed a relatively shallow gradient of 0.4 feet/mile. Some erosion was observed occurring along the channel banks and immediately downstream of the outfall, deposition of relatively fine-grained sediment is occurring in pooled areas within the stream.
- Reach 2 of Elliott Ditch is characterized by a straight channel with a steeper channel gradient of approximately 8 feet/mile. The north side of the channel is upland area and the south side is a preserved T-4 terrace. Sediment deposition occurs in this reach on the T-4 terrace after large flood events and in-channel deposition is associated with pools.
- Reach 3 has a relatively straight channel with only minor meandering. The channel banks are steeper than in Reach 2, but the channel gradient is similar at 8 feet/mile. Elliott Ditch has a deeply incised channel and steep channel banks within this reach. Natural T-6 and T-7 terraces are preserved adjacent to both sides of the ditch. Additionally, a T-5 terrace is present on the north side of the ditch at the downstream end of the reach. Deposition in the overbank area is unlikely except for large flood events and in-channel deposition is limited to the pool areas.

The investigation of soils and sediments was performed in accordance with the regulatory-approved FSP, as prepared by TetraTech CES and dated February 2, 2016. This report presents our observations, findings, and discussion regarding the Project.

1.1 SAMPLNG SCOPE

The FSP and two subsequent, targeted sampling events were conducted within and along the first 1.59 miles of Elliott Ditch. Provided in the following is a summary of the field activities performed in association with each assessment and the sample locations are shown on Figures 3, 3A, 3B, 3C, 4, 4A, and 4B.

<u>FSP Sampling Event</u>

- Sediment poling and surveying;
- Sediment boring installation and sampling at 13 locations; and,
- Soil boring installation and sampling at 33 locations.

<u>February 2018 Targeted Assessment</u>

- Sediment boring installation and sampling at one location; and,
- Soil boring installation and sampling at 11 locations, including boring at one previously assessed location.

<u>June 2018 Targeted Assessment</u>

- Soil boring installation and sampling at 17 locations, including boring at one previously assessed location.

1.2 FACILITY DESCRIPTION

The Arconic Lafayette Operations (Facility) reside at 3131 East Main Street in Fairfield Township, Tippecanoe County, Lafayette, Indiana, and produces aluminum extrusions serving an international market. The extrusions include tube, aerospace components, and oil and gas drilling products. Arconic began production at the Facility in 1937 and the Facility currently includes roughly 2.3 million square feet of operations on 172 acres. Topographic relief in the area of the

Facility ranges from approximately 650 to 670 feet above mean sea level (MSL). The locations of the Facility and Elliott Ditch are shown on Figure 1.

1.3 DESCRIPTION OF ELLIOTT DITCH

Elliott Ditch is a tributary to Wea Creek, which is a tributary to the Wabash River, just downstream of Lafayette, Indiana. Please refer to Figure 1 for the location of Elliott Ditch and associated streams. In addition to its base flow, Elliott Ditch receives wastewater and storm water discharges from local industrial and residential sources, including from a National Pollution Discharge Elimination System (NPDES) permitted outfall (Outfall 001) from the Facility. Outfall 001 is situated approximately 1-mile south of the Facility. Discharge from the outfall includes treated sanitary and industrial process water, as well as storm water. The distance from the outfall to the Elliott Ditch and Wea Creek confluence is approximately 4.1 miles and to the Wabash River is approximately 7.5 miles. The geomorphic surface mapping completed for Elliott Ditch by TetraTech CES, as documented in the geomorphic study, suggests that Elliott Ditch has eight distinct reaches (erosional/depositional regimes):

- Reach 1: Outfall 001 to downstream of the railroad bridge
- Reach 2: The railroad bridge to the South 18th Street Bridge
- Reach 3: South 18th Street Bridge to upstream of the 9th Street Bridge
- Reach 4: South 9th Street Bridge to north of Brookside Drive
- Reach 5: North of Brookside Drive to downstream of Poland Hill Road
- Reach 6: Downstream of Poland Hill Road to downstream of Old Romney Road Bridge
- Reach 7: Downstream of Old Romney Road Bridge to upstream of US Hwy 231 South Bridge
- Reach 8: Upstream of US Hwy 231 South to the Elliott Ditch – Wea Creek confluence

This Field Sampling Report is focused on the portion from the outfall (Milepost 0.0) to Milepost 1.59 or Reaches 1 through 3, which includes the channelized portion of Elliott Ditch. Please refer to Figure 2 for the portion of Elliott Ditch included in this assessment.

1.4 TIMELINE OF RELEVANT EVENTS

Elliott Ditch has been subject to previous assessments and remediation due to evidence of PCBs having been released through Outfall 001. Samples of fish, water, and sediment collected in the 1980s from Elliott Ditch and Wea Creek indicate that PCBs are present in these media. In response to these findings, Arconic conducted in-stream remediation of sediment and instituted an enhanced wastewater treatment program for targeted removal of PCBs. In 1990, Arconic excavated sediments in the Elliott Ditch starting 100 feet upstream of Outfall 001 and ending at the 18th Street Bridge. In the late 1990s, Arconic instituted a wastewater management program, which significantly reduced flow to Outfall 001 through removal of non-contact cooling water. Arconic also began to treat its dry weather discharge to Elliott Ditch using canister filter systems in January 2000. In 2007, Arconic developed and implemented a Natural Media Filtration treatment process. The combination of these actions have reduced PCB loadings from Outfall 001 by at least tenfold. Provided in the following is a brief chronological summary of the investigations that led to the preparation and implementation of the FSP and subsequent targeted assessments.

- 1980s – Sampling of sediment, water, and fish by Indiana Department of Environmental (IDEM)
- Late 1980s – Sampling of sediment, water, and fish by Arconic
- Late 1990-Early 1991 – Arconic removed sediment starting 100 feet upstream of Outfall 001 and ending at the 18th Street Bridge
- Late 1990s through 2008 – Arconic developed and implemented changes to its wastewater management program
- 1999 – Comprehensive sediment and fish sampling by IDEM
- 1999-2002 – IDEM/U.S. Environmental Protection Agency (USEPA) sued Arconic under Clean Water Act (CWA) for discharges in excess of NPDES permit limits
- 2002 – USEPA and Arconic entered into Consent Decree (CD), which required, among other things, investigation of Elliott Ditch
- 2003/4 – Arconic performed Phase I, Phase II, and Phase III of Elliott Ditch investigation, which included sediment, water, and fish sampling
- 2008 – Arconic performed Phase IV of the Elliott Ditch investigation, which included fish and water sampling, and submitted a Report to USEPA
- 2010 – Arconic performed Phase V-A of Elliott Ditch investigation, which included sediment sampling

- 2011 – Arconic performed a monitoring program, which included sediment and water sampling, for a soluble oil spill
- 2012 – Arconic Phase V-B of Elliott Ditch investigation planned, which included fish tissue and water sampling
- 2012/2013 – Arconic performed the Phase V-B investigation of Elliott Ditch to assess fish tissue and water for PCB impacts
- 2014/2015 – Arconic performed a geomorphologic mapping study of Elliott Ditch
- 2016 – Arconic prepared a FSP to collect sediment and soil samples to further assess PCB impacts to the ditch

1.5 REGULATORY CONSIDERATIONS

1.5.1 Consent Decree and RCRA Corrective Action

Investigations of Elliott Ditch from the early 2000s through 2012 were conducted per the Consent Decree (CD) between Arconic and USEPA. The CD is associated with Clean Water Act violations and is in the process of being closed. The Facility is subject to Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) and is in the process of implementing a RCRA Facility Investigation (RFI). This Project is being performed as part of the RCRA CA process.

1.5.2 PCB Source and Release Date

Arconic has performed a detailed review of historic operations at the Facility to determine the source and release date of the PCB impacts identified in Elliott Ditch. Provided in the following is a summary of the review results. Please note that Alcoa is used interchangeably with Arconic in this section of the report.

To reduce the potential for a recurrence of an April 1955 petroleum oil fire at an Alcoa facility in Texas, Alcoa issued guidance to facility managers for the replacement of petroleum-based oils with non-flammable fluids. Recommended non-flammable fluids included Monsanto's Pydraul-branded fluids known to contain PCBs. The Lafayette Operations (Facility) followed this guidance and changed some if its petroleum-based oils to Pydraul-branded fluids. In the late-1950s and

1960s, the Facility documented leaks of equipment containing non-flammable fluids including locations that flowed to the industrial storm sewer and to the sewage treatment plant.

As a response to a 1970 bulletin from Monsanto to facility consumers on the potential environmental effects of Pydraul-branded fluids, the Facility immediately began to discontinue use of certain oils and implement policy to prevent discharge of the oils to the sewers. More specifically, in 1972, the Facility implemented a program to change several of the fire-resistant fluids from chlorinated bi-phenyl-based fluids to ester-based fluids. Later correspondence indicated that by 1974, all PCB-containing Pydraul had been eliminated from Facility reserves. Starting in the summer of 1978, the Facility initiated an inventory, comprehensive testing, and fluid replacement program for all equipment previously containing PCB-based fluids and equipment potentially contaminated by PCB-based fluids. In April 1979, the Alcoa Technical Center completed the first of two wastewater characterization studies identifying PCBs in the industrial sewer sediment, wastewater treatment plant sludge, and industrial influent.

In September 1979, the Facility notified the Stream Pollution Control Board of the presence of PCBs in confirmatory samples collected from the sewage treatment plant sludge. On December 7, 1979, the Indiana State Board of Health (ISBH) collected a sample from the Outfall 001 discharge, which according to the ISBH, "confirmed the presence of PCB in the discharge". The confirmation is believed to be a result of documented leaks from equipment containing non-flammable fluids including locations that flowed to the industrial storm sewer and to the sewage treatment plant.

In summary, based on the results of the record search for the Facility the following conclusions can be reached:

- In the 1970s, the Facility implemented a program to rid equipment of containing PCB-containing fluids and PCB-contaminated materials (sludges, press waters, oils). Stores of PCB-containing Pydraul non-flammable fluid were eliminated from Facility reserves by 1974;
- A release occurred prior to April 18, 1978. No spills from equipment with PCB-containing fluids that resulted in a discharge to Elliott Ditch were documented after April 18, 1978;
- The source concentration is believed to be greater than 50 mg/kg and included predominantly Aroclor 1248; and,

- Based on the facts presented above, any exceedance of the NPDES permit and/or discharge of impacted media to surface waters would be derived from pre-April 18, 1978 original release.

1.6 INVESTIGATION OBJECTIVE AND STRATEGY

Per the FSP, the objective of this Project is to support the development of a conceptual model to understand the distribution of PCB impacts in Elliott Ditch and the adjacent floodplain caused by historical releases from Outfall 001. This objective has been met by poling and the collection of GPS readings to define the horizontal and vertical extent of fine-grained deposits in-channel, sediment sampling to characterize its profile, soil sampling to characterize its profile, and sediment and soil analytical testing to assess the presence/absence and concentration of PCBs. The additional targeted investigations conducted after implementation of the scope of the FSP were primarily focused on assessing the extent of PCB impacts to upland soils, particularly along the levee (anthropogenic surface). The levee is present on the eastern bank of Elliott Ditch, from Outfall 001 to the first railroad crossing, approximately 0.5 miles from the outfall.

2.0 PREMOBILIZATION TASK SUMMARY

CEC initiated the Project by preparing a series of plans to support field activities. Provided in the following is a brief summary of the efforts that occurred prior to implementing the FSP and subsequent targeted assessments.

2.1 PRIVATE PROPERTY ACCESS COORDINATION

2.1.1 Implementation of the FSP

2.1.1.1 Targeted Properties

The sampling associated with the Project took place on private property. As such, CEC prepared a Study Area Access Plan to guide outreach to private property owners in support of executing the Project. CEC initially gathered property boundaries and ownership information from the Tippecanoe County Geographic Information System (GIS) Department for parcels where samples were to be collected. The ownership information available only included the property owner address; no phone numbers or e-mail addresses. There were 24 private properties with 18 different owners targeted for access in support of implementing the FSP. Initially, CEC used this information to engage the private property owners with a mailing that included an introductory letter and Project fact sheet. The initial mailing resulted in a number of the private property owners calling CEC to discuss the Project and arrange face-to-face meetings. For those owners that did not contact CEC, a canvasing approach (i.e. knocking on doors) was implemented for outreach.

CEC met with many of the property owners privately to discuss the Project, their concerns, answer questions, and obtain access approval. Permission to access property was required from 18 private property owners and was needed to complete sampling at locations identified in the FSP. Of those 18 property owners, CEC obtained verbal or written approvals from 14. Of the four property owners that would not provide access, one was a vacant property, two did not support the Project, and the other was Duke Energy (Duke). Duke requested copies of the Project files to perform its own environmental and legal review before providing access. Duke has since completed its review and prepared its own agreement that provides access for sampling, along with other terms and conditions. As of the date of this report, the sample(s) from the Duke property has not been collected.

2.1.1.2 Alternate Properties

A subset of the sampling locations proposed in the FSP had to be relocated due to the inability to reach the private property owners or the unwillingness to grant access. All but one of these sampling locations were relocated to the same geomorphic surfaces, at a similar distance downstream from the outfall, and on accessible properties. The one sample that was not relocated is present on the T-1 surface on the Duke Energy property. This boring could not be relocated due to no other T-1 surfaces being present within the reaches of the assessment. The other locations were moved to either the property on the other side of the stream, if access had been obtained from its owner and it contained the same geomorphic surface(s) as the property that would not provide access. Alternatively, the locations were moved to a nearby (adjacent if possible) property on the same side of the stream if it contained the necessary geomorphic surface(s) for sampling. In total, two sampling locations were moved across the stream and five were moved to nearby properties on the same side of the stream. The sampling locations moved to nearby properties required access to be provided verbally by three other private property owners. Please refer to Figures 3 and 4 for the properties where access was unattainable, the accessed properties, as well as the final sampling locations. This approach to modifying sampling locations due to inaccessible properties was reviewed and approved by the IDEM via teleconference.

2.1.2 Implementation of the Targeted Assessments

The two targeted sampling assessments took place on both private properties that had already provided access approval and those that had yet to be involved with the Project. Seven of the fourteen private property owners identified previously were involved in the targeted sampling projects. Permission for additional sampling was granted by phone or e-mail from these private property owners. The additional assessments required CEC to engage two new private property owners in a manner consistent with those property owners contacted previously. These two new private property owners provided authorization for sample collection, one via e-mail and the other via a signed Access Agreement. In accordance with the Access Plan, all property owners were contacted at least 7 days prior to the commencement of sampling activities on their property.

Please refer to Appendix I for the Study Area Access Plan that includes figures, example mailer, fact sheet, and the Access Agreement prepared and implemented in support of this Project.

2.2 OTHER PLANNING CONSIDERATIONS

A site and project-specific Contractor Safety Plan (CSP), Project Safety, Health, and Environmental Review (PSHER), and Safe Work Plan were prepared for the field activities. The CSP incorporated critical components such as fatality prevention, human performance, and stop criteria. The CSP was reviewed in detail and formally accepted by all field personnel prior to the commencement of field activities. The PSHER and Safe Work Plan are Facility-specific planning requirements identified in the Site Conditions document. The PSHER and Safe Work Plan were prepared and submitted to the Facility and reviewed by field staff prior to the commencement of field activities.

CEC also prepared a Waste Management Plan (WMP) that identified wastes that would be generated during the field effort and outlined how those wastes would be stored, characterized, and managed. The WMP included information applicable to transporting waste materials back to the Facility for secure staging until the material was transported offsite for disposal or managed onsite. The WMP was reviewed by field personnel and understood prior to commencement of field activities.

Lastly, CEC contacted Indiana 811, the underground utility locating service in advance of each sampling event. Indiana 811 marked those utilities present within the drainage easement right-of-way. In general, underground cable lines are present along Elliott Ditch and laterals run to those private properties with service.

3.0 FIELD TASK SUMMARY

Implementation of the field portion of the FSP included two separate mobilizations. The first was to conduct sediment poling along the proposed sampling transects to assess the thicknesses and finalize the sampling locations. The second mobilization was to collect soil and sediment samples at the finalized locations. Two subsequent mobilizations, one in February 2018 and the other in June 2018, occurred as part of the targeted investigations, which were focused primarily on the PCBs impacts to upland soils within the first three reaches of Elliott Ditch.

3.1 POLING AND SURVEYING

CEC conducted a poling assessment of Elliott Ditch near the proposed 13 sediment sampling locations following the procedure outlined in Section 5.1 and the Standard Operating Procedure (SOP) for Poling Measurements to Estimate Soft Sediment Thickness of the FSP. Field staff performed the poling task in chest waders without the need of a boat. The poling exercise was conducted using a survey grade, real time kinetic (RTK)-global positioning system (GPS) unit, total station, and extendable rod with 0.1-foot gradations. The rod was fitted with a 6-inch diameter disc to collect the depth of water above the sediment surface. The water surface, stream bottom, and advancement depth (surface, hard, and overall push) elevations, and spatial locations were collected real time in the RTK-GPS unit or total station. The total station was used for data collection in areas of dense canopy. Poling was conducted following a grid-based approach with spacing based on the apparent size of the sediment deposits and extended one grid spacing beyond the apparent boundary of the depositional feature. Observations, i.e. sediment type, geomorphic setting, and presence/absence of aquatic vegetation, collected from each rodding location were also collected electronically in the surveying equipment. The data summary tables from the poling and surveying can be found in Appendix II.

The poling assessment was used to finalize the sediment sampling locations. In general, the locations were moved such that the samples were collected from the area containing the thickest deposits on each transect. The sediment sampling locations were finalized in the office before mobilizing into the field for collection.

3.2 SEDIMENT SAMPLING

CEC collected sediment samples following the SOPs found in the FSP at the locations selected based on access coordination and poling. Field staff navigated to the sediment sampling locations using a RTK-GPS unit. The sediment samples were collected using a Russian Peat Borer after unsuccessful attempts to collect the samples with check valve and recovery auger samplers. The latter two pieces of equipment were unable to meet the 80-percent recovery requirement specified in the FSP due to granular materials present within the sediment profile. The gravel and sand would cause the check valve to stick or get caught in the catcher of the recovery auger, limiting recovery to approximately 20 to 40-percent. The sediment samples were collected by field staff donning chest waders and nitrile gloves. The Russian Peat Borer was advanced to the discrete sampling interval using manual pressure and, when necessary, a slide hammer. Once at the targeted depth interval, the sampler rod was rotated to simultaneously open the sampling chamber and cut the core. Sediment recovery using the Russian Peat Borer was in excess of 90-percent at most sampling locations. Each recovered core was removed from the sampling chamber and placed onto plastic sheeting near the ditch for logging purposes. The cores were then placed into labeled plastic bags for subsequent processing and sampling. This process continued until sampler refusal. Please refer to Figures 3, 3a, 3b, 3c, 4, 4a, and 4b and Table 1 for the sediment sampling locations.

Reusable sampling equipment was grossly decontaminated between each sampling interval at the same location by removal solids and rinsing with distilled water. The sampling equipment was also decontaminated using brushes, Alconox and distilled water mixture, and rinsed with distilled water between sampling locations. Decontamination solids and fluids were containerized in matrix specific 55-gallon drums near the ditch.

3.3 SOIL SAMPLING

3.3.1 Implementation of the FSP

CEC collected these soil samples following the SOPs and at the selected locations found in the FSP. As discussed previously, a subset of these locations had to be moved due to access considerations. Field staff navigated to the approximate soil sampling locations using a RTK-GPS unit. Slight modifications to the soil sampling locations were made in the field to account for physical obstructions such as trees, man-made features (i.e. structures), underground utilities, large roots, and fences. The actual sampling locations were collected in the field using the RTK-GPS unit. When possible, soil samples were collected using a soil recovery auger fitted with a stainless steel core and 6-inch poly liners per the FSP. The auger was advanced in 6-inch intervals by hand, using a gas powered rotary hammer drill, manual force or a combination of the two. The recovery auger was then extracted from the borehole by threading a T-handle to the top of the extension rod and pulling it out while limiting rotation. Each recovered core in the poly liner was removed from the sampling auger and capped on both ends, noting the orientation of the sample as “top” and “bottom”. The cores were then labeled with location and depth information for subsequent processing and sampling.

Reusable sampling equipment was grossly decontaminated between each sampling interval at the same location by removal solids and rinsing with distilled water. The sampling equipment was also decontaminated using brushes, Alconox and distilled water mixture, and rinsed with distilled water between sampling locations. Decontamination solids and fluids were containerized in matrix specific 55-gallon drums near the ditch.

3.3.2 Implementation of the Targeted Assessments

The soil sampling locations and depths for the targeted assessments were selected based on the results of the FSP and access considerations. These samples and associated analytical results were used to supplement the data from the FSP to provide a better understanding of the spatial distribution of PCB impacts. For shallow soil borings with a targeted depth of 2 feet below grade, field staff collected samples according to the following. If field staff was able to advance to the targeted depth and obtain the required recovery using the soil auger and manual force, samples were collected in this fashion as described previously. However, at several locations, the soil recovery auger could not achieve the required depth or provide sufficient recovery due to soil characteristics (clay content, moisture, and density) and friction and an 8-inch stainless steel hand trowel was used to sample these locations. Samples were collected and processed per the FSP to ensure consistency between sample locations and across different field efforts. Soil samples were collected in 6-inch intervals, placed in 6-inch poly liners while maintaining orientation of the recovered media, and capped on both ends with “top” and “bottom” being noted on liner. The soil sampling process continued at each location until met with refusal or a depth of 2 feet below grade, whichever occurred first.

Additionally, nineteen soil borings were advanced on the levee surface located on the east side of Elliott Ditch between Outfall 001 and the first railroad crossing utilizing a small, track-mounted Geoprobe. A Geoprobe was utilized to advance these borings due to the increase in targeted depth and soil conditions. These borings were advanced in two-foot increments to four feet or eight feet below grade and processed per the FSP. The borings were advanced in two-foot increments to increase the amount of soil recovery. Please refer to Figures 3, 3a, 3b, 3c, 4, 4a, and 4b and Table 1 for the soil sampling locations.

Reusable sampling equipment, including the drill rig and all downhole tooling, was grossly decontaminated between each sampling interval at the same location by removal solids and rinsing with distilled water. The sampling equipment was also decontaminated using brushes, Alconox and distilled water mixture, and rinsed with distilled water between sampling locations. Decontamination solids and fluids were containerized in matrix specific 55-gallon drums near the ditch.

3.4 SAMPLE LOGGING AND PROCESSING

The sediment and soil cores were processed, logged, and sampled by a soil scientist. Logging of both materials was performed in accordance with the SOPs in the FSP and documented by hand on the appropriate field forms. Copies of the forms for the sediment and soil samples can be found in Appendices III and IV, respectively. Sediment samples were collected from each of the observed depositional layers found in the cores. Soil samples were collected from each of the observed horizons, and if a horizon was more than 12-inches in length, it was split into multiple samples. Similarly, if there were distinctly different material present within the same horizon, samples of each were collected. The samples were placed into 4-ounce laboratory provided glass jars and stored in a cooler on ice. Each of the samples was named according to the convention identified in Section 6.1 of the FSP. The samples were transported under chain of custody to the TestAmerica Laboratory in North Canton, Ohio. The sediment samples were analyzed for PCBs via EPA Method 8082 following sample preparation Method 3540. Preparation Method 3540 used both polar and nonpolar solvent extractions to provide more accurate and precise results. The soil samples were analyzed for PCBs via EPA Method 8082 following sample preparation Method 3540. The preparation for the soil samples used a nonpolar solvent only due to relatively low moisture content.

There were 42 sediment samples and 165 soil samples, not including quality assurance/quality control samples, collected as part of the FSP and subsequent targeted assessments. For QA/QC purposes, field duplicates were collected at a ratio of approximately one per ten samples and matrix spike/matrix spike duplicates were collected at a ratio of approximately one per twenty samples, per the FSP. Five duplicates, three matrix spike/matrix spike duplicates (MS/MSDs), and one equipment/rinsate blank collected as part of sediment sampling. Similarly, there were nineteen duplicates and six MS/MSDs collected as part of soil sampling. The QA/QC sample nomenclature followed the same convention discussed previously and used qualifiers such as “FD” for field duplicate and “MS/MSD” for matrix spike/matrix spike duplicate.

3.5 INVESTIGATION DERIVED WASTE MANAGEMENT

There was little excess sediment and soil generated during the sampling efforts. The majority of the recovered media was placed into laboratory provided glassware. Decontamination water and disposable materials (i.e. spent personal protective equipment, plastic sleeves, etc.) that were generated as part of this investigation were stored in matrix-specific 55-gallon drums. The contents of each drum were sampled by CEC and analyzed for PCBs via EPA Method 8082 in support of characterization. Each drum was labeled with a "Pending Analysis" sticker and the contents and accumulation start date were noted on the drum. The drums were temporarily staged in a secure area near the ditch and transported to the Facility by a third party vendor for secure staging prior to disposal. The drummed solids contained less than 50 mg/Kg PCBs and were managed by the Facility at a RCRA Subtitle D landfill under an existing waste profile for these materials. The drummed liquids did not contain detectable concentrations of PCBs and were managed by the Facility at its wastewater treatment plant.

4.0 FINDINGS

4.1 SEDIMENT THICKNESS AND VOLUME EVALUATION

The data collected during poling was processed for an analysis of depositional areas within the 13 sediment sampling areas of Elliott Ditch. The analysis included estimating the extents of depositional areas, the thicknesses of the observed soft sediment layers, and volume estimates. CEC has prepared figures identifying the confirmed depositional area extents and sediment thicknesses. AutoCAD Civil3D software was used to perform the described analysis and generate the figures. Please refer to Figure 5 and Figures 5A through 5M for the results of the poling task.

A summary of each of the 13 depositional areas can be found in Table 2. Detailed poling log sheets including the point name, water depth, soft, hard, and total push depths, sediment type, geomorphic feature, and if aquatic vegetation was present can be found in Appendix II.

4.2 SEDIMENT CHARACTERISTICS

Sediment samples were collected within Elliott Ditch to the depths identified during the poling and surveying field effort. The majority of the sediment samples included an initial layer of medium to coarse sand with varying gravel content (typically in the range of 15 to 35-percent) followed by intermixed layers of sandy and silty loam. At greater depths (i.e. greater than 3-feet below grade) samples included a horizon of silty or sandy clay. The sediment samples were typically black to very dark brown in color. The majority of the sediment samples did not contain appreciable wood or organic content. Shells were identified in less than 10-percent of the samples. The field sampling sheets for the sediment can be found in Appendix III.

4.3 SEDIMENT PCB ANALYTICAL RESULTS

The sediment samples were collected and analyzed as discussed previously. A summary of the PCB analytical results for the sediment samples is provided in Table 3 and the associated laboratory analytical reports can be found in Appendix V. A total of 47 sediment samples, including 5 field duplicates, were submitted for analytical testing for PCBs via EPA Method 8082 and preparation Method 3540, using both polar and nonpolar solvents for extraction. PCBs were detected in all 47 samples ranging from 0.28 milligrams per Kilogram (mg/Kg) to 39.9 mg/Kg. PCBs were detected at concentrations greater than 1 mg/Kg in 32 of the 47 sediment samples and at concentrations greater than 10 mg/Kg in eight of the samples. Of the PCB concentrations exceeding 10 mg/Kg, six of the eight samples were collected from Milepost 00.60 to Milepost 1.03. Relatively higher concentrations of PCBs (i.e. greater than 10 mg/Kg) in sediment were typically observed from 1.5 to 3.5-feet below grade. The lowest PCB concentrations (i.e. less than 5 mg/Kg) were typically seen at or near the sediment surface.

4.4 SOIL CHARACTERISTICS

The subsurface geology encountered in the soil borings advanced through the various naturally occurring geomorphic surfaces was indicative of native, residual, materials. Soils were typically dark brown to black in color, very plastic, and significant increases in soil consolidation were noted as the depth below ground surface increased. Root and wood content was typically less than 15-percent. Rock and other granular materials were observed in the majority of the soil borings at less than 15-percent; however, a portion of the soil samples contained between 15 and 35 percent. Odors were not observed in the soil samples. The granular structure of the soils was typically fine to very fine with an isolated group of samples exhibiting medium grain characteristics. The vast majority of the subsurface geology within the investigation area was a loam material with varying amounts of sand and silt. The presence of sand and silt typically decreased with depth. Isolated horizons of clay, clayey loam, and silty clay were observed in a subset of borings typically at depths greater than 1.25-feet below grade.

Subsurface geology of the man-made levee along Elliott Ditch was indicative of soils introduced through anthropogenic activity. Soils were varied in distinct horizons below ground surface and showed evidence of the levee construction through lifts of fill material. For the assessed areas of the levee, a soil horizon of organic material and silty loam was typically present at 0.0 to 0.5 feet below grade. Under this horizon, the majority of soils consist of an aggregate of clay loam, silty clay, and clay with sand. Between 0.5 and 4.0 feet below grade, soils were typically reddish brown or brown to dark brown in color, moderately to very plastic with fine granular structure. Very plastic, black clay with sand was present at some locations along the levee at depths between 2.5 feet and 4.0 below grade. While most samples had gravel content less than 15-percent, isolated horizons less than 0.5 feet in thickness were identified containing greater than 60-percent gravel. This is indicative of the levee construction taking place in lifts and possibly including graveled access roads. The soil field sampling sheets can be found in Appendix IV.

4.5 SOIL PCB ANALYTICAL RESULTS

The soil samples were collected and analyzed as discussed previously. Please refer to Table 4 for a summary of the PCB analytical results for the soil samples and Appendix V for the associated laboratory analytical reports. A total of 184 soil samples, including 19 field duplicates, were submitted for analytical testing during implementation of the FSP. PCBs were detected in 124 of the 184 soil samples at concentrations ranging from 0.02 mg/Kg to 94.2 mg/Kg. PCBs were detected at concentrations greater than 1 mg/Kg in 51 of the 184 soil samples and at concentrations greater than 10 mg/Kg in 12 of the samples. Five samples, including one duplicate, exceeded 50 mg/Kg and all were collected from the levee.

PCB concentrations, if detected, in the upland soil were typically observed to be less than 1 mg/Kg. The lone exception comes from the upland surface at Milepost 00.51, which contained PCB concentrations in the range of 2 to 7 mg/Kg. This upland area is situated between the two sets of railroad tracks, which may subject it to flooding conditions dissimilar to the other areas. PCB detections from the fourth terrace (T-4) surfaces were all less than 1 mg/Kg; whereas, PCB detections from the T-6 surfaces ranged from non-detect to 4.65 mg/Kg. Of the 16 samples from the T-6 surface, three exceeded 1 mg/Kg. The T-7 geomorphic surface did not contain concentrations of PCBs greater than 1 mg/Kg with the exception of the samples at Milepost 01.14, which contained samples from four different boring locations that exceed this concentration. The depression and floodplain surfaces contained PCB concentrations ranging from approximately 0.07 to 2.44 mg/Kg, with the relatively higher concentrations being observed at greater than six inches in depth.

The highest concentrations of PCBs and widest extent of impacts were observed in the levee surface with concentrations greater than 50 mg/Kg being observed in five samples, one of which was a duplicate. PCB concentrations exceeding 10 mg/Kg were observed in 11 samples from the levee surface. The PCB impacts to the levee vary in depth across the anthropogenic feature; however, it appears to be limited to the upper two to three feet of material. The deepest soil sample with a concentration exceeding 1 mg/Kg was collected from 1.75 to 2.75 feet below grade at Milepost 00.17.

4.6 GEOMORPHOLOGY ASSESSMENT

The FSP is based on the geomorphology of Elliott Ditch and the understanding that PCBs tend to adsorb to finer grained materials, i.e. silt and clay sized particles that often contain organic matter. The geomorphic and anthropogenic features of the ditch have influenced depositional patterns both within the channel sediment and floodplain soil. The assessment approach includes the collection of sediment and soil samples along transects of known depositional and erosional features. The transects included sediment samples being collected from within the ditch itself, and soil samples being collected from the observed geomorphic surfaces or terraces and upland areas to assess the distribution of PCBs associated with historic releases from Outfall 001. Justification for sampling locations is provided in Table 3 of the FSP.

The geomorphology based sampling approach is supported by the results of this assessment. In regards to the sediment results, the assessed portion of the ditch should be discussed in two different sections. The first being from the outfall to Milepost 01.00, which contains thicker depositional areas, ranging from 0.7 to 4.3 feet in depth, and more sediment horizons than the subsequent section. This is to be expected based on the geomorphic study since this portion is less steep (Reach 1) and deposition is expected in areas of pooled water (Reaches 1 and 2). The highest PCB concentrations are detected in samples at depth in these reaches. More specifically, from the outfall to Milepost 00.47, the highest PCB detections came from the deepest samples at each of the four locations, with the highest concentration (16.87 mg/Kg) being found nearest the outfall. From Milepost 00.47 to 01.00, the highest PCB concentrations tend to occur from 1.75 to 3.50 feet below the top of sediment. PCBs were detected in the shallow sediments at lower concentrations than at depth. The shallower sediment contains more granular material, which is less likely to support adsorption of PCBs. These results indicate that the release of PCBs is likely historic in nature since the appreciable impacts occur at depth and have been covered over time. The impacts observed in the shallower sediments could be attributable to resuspension and migration of historically accumulated PCBs, likely in finer grained materials.

The sediment deposits from Milepost 01.00 to 01.59 are less prevalent and thick, ranging from 0.29 to 2.25 feet in depth, and contain fewer distinct horizons. This is to be expected given the Elliott Ditch channel characteristics, i.e. steep, deeply incised channel, etc., within this stretch. PCB concentrations are less than 2.03 mg/Kg in all but two samples collected from this section. Appreciable PCB detections, greater than 16.0 mg/Kg, occur at Milepost 1.03 in the two samples collected from 1 to 2 feet below the top of sediment.

The PCB concentrations in soil samples from the various, naturally occurring geomorphic surfaces tend to be similar. For example, the upland and T-4 surface samples were all less than 1 mg/Kg, with the exception of what was observed in the upland soil from Milepost 00.51. As noted previously, this sample location is between the two railroad tracks and could be subject to different flooding conditions that other upland sampling locations. Similarly, the T-7 surface only contained PCB concentrations in excess of 1 mg/Kg in samples from four different boring locations at Milepost 01.14. The remainder of the soil samples from this surface exhibited similar soil characteristics and PCB concentrations. The levee, an anthropogenic feature, is inherently heterogeneous given how it appears to be constructed with different fill material sources over time. The observed soil conditions and PCB concentrations in the collected samples vary over the levee; however, impacts greater than 1 mg/Kg tend to be limited to the upper two to three feet of material.

4.7 PCB AROCLOR OBSERVATIONS

The PCB Aroclor patterns provide insight into the historic source material associated with the PCB impacts. In all but five of the soil samples, the detected PCBs were quantified as Aroclors 1248 and/or 1260, which agrees with Aroclors typically observed at the Facility and in the Pydraul source material. The Aroclor patterns in the sediment are more difficult to assess and understand.

In all but one of the sediment samples upgradient of the railroad crossings, the second crossing is approximately at Milepost 00.53, the detected PCBs were quantified as Aroclors 1248 and/or 1260. The sample containing different Aroclors, quantified as Aroclors 1242 and 1254, was located at Milepost 00.25 from a depth of 3.51 to 4.3 feet below the top of sediment surface. From Milepost 00.54 to 1.03, the stretch of Elliott Ditch from the second railroad crossing to the 18th Street crossing, the majority of the detected PCBs were quantified as Aroclors 1242 and 1254. After the 18th Street crossing, the detected PCBs were quantified again as Aroclors 1248 and/or 1260. The shift in the PCB Aroclor quantified for the samples from Milepost 00.54 to 1.03 could be the result of anaerobic dechlorination weathering resulting in lighter chlorinated Aroclors being reported from sources of heavier chlorinated Aroclors. It could also be the result of a different source material.

5.0 DATA QUALITY

Data quality objectives (DQOs) were evaluated by assessing the following quality indicators: precision, accuracy, representativeness, completeness, and comparability.

5.1 PRECISION

Precision is a measure of the reproducibility of analyses under a given set of conditions (i.e., the degree to which two or more measurements are in agreement). Precision evaluates how far different individual reported values are from the average or mean. Precision is thus a measure of the magnitude of random error and will be expressed as the relative percent difference (RPD). The lower the RPD value is, the more precise (i.e., reproducible) the data.

Precision is evaluated using the RPD, which is determined according to the following equation:

$$RPD = \frac{|Value\ 1 - Value\ 2|}{Arithmetic\ Mean\ of\ Value\ 1\ and\ 2}\ x\ 100$$

This equation above is appropriate when the analytical results are greater than 5 times the reporting limit (RL). For results that are near the limit of quantitation, acceptable precision is demonstrated by the absolute value of the difference between Value 1 and Value 2 being within 2 times the RL. For results that are reported between the RL and the method detection limit (MDL), precision is considered poor by definition (i.e., the results are considered qualitatively acceptable in that a constituent can be identified, but are quantitatively suspect since the concentration cannot be accurately quantified). This is the reason that results between the RL and MDL are "J" flagged as estimated.

For this investigation, precision for sediment samples was evaluated using the analytical results for samples ED-00.08-SD02-0.75-1.4, ED-00.25-SD01-3.51-4.3, ED-00.72-SD03-2.40-3.50, ED-01.03-SD02-0-0.98, ED-1.03-SD02-0.98-1.65 and the respective duplicate samples. Acceptable precision for field duplicates in sediment is typically RPD < 40-percent. Four of the five sediment samples met this precision criteria. The one sample that does not, ED-1.03-SD02-0.98-1.65, is likely the result of chemical heterogeneity across the sediment matrix and heterogeneity of the sediment matrix itself.

The soil samples precision was evaluated in a similar fashion. Of the 19 soil samples with duplicates, the RPD was only able to be calculated for 11 of them due to non-detects in almost half of these samples. The RPD met the 40-percent precision criteria in six of the 11 samples, indicative of chemical heterogeneity across the soil matrix and heterogeneity of the soil matrix itself. However, these analyses of precision is not expected to impact the usability of the data.

5.2 ACCURACY

Accuracy is a measure of the bias that exists in a measurement system (i.e., the degree of agreement between an observed value and a reference or true value). Accuracy measures the average or systematic error of a measurement method or sampling method. Accuracy in the field is determined through the collection of equipment and trip blanks and review of the results for evidence of sample contamination stemming from field activities or sample transport.

Non-disposable sampling equipment used throughout the investigation was thoroughly cleaned between each sample location, thus minimizing the potential for impacts to sampling stemming from field activities. One equipment blank sample, identified as “Equip Rinsate”, was collected from the stainless steel soil augering equipment to verify that constituents were not being introduced into the sample due to improper decontamination between boring locations. PCBs were not detected in the rinsate sample.

5.3 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represent the environmental condition. Representativeness is accomplished by maintaining sample integrity with appropriate preservation and meeting technical holding times and by collecting a statistically significant number of samples. Field representativeness is dependent upon the proper design of the sampling program and will be satisfied by following proper sampling techniques.

Field work was conducted in accordance the regulatory approved FSP and the associated SOPs. Samples were collected using laboratory provided containers, preserved in a cooler on ice, and were immediately delivered to the laboratory within specified hold times. Sample locations are as justified in Table 3 of the FSP and designed to assess the erosional and depositional features of Elliott Ditch from Facility Outfall 001 to Milepost 1.59. Accordingly, the analytical results are considered to be representative of this reach of Elliott Ditch.

5.4 COMPLETENESS

Completeness is the measurement of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under "normal" conditions. Completeness establishes whether a sufficient number of valid measurements were obtained. The closer this value is to 100, the more complete the measurement process. Data rejected, whether due to sampling design error, measurement error, or bias or sample matrix interferences, will be considered invalid measurements. The following formula was used to estimate completeness:

$$Percent\ Completeness = \frac{V}{T}\ x\ 100$$

Where:

V = number of measurements judged valid

T = total number of measurements

The sampling location situated on the T-1 surface on Duke Energy Property is the only data that is missing from this assessment that was specified in the FSP. All other sampling points were collected, not necessarily in the exact specified location due to access issues, but on the targeted geomorphic surface near the specified Milepost. Two additional field sampling efforts were performed in accordance with the FSP to collect targeted information. Therefore, the dataset for this portion of the Elliott Ditch assessment is considered complete.

5.5 COMPARABILITY

Comparability expresses the confidence with which one set of data can be compared to another. It is a qualitative measurement to ensure sampling and analytical procedures are consistent within and between data sets, such as split sampling or monitoring. Analytical data is comparable when similar sampling, analytical methods, and reporting limits are consistently used for assessments of Elliott Ditch. Comparability was controlled by requiring the use of specific nationally-recognized analytical methods and requiring consistent method performance criteria.

Sampling was conducted in accordance with the approved FSP and associated SOPs. Because of this, the sampling procedure between sample locations and across different sampling events was consistent. Additionally, the same laboratory analyzed samples using consistent analytical methods. Thus, the data set is considered comparable.

TABLES

Table 1. Sediment and Soil Sampling Locations Elliott Ditch Field Sampling Report Lafayette, Tippecanoe County, Indiana August 2018			
Boring ID	**Northing (feet)**	**Easting (feet)**	**Assessment**
ED-00.00-SL01	1,869,378.92	3,015,067.30	Additional Sampling
ED-00.00-SL03	1,869,400.56	3,015,093.48	Additional Sampling
ED-00.00-SL04	1,869,294.01	3,015,043.12	Additional Sampling
ED-00.02-SL01	1,869,315.12	3,014,964.44	Additional Sampling
ED-00.05-SL01	1,869,223.98	3,014,825.12	Additional Sampling
ED-00.08-SD02	1,869,094.82	3,014,604.72	FSP
ED-00.08-SL01	1,869,190.16	3,014,650.63	FSP
ED-00.08-SL03	1,869,135.64	3,014,698.12	FSP
ED-00.08-SL04	1,869,066.59	3,014,765.16	FSP
ED-00.08-SL05	1,869,067.08	3,014,613.53	Additional Sampling
ED-00.13-SL01	1,868,975.28	3,014,519.78	Additional Sampling
ED-00.17-SL01	1,868,850.93	3,014,389.57	Additional Sampling
ED-00.17-SL02	1,868,799.18	3,014,349.04	Additional Sampling
ED-00.19-SL01	1,868,726.19	3,014,254.17	Additional Sampling
ED-00.21-SL01	1,868,677.98	3,014,170.09	Additional Sampling
ED-00.23-SL01	1,868,631.70	3,014,076.12	Additional Sampling
ED-00.25-SD01	1,868,643.99	3,014,036.70	FSP
ED-00.25-SL02	1,868,580.11	3,013,983.51	FSP
ED-00.25-SL03	1,868,514.71	3,014,053.32	FSP
ED-00.25-SL04	1,868,616.44	3,013,941.63	FSP
ED-00.27-SL01	1,868,506.18	3,013,932.37	Additional Sampling
ED-00.29-SL01	1,868,418.53	3,013,878.38	Additional Sampling
ED-00.31-SL01	1,868,316.15	3,013,813.16	Additional Sampling
ED-00.33-SL01	1,868,217.98	3,013,748.65	Additional Sampling
ED-00.36-SL01	1,868,114.90	3,013,689.75	Additional Sampling
ED-00.39-SD02	1,868,039.02	3,013,597.07	FSP
ED-00.39-SL01	1,868,018.03	3,013,553.06	FSP
ED-00.39-SL03	1,867,992.66	3,013,608.85	FSP
ED-00.39-SL04	1,867,949.16	3,013,695.32	FSP
ED-00.41-SL01	1,867,899.62	3,013,539.41	Additional Sampling
ED-00.44-SL01	1,867,757.97	3,013,433.80	Additional Sampling
ED-00.47-SD02	1,867,703.13	3,013,346.80	FSP
ED-00.47-SL01	1,867,689.50	3,013,286.40	FSP
ED-00.47-SL03	1,867,660.53	3,013,356.13	FSP
ED-00.47-SL04	1,867,617.04	3,013,448.18	FSP
ED-00.51-SD02	1,867,474.48	3,013,175.15	FSP
ED-00.51-SL01	1,867,488.83	3,013,161.52	FSP

Boring ID	Northing (feet)	Easting (feet)	Assessment
ED-00.51-SL03	1,867,459.87	3,013,236.82	FSP
ED-00.51-SL06	1,867,415.72	3,013,207.87	Additional Sampling
ED-00.54-SD03	1,867,300.71	3,013,071.29	Additional Sampling
ED-00.55-SL01	1,867,284.67	3,013,090.86	Additional Sampling
ED-00.55-SL02	1,867,269.43	3,013,110.90	Additional Sampling
ED-00.60-SD02	1,867,085.05	3,012,861.47	FSP
ED-00.60-SL01	1,867,131.06	3,012,853.13	FSP
ED-00.60-SL03	1,867,087.45	3,012,897.81	FSP
ED-00.72-SD03	1,866,696.52	3,012,430.68	FSP
ED-00.72-SL01	1,866,625.21	3,012,465.50	FSP
ED-00.72-SL02	1,866,707.44	3,012,427.86	FSP
ED-00.72-SL04	1,866,681.96	3,012,436.28	FSP
ED-00.82-SD02	1,866,704.14	3,011,826.97	FSP
ED-00.82-SL01	1,866,731.67	3,011,901.21	FSP
ED-00.82-SL03	1,866,680.60	3,011,873.47	FSP
ED-00.82-SL04	1,866,636.94	3,011,895.86	FSP
ED-01.03-SD02	1,866,900.88	3,010,838.13	FSP
ED-01.03-SL01	1,866,929.55	3,010,855.90	FSP
ED-01.03-SL03	1,866,845.67	3,010,817.09	FSP
ED-01.14-SD02	1,866,726.26	3,010,229.29	FSP
ED-01.14-SL01	1,866,764.12	3,010,218.24	FSP
ED-01.14-SL03	1,866,724.19	3,010,279.63	FSP
ED-01.14-SL04	1,866,776.90	3,010,260.89	Additional Sampling
ED-01.14-SL05	1,866,791.34	3,010,178.80	Additional Sampling
ED-01.14-SL06	1,866,737.60	3,010,182.01	Additional Sampling
ED-01.24-SD02	1,866,557.13	3,009,897.96	FSP
ED-01.24-SL01	1,866,577.39	3,009,886.95	FSP
ED-01.24-SL03	1,866,533.34	3,009,904.12	FSP
ED-01.24-SL04	1,866,609.54	3,009,882.92	Additional Sampling
ED-01.24-SL05	1,866,572.43	3,009,873.63	Additional Sampling
ED-01.24-SL06	1,866,593.40	3,009,920.68	Additional Sampling
ED-01.37-SD02	1,866,141.98	3,009,262.65	FSP
ED-01.37-SL01	1,866,198.53	3,009,244.15	FSP
ED-01.37-SL03	1,866,264.58	3,009,228.30	FSP
ED-01.49-SD03	1,865,918.07	3,008,753.35	FSP
ED-01.49-SL01	1,865,973.73	3,008,695.96	FSP
ED-01.49-SL02	1,865,948.23	3,008,696.02	FSP
ED-01.49-SL04	1,865,879.01	3,008,696.18	FSP

NOTE:
1. All coordinates are Indiana State Plane West, units are feet.
2. “SD” in the boring ID indicates sediment and “SL” is soil.

Table 2. Sediment Poling Volume Estimates
Elliott Ditch Field Sampling Report
Lafayette, Tippecanoe County, Indiana
August 2018

Transect	Area (SF)	Max Thickness (Feet)	Volume (CY)
A	2,285.78	3.80	137
B	2,307.03	4.36	118
C	2,861.56	4.60	183
D	1,391.03	3.53	85
E	586.70	3.00	14
F	850.18	2.62	37
G	292.68	4.34	12
H	295.94	0.80	5
I	366.50	2.35	13
J	230.31	1.84	5
K	285.27	3.00	7
L	846.82	3.36	15
M	236.17	1.30	5

Table 3. Sediment Sampling PCB Analytical Results
Elliott Ditch Field Sampling Report
Lafayette, Tippecanoe County, Indiana
August 2018

Boring/Sample ID	PCB Aroclor									Total PCBs (mg/Kg)
	1016	1221	1232	1242	1248	1254	1260	1262	1268	
ED-00.08-SD02										
0 - 0.45'	ND	ND	ND	ND	0.68	ND	ND	ND	ND	0.68
0.45 - 0.75'	ND	ND	ND	ND	4.31	ND	0.17	ND	ND	4.48
0.75 - 1.4'	ND	ND	ND	ND	1.14	ND	0.05	ND	ND	1.19
0.75 - 1.4' FD	ND	ND	ND	ND	1.15	ND	0.06	ND	ND	1.21
1.4 - 2.03'	ND	ND	ND	ND	7.73	ND	ND	ND	ND	7.73
ED-00.25-SD01										
0 - 0.57'	ND	ND	ND	ND	0.48	ND	ND	ND	ND	0.48
0.57 - 3.51'	ND	ND	ND	ND	0.30	ND	ND	ND	ND	0.30
3.51 - 4.3'	ND	ND	ND	13.50	ND	3.37	ND	ND	ND	16.87
3.51 - 4.3' FD	ND	ND	ND	12.30	ND	1.33	ND	ND	ND	13.63
ED-00.39-SD02										
0 - 2.20'	ND	ND	ND	ND	0.91	ND	ND	ND	ND	0.91
2.20 - 2.41'	ND	ND	ND	ND	2.77	ND	ND	ND	ND	2.77
2.41 - 3.54'	ND	ND	ND	ND	2.89	ND	ND	ND	ND	2.89
3.54 - 4.30'	ND	ND	ND	ND	4.64	ND	0.14	ND	ND	4.78
ED-00.47-SD02										
0 - 0.33'	ND	ND	ND	ND	1.09	ND	0.05	ND	ND	1.14
0.33 - 1.46'	ND	ND	ND	ND	2.74	ND	0.15	ND	ND	2.89
1.46 - 1.96'	ND	ND	ND	ND	1.38	ND	0.08	ND	ND	1.46
1.96 - 3.13'	ND	ND	ND	ND	2.48	ND	ND	ND	ND	2.48
ED-00.51-SD02										
0 - 0.36'	ND	ND	ND	ND	0.62	ND	0.03	ND	ND	0.64
0.36 - 0.68'	ND	ND	ND	ND	1.31	ND	0.04	ND	ND	1.35
0.68 - 1.65'	ND	ND	ND	ND	0.55	ND	ND	ND	ND	0.55
1.65 - 1.75'	ND	ND	ND	ND	0.95	ND	0.06	ND	ND	1.01
ED-00.54-SD03										
0 - 0.45'	ND	ND	ND	0.55	ND	0.11	ND	ND	ND	0.66
0.45 - 0.9'	ND	ND	ND	0.29	ND	0.10	ND	ND	ND	0.40
ED-00.60-SD02										
0 - 1.76'	ND	ND	ND	ND	1.03	ND	0.03	ND	ND	1.06
1.76 - 2.22'	ND	ND	ND	ND	23.80	ND	ND	ND	ND	23.80
2.22 - 2.39'	ND	ND	ND	8.09	ND	1.19	ND	ND	ND	9.28
2.39 - 2.63'	ND	ND	ND	0.51	ND	0.06	ND	ND	ND	0.56
2.63 - 3.30'	ND	ND	ND	4.42	ND	0.44	ND	ND	ND	4.86

Boring/Sample ID	PCB Aroclor									Total PCBs (mg/Kg)
	1016	1221	1232	1242	1248	1254	1260	1262	1268	
ED-00.72-SD03										
0 - 2.06'	ND	ND	ND	ND	0.84	ND	0.04	ND	ND	0.88
2.06 - 2.40'	ND	ND	ND	1.45	ND	0.16	ND	ND	ND	1.61
2.40 - 3.50'	ND	ND	ND	12.10	ND	1.96	ND	ND	ND	14.06
2.40 - 3.50' FD	ND	ND	ND	11.00	ND	1.71	ND	ND	ND	12.71
3.50 - 3.84'	ND	ND	ND	6.57	ND	1.01	ND	ND	ND	7.58
3.84 - 4.05'	ND	ND	ND	6.98	ND	1.44	ND	ND	ND	8.42
4.05 - 4.30'	ND	ND	ND	4.54	ND	0.64	ND	ND	ND	5.18
0.39 - 0.70'	ND	ND	ND	ND	0.34	ND	ND	ND	ND	0.34
ED-01.03-SD02										
0 - 0.98'	ND	ND	ND	1.58	ND	ND	0.05	ND	ND	1.63
0 - 0.98' FD	ND	ND	ND	ND	1.76	ND	0.05	ND	ND	1.81
0.98 - 1.65'	ND	ND	ND	39.90	ND	ND	ND	ND	ND	39.90
0.98 - 1.65' FD	ND	ND	ND	17.10	ND	ND	ND	ND	ND	17.10
1.65 - 1.87'	ND	ND	ND	ND	16.00	ND	ND	ND	ND	16.00
1.87 - 2.25'	ND	ND	ND	1.79	ND	0.24	ND	ND	ND	2.03
ED-01.14-SD02										
0 - 1.05'	ND	ND	ND	ND	0.62	ND	0.04	ND	ND	0.65
ED-01.24-SD02										
0 - 0.17'	ND	ND	ND	ND	0.54	ND	ND	ND	ND	0.54
0.17 - 0.29'	ND	ND	ND	ND	0.28	ND	ND	ND	ND	0.28
ED-01.37-SD02										
0 - 0.90'	ND	ND	ND	ND	1.46	ND	0.05	ND	ND	1.51
ED-01.49-SD03										
0 - 0.70'	ND	ND	ND	ND	0.42	ND	ND	ND	ND	0.42

NOTES

ND = constituent was not detected above the method detection limit

Table 4. Soil Sampling PCB Analytical Results Elliott Ditch Field Sampling Report Lafayette, Tippecanoe County, Indiana August 2018											
Boring/Sample ID	**Geomorphic Surface**	**PCB Aroclor**									**Total PCBs (mg/Kg)**
		1016	**1221**	**1232**	**1242**	**1248**	**1254**	**1260**	**1262**	**1268**	
ED-00.00-SL01											
0 - 0.91'	Levee	ND	ND	ND	ND	0.08	ND	ND	ND	ND	0.08
0.91 - 2.21'		ND	ND	ND	ND	3.12	ND	ND	ND	ND	3.12
2.21 - 3.12'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.00-SL03											
0 - 0.9'	Levee	ND	ND	ND	ND	1.26	ND	ND	ND	ND	1.26
0.9 - 1.7'		ND	ND	ND	ND	0.06	ND	ND	ND	ND	0.06
1.7 - 2.5'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.00-SL04											
0 - 0.9'	Levee	ND	ND	ND	ND	0.04	ND	ND	ND	ND	0.04
0 - 0.9' FD		ND	ND	ND	ND	0.03	ND	ND	ND	ND	0.03
0.9 - 1.8'		ND	ND	ND	ND	0.03	ND	ND	ND	ND	0.03
1.8 - 2.7'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.02-SL01											
0 - 0.63'	Levee	ND	ND	ND	ND	1.02	ND	ND	ND	ND	1.02
0.63 - 1.76'		ND	ND	ND	ND	0.07	ND	ND	ND	ND	0.07
1.76 - 2.18'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2.18 - 3.43'		ND	ND	ND	ND	0.04	ND	ND	ND	ND	0.04
ED-00.05-SL01											
0 - 0.67'	Levee	ND	ND	ND	ND	3.19	ND	0.36	ND	ND	3.55
0.67 - 1.2'		ND	ND	ND	ND	0.03	ND	ND	ND	ND	0.03
1.4 - 2.3'		ND	ND	ND	ND	0.05	ND	ND	ND	ND	0.05
2.3 - 3.3'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.08-SL01											
0 - 0.5'	Upland	ND	ND	ND	ND	0.17	ND	0.03	ND	ND	0.19
0.5 - 1.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1.0 - 1.86'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1.86 - 2.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.08-SL03											
0 - 0.5'	Levee	ND	ND	ND	ND	7.15	ND	0.84	ND	ND	7.99
0.5 - 0.97'		ND	ND	ND	ND	1.93	ND	0.13	ND	ND	2.06
0.97 - 1.47'		ND	ND	ND	ND	66.00	ND	2.72	ND	ND	68.72
1.50 - 2.0'		ND	ND	ND	ND	78.30	ND	4.30	ND	ND	82.60
2.25 - 2.75'		ND	ND	ND	ND	0.05	ND	ND	ND	ND	0.05
2.75 - 3.5'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.08-SL04											
0 - 0.67'	Upland Swale	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.67 - 0.86'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.86 - 1.36'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1.50 - 2.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ED-00.08-SL05											
0 - 0.67'	Levee	ND	ND	ND	ND	17.00	ND	1.23	ND	ND	18.23
0.67 - 1.25'		ND	ND	ND	ND	5.49	ND	0.26	ND	ND	5.75
1.25 - 2.1'		ND	ND	ND	ND	0.04	ND	ND	ND	ND	0.04
2.1 - 3.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.13-SL01											
0 - 0.67'	Levee	ND	ND	ND	ND	5.56	ND	0.35	ND	ND	5.91
0.67 - 1.67'		ND	ND	ND	ND	0.30	ND	ND	ND	ND	0.30
1.6 - 2.75'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2.75 - 3.08'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.17-SL01											
0 - 0.75'	Levee	ND	ND	ND	ND	2.94	ND	0.43	ND	ND	3.37
0 - 0.75' FD		ND	ND	ND	ND	2.64	ND	ND	ND	ND	2.64
0.75 - 1.75'		ND	ND	ND	ND	13.50	ND	0.97	ND	ND	14.47
1.75 - 2.75'		ND	ND	ND	ND	51.60	ND	ND	ND	ND	51.60
2.75 - 3.75'		ND	ND	ND	ND	0.03	ND	ND	ND	ND	0.03
ED-00.17-SL02											
0 - 0.8'	Levee	ND	ND	ND	ND	94.20	ND	ND	ND	ND	94.20
0 - 0.8' FD		ND	ND	ND	ND	60.40	ND	ND	ND	ND	60.40
0.8 - 1.8'		ND	ND	ND	ND	3.94	ND	ND	ND	ND	3.94
1.8 - 2.8'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.19-SL01											
0 - 0.8'	Levee	ND	ND	ND	ND	1.50	ND	ND	ND	ND	1.50
0.8 - 1.5'		ND	ND	ND	ND	0.18	ND	ND	ND	ND	0.18
0.8 - 1.5' FD		ND	ND	ND	ND	0.17	ND	ND	ND	ND	0.17
1.5' - 1.8'		ND	ND	ND	ND	1.58	ND	ND	ND	ND	1.58
1.8 - 2.3'		ND	ND	ND	ND	1.69	ND	ND	ND	ND	1.69
ED-00.21-SL01											
0 - 1.0'	Levee	ND	ND	ND	ND	0.83	ND	ND	ND	ND	0.83
1.0 - 2.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1.0 - 2.0' FD		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.23-SL01											
0 - 0.7'	Levee	ND	ND	ND	ND	11.40	ND	1.26	ND	ND	12.66
0.7' - 1.2'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.7 - 1.2' FD		ND	ND	ND	ND	0.03	ND	ND	ND	ND	0.03
1.2 - 2.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.25-SL02											
0 - 0.5'	Levee	ND	ND	ND	ND	4.14	ND	0.50	ND	ND	4.64
0 - 0.5' FD		ND	ND	ND	ND	4.71	ND	0.54	ND	ND	5.25
0.5 - 1.0'		ND	ND	ND	ND	0.69	ND	0.09	ND	ND	0.77
1.0 - 1.5'		ND	ND	ND	ND	1.60	ND	0.17	ND	ND	1.77
ED-00.25-SL03											
0 - 0.5'	Upland Swale	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.5 - 1.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ED-00.25-SL04											
0 - 0.5'	Upland	ND	ND	ND	ND	ND	0.07	ND	ND	ND	0.07
0.5 - 1.0'		ND	ND	ND	ND	ND	0.04	ND	ND	ND	0.04
1.0 - 1.5'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1.5' - 2.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.27-SL01											
0 - 1.0'	Levee	ND	ND	ND	ND	25.50	ND	ND	ND	ND	25.50
1.0 - 1.9'		ND	ND	ND	ND	0.13	ND	ND	ND	ND	0.13
1.9 - 2.8'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.29-SL01											
0 - 0.7'	Levee	ND	ND	ND	ND	6.46	ND	ND	ND	ND	6.46
0.7 - 1.7'		ND	ND	ND	ND	0.05	ND	ND	ND	ND	0.05
1.7 - 2.7'		ND	ND	ND	ND	0.07	ND	ND	ND	ND	0.07
1.7 - 2.7' FD		ND	ND	ND	ND	0.05	ND	ND	ND	ND	0.05
ED-00.31-SL01											
0 - 1.0'	Levee	ND	ND	ND	ND	22.40	ND	ND	ND	ND	22.40
1.0 - 2.0'		ND	ND	ND	ND	0.37	ND	ND	ND	ND	0.37
ED-00.33-SL01											
0 - 0.7'	Levee	ND	ND	ND	ND	0.98	ND	0.17	ND	ND	1.14
0.7 - 1.6'		ND	ND	ND	ND	0.33	ND	ND	ND	ND	0.33
1.6 - 2.3'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.36-SL01											
0 - 0.4'	Levee	ND	ND	ND	ND	0.37	ND	ND	ND	ND	0.37
0.4 - 1.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1.0 - 1.5'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1.5 - 2.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1.5 - 2.0' FD		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.39-SL01											
0 - 0.5'	Upland	ND	ND	ND	ND	0.09	ND	ND	ND	ND	0.09
0.5 - 1.0'		ND	ND	ND	ND	0.13	ND	ND	ND	ND	0.13
ED-00.39-SL03											
0 - 0.69'	Levee	ND	ND	ND	ND	5.00	ND	ND	ND	ND	5.00
0 - 0.69' FD		ND	ND	ND	ND	6.09	ND	0.39	ND	ND	6.48
0.69 - 0.98'		ND	ND	ND	ND	0.58	ND	ND	ND	ND	0.58
0.98 - 1.17'		ND	ND	ND	ND	5.02	ND	0.77	ND	ND	5.79
1.17 - 1.5'		ND	ND	ND	ND	0.11	ND	ND	ND	ND	0.11
ED-00.39-SL04											
0 - 0.5'	Upland Swale	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.5 - 1.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.41-SL01											
0 - 0.5'	Levee	ND	ND	ND	ND	19.20	ND	ND	ND	ND	19.20
0.5 - 1.0'		ND	ND	ND	ND	1.98	ND	ND	ND	ND	1.98
1.0 - 1.5'		ND	ND	ND	ND	0.45	ND	ND	ND	ND	0.45
1.5 - 2.0'		ND	ND	ND	ND	0.04	ND	0.77	ND	ND	0.81
1.5 - 2.0' FD		ND	ND	ND	ND	0.04	ND	ND	ND	ND	0.04

ED-00.44-SL01											
0 - 0.5'	Levee	ND	ND	ND	ND	0.34	ND	ND	ND	ND	0.34
0.5 - 1.0'		ND	ND	ND	ND	0.41	ND	ND	ND	ND	0.41
1.0 - 1.5'		ND	ND	ND	ND	0.45	ND	ND	ND	ND	0.45
1.5 - 1.8'		ND	ND	ND	ND	0.03	ND	ND	ND	ND	0.09
1.8 - 2.0'		ND	ND	ND	ND	0.14	ND	ND	ND	ND	0.29
ED-00.47-SL01											
0 - 0.5'	Upland	ND	ND	ND	ND	0.20	ND	ND	ND	ND	0.20
ED-00.47-SL03											
0 - 0.77'	Levee	ND	ND	ND	ND	0.37	ND	ND	ND	ND	0.37
0 - 0.77' FD		ND	ND	ND	ND	0.75	ND	ND	ND	ND	0.75
ED-00.47-SL04											
0 - 0.80'	Upland Swale	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.51-SL01											
0 - 0.5'	Upland	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.5 - 1.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.51-SL03											
0 - 0.5'	Upland	ND	ND	ND	ND	2.68	ND	ND	ND	ND	2.68
0 - 0.5' FD		ND	ND	ND	ND	5.52	ND	ND	ND	ND	5.52
0.5 - 1.0'		ND	ND	ND	ND	6.44	ND	ND	ND	ND	6.44
ED-00.51-SL06											
1.0 - 2.0'	Upland	ND	ND	ND	ND	2.79	ND	0.42	ND	ND	3.21
ED-00.55-SL01											
0 - 0.42'	T-4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.5 - 0.88'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.55-SL02											
0 - 0.42'	Upland	ND	ND	ND	ND	0.03	ND	ND	ND	ND	0.03
0.5 - 0.96'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.60-SL01											
0 - 0.19'	Upland	ND	ND	ND	ND	ND	0.21	ND	ND	ND	0.21
0.19 - 1.0'		ND	ND	ND	ND	0.19	ND	ND	ND	ND	0.19
ED-00.60-SL03											
0 - 0.89'	T-4	ND	ND	ND	ND	0.03	ND	ND	ND	ND	0.03
0.89 - 1.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.72-SL01											
0 - 0.50'	Upland	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0 - 0.50' FD		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.50 - 1.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-00.72-SL02											
0 - 0.5'	F	ND	ND	ND	ND	1.44	ND	ND	ND	ND	1.44
0.5 - 1.0'		ND	ND	ND	ND	1.81	ND	0.12	ND	ND	1.93
1.0 - 1.5'		ND	ND	ND	ND	2.29	ND	0.15	ND	ND	2.44
ED-00.72-SL04											
0 - 0.11'	T-4	ND	ND	ND	ND	0.05	ND	ND	ND	ND	0.05
0.11 - 0.47'		ND	ND	ND	ND	0.02	ND	ND	ND	ND	0.02
0.47 - 1.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

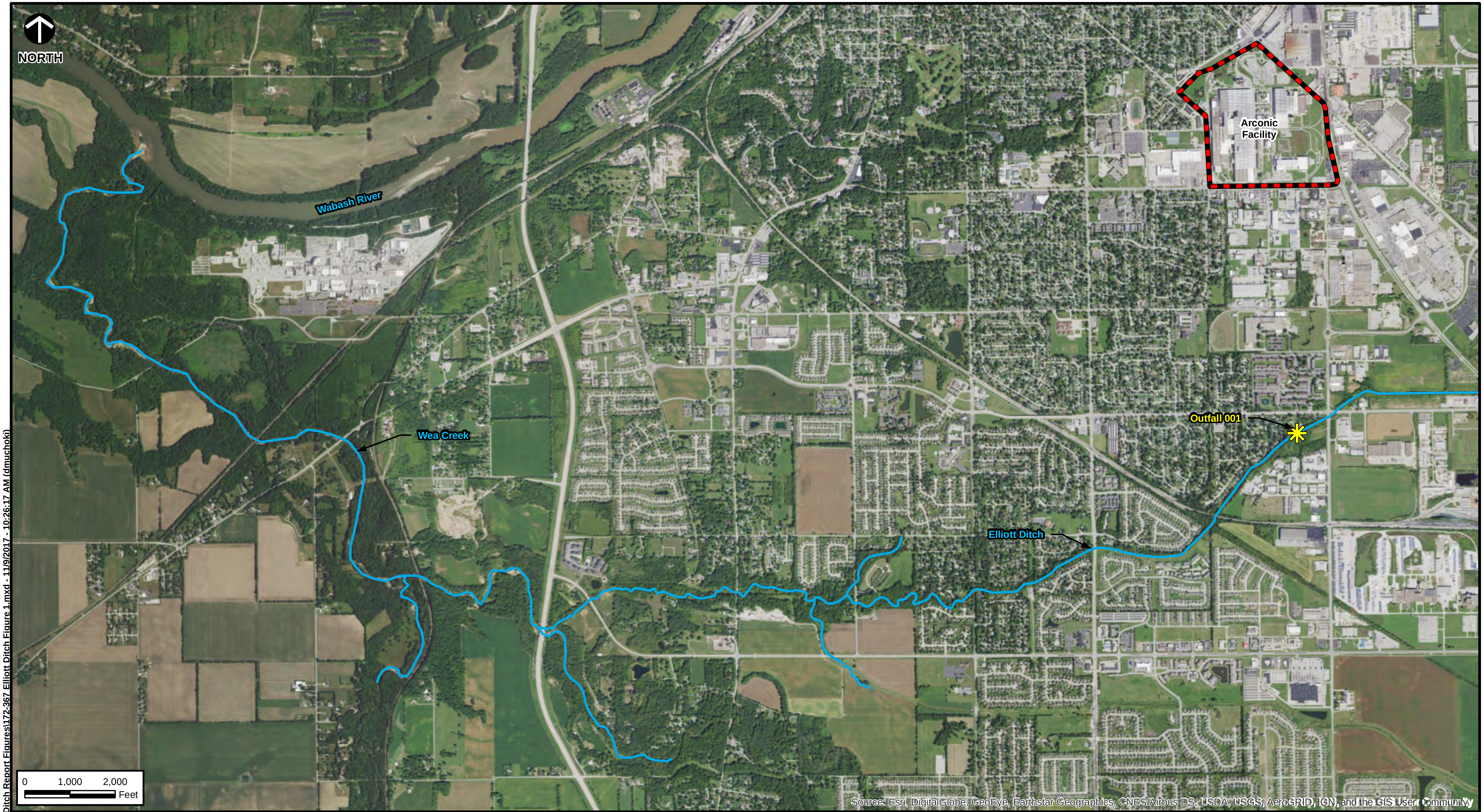
ED-00.82-SL01											
0 - 0.22'	Upland	ND	ND	ND	ND	0.34	ND	0.06	ND	ND	0.40
0.22 - 0.5'		ND	ND	ND	ND	0.26	ND	0.06	ND	ND	0.32
ED-00.82-SL03											
0 - 0.5'	Depression	ND	ND	ND	ND	0.07	ND	ND	ND	ND	0.07
0.5 -1.0'		ND	ND	ND	ND	1.12	ND	0.08	ND	ND	1.20
ED-00.82-SL04											
0 - 0.13'	T-4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.13 - 0.5'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-01.03-SL01											
0 - 0.5'	Upland	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0 - 0.5' FD		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-01.03-SL03											
0 - 0.21'	T-4	ND	ND	ND	ND	0.07	ND	ND	ND	ND	0.07
0.21 - 1.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-01.14-SL01											
0 - 0.5'	T-7	ND	ND	ND	ND	2.15	ND	0.34	ND	ND	2.49
0.5 - 1.0'		ND	ND	ND	ND	11.40	ND	1.30	ND	ND	12.70
1.0 - 1.5'		ND	ND	ND	ND	6.33	ND	0.94	ND	ND	7.27
ED-01.14-SL03											
0 - 0.5'	T-6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.5 - 1.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.5 - 1.0' FD		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-01.14-SL04											
0 - 0.5'	T-7	ND	ND	ND	ND	2.46	ND	ND	ND	ND	2.46
0.5 - 1.0'		ND	ND	ND	ND	0.73	ND	ND	ND	ND	0.73
1.0 - 1.5'		ND	ND	ND	ND	0.77	ND	ND	ND	ND	0.77
1.5 - 1.8'		ND	ND	ND	ND	1.08	ND	ND	ND	ND	1.08
ED-01.14-SL05											
0 - 0.5'	Upland	ND	ND	ND	ND	0.21	ND	ND	ND	ND	0.21
0.5 - 1.0'		ND	ND	ND	ND	0.23	ND	ND	ND	ND	0.23
1.0 - 1.5'		ND	ND	ND	ND	0.18	ND	ND	ND	ND	0.18
ED-01.14-SL06											
0 - 0.5'	T-7	ND	ND	ND	ND	1.18	ND	0.39	ND	ND	1.57
0.5 - 1.0'		ND	ND	ND	ND	0.32	ND	0.11	ND	ND	0.43
1.0 - 1.5'		ND	ND	ND	ND	0.22	ND	0.06	ND	ND	0.28
ED-01.24-SL01											
0 - 0.87'	T-6	ND	ND	ND	ND	4.24	ND	0.41	ND	ND	4.65
0.87 - 1.0'		ND	ND	ND	ND	0.66	ND	0.05	ND	ND	0.71
ED-01.24-SL03											
0 - 0.5'	T-7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-01.24-SL04											
0 - 0.84'	Upland	ND	ND	ND	ND	0.03	ND	ND	ND	ND	0.03
1.0 - 1.46'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ED-01.24-SL05											
0 - 0.42'	T-6	ND	ND	ND	ND	0.80	ND	0.18	ND	ND	0.99
0 - 0.42' FD		ND	ND	ND	ND	0.90	ND	0.19	ND	ND	1.09
0.5 - 1.46'		ND	ND	ND	ND	1.10	ND	0.21	ND	ND	1.31
ED-01.24-SL06											
0 - 0.84'	T-6	ND	ND	ND	ND	0.13	ND	0.03	ND	ND	0.16
1 - 1.96'		ND	ND	ND	ND	0.14	ND	0.03	ND	ND	0.16
ED-01.37-SL01											
0 - 0.9'	Upland	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0 - 0.9' FD		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-01.37-SL03											
0 - 0.27'	T-7	ND	ND	ND	ND	0.77	ND	0.12	ND	ND	0.89
0.27 - 0.92'		ND	ND	ND	ND	0.16	ND	ND	ND	ND	0.16
0.92 - 1.07'		ND	ND	ND	ND	0.24	ND	0.03	ND	ND	0.27
1.07 - 2.0'		ND	ND	ND	ND	0.19	ND	ND	ND	ND	0.19
ED-01.49-SL01											
0 - 0.5'	T-7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0 - 0.5' FD		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ED-01.49-SL02											
0 - 0.5'	T-6	ND	ND	ND	ND	0.16	ND	0.02	ND	ND	0.19
0.5 - 1.0'		ND	ND	ND	ND	0.12	ND	ND	ND	ND	0.12
ED-01.49-SL04											
0 - 0.5'	T-6	ND	ND	ND	ND	ND	0.03	ND	ND	ND	0.03
0.5 - 1.0'		ND	ND	ND	ND	ND	0.02	ND	ND	ND	0.02
1.0 - 1.81'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1.81 - 2.0'		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTES

ND = constituent was not detected above the laboratory method detection limit

FIGURES



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LEGEND

Outfall 001

Arconic Facility

Water Features

REFERENCE

ESRI WORLD IMAGERY / ARCGIS MAP SERVICE:
HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY
ACCESSED 11/9/2017

Civil & Environmental Consultants, Inc.
2704 Cherokee Farm Way, Suite 101 Knoxville, TN 37920
865-977-9997 • 865-774-7767
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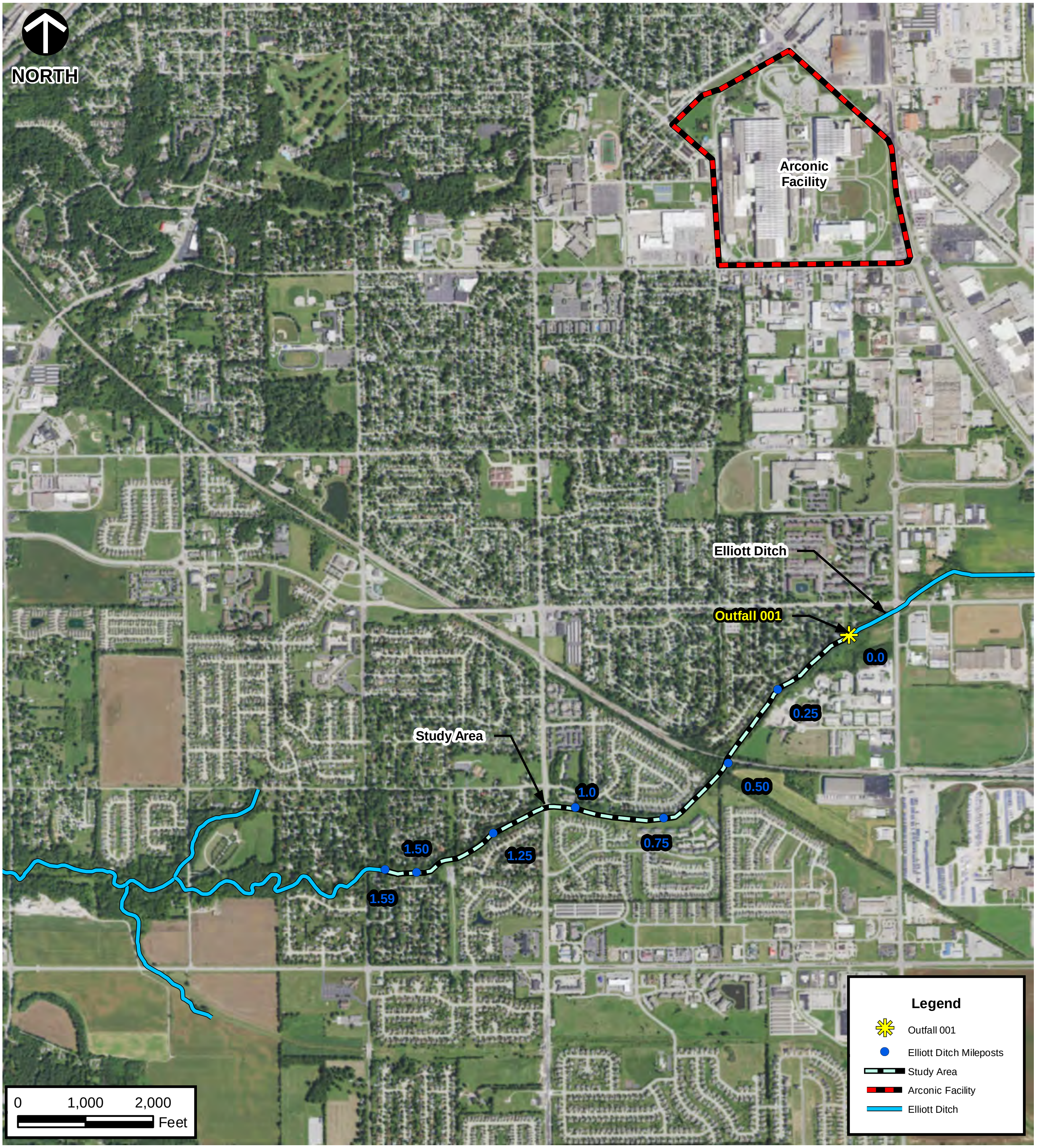
ELLIOTT DITCH
FIELD SAMPLING REPORT
LAFAYETTE, INDIANA

ELLIOTT DITCH VICINITY MAP

DRAWN BY: DMM	CHECKED BY: JMB	APPROVED BY: TLM*	FIGURE NO: 1
DATE: NOVEMBER 09, 2017	SCALE: 1 " = 2,000 '	PROJECT NO: 172-367.0002	

Signature on File *



SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 11/9/2017
IMAGE DATE: 03/12/2011

P:\2017\172-367\-GIS\Maps\Elliot Ditch Report Figures\172-367 Elliott Ditch Figure 2.mxd - 11/9/2017 - 9:47:37 AM (dmuchoki)

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LAFAYETTE, INDIANA

ELLIOTT DITCH STUDY AREA

DRAWN BY: DMM	CHECKED BY: JMB	APPROVED BY: TLM*	FIGURE NO: 2
DATE: NOVEMBER 09, 2017	DWG SCALE: 1 " = 2,000 '	PROJECT NO: 172-367.0002	

Signature on File *

SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 8/28/2018
IMAGE DATE: 03/12/2011

P:\2017\172-367\-GIS\Maps\Elliot Ditch Report Figures\172-367 Elliott Ditch Figure 3.mxd - 8/28/2018 - 4:26:22 PM (mbruck)

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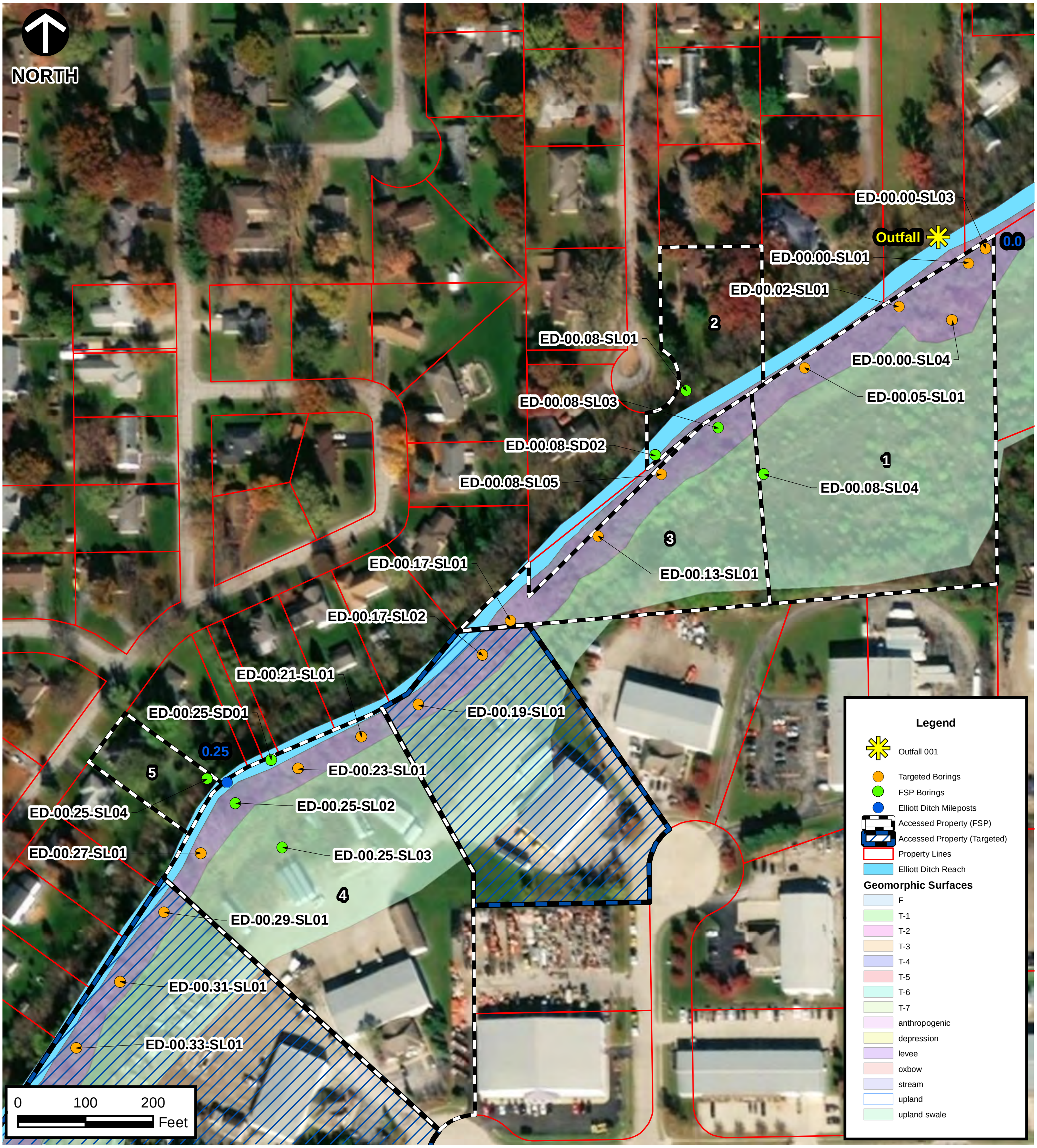
FIELD SAMPLING REPORT
LAFAYETTE, INDIANA

ACCESSED PROPERTIES AND SAMPLING LOCATIONS (MILEPOST 0.0 -1.0)

DRAWN BY: DMM	CHECKED BY: JMB		APPROVED BY: TLM*		FIGURE NO:	3
DATE: AUGUST 28, 2018	DWG SCALE: 1 " = 600 '		PROJECT NO: 172-367.0002			

Signature on File *



SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 8/24/2018
IMAGE DATE: 03/12/2011

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LAFAYETTE, INDIANA

SAMPLE LOCATIONS AND IDENTIFICATIONS

DRAWN BY: DMM	CHECKED BY: JMB		APPROVED BY: TLM*		FIGURE NO:	3A
DATE: AUGUST 24, 2018	DWG SCALE: 1 " = 200 '		PROJECT NO: 172-367.0002			

Signature on File *

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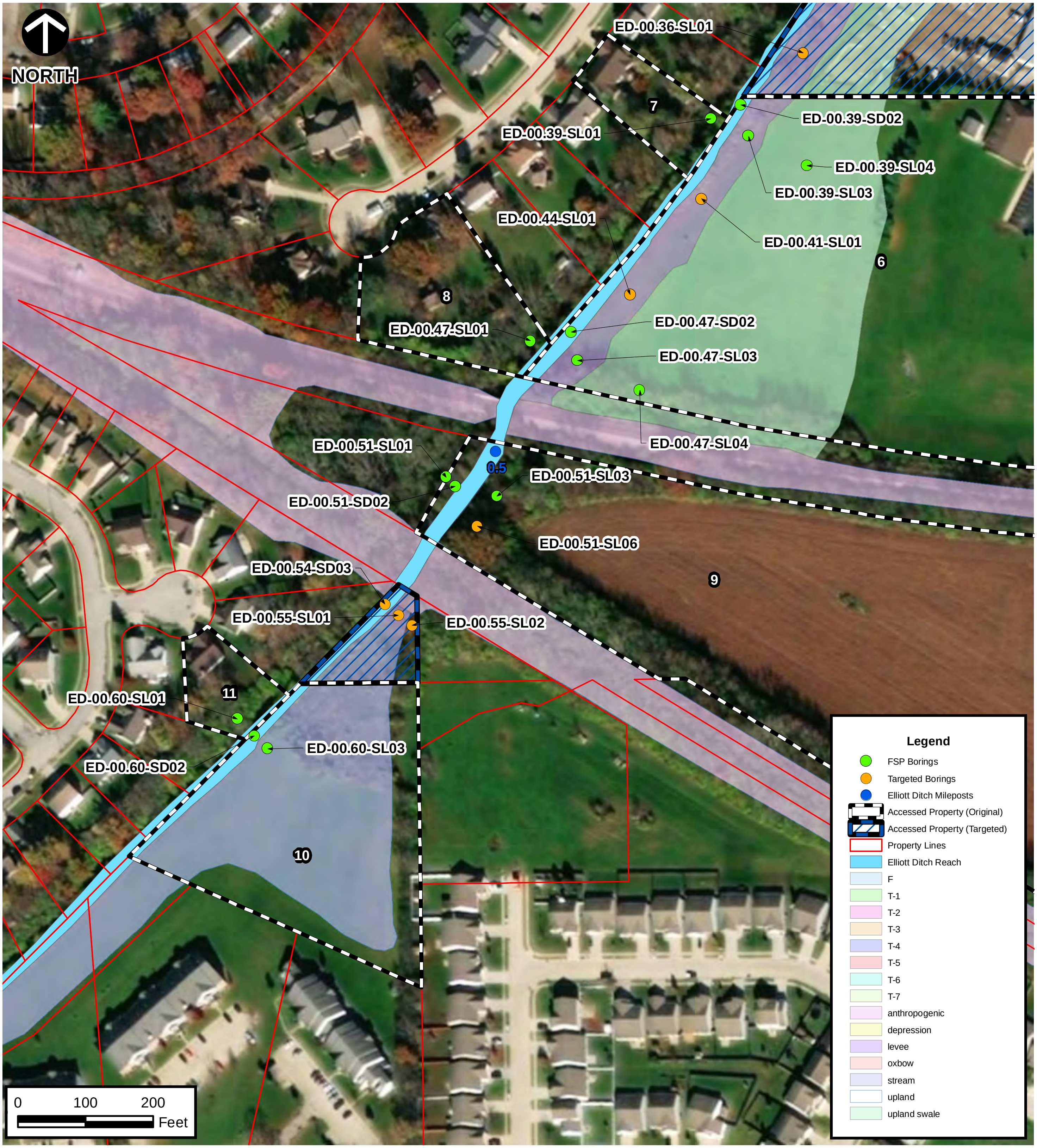

SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 8/24/2018
IMAGE DATE: 03/12/2011

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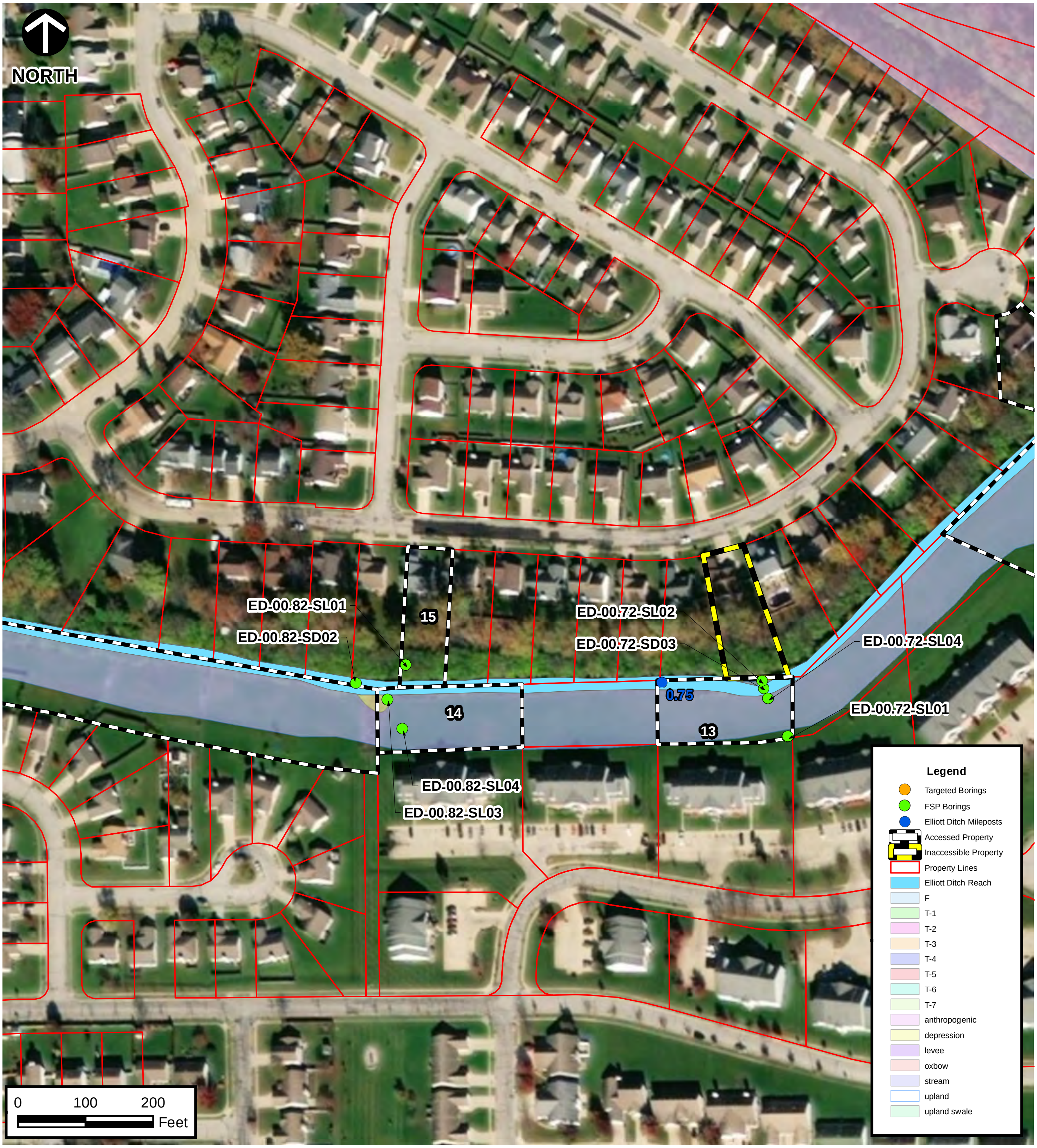
SAMPLE LOCATIONS AND IDENTIFICATIONS

DRAWN BY: DMM	CHECKED BY: JMB	APPROVED BY: TLM*	FIGURE NO:
DATE: AUGUST 24, 2018	DWG SCALE: 1 " = 200 '	PROJECT NO: 172-367.0002	3B

Signature on File *

P:\2017\172-367\-GIS\Maps\Elliot Ditch Report Figures\172-367 Elliott Ditch Figure 3B.mxd - 8/24/2018 - 2:52:29 PM (mbruck)



SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 8/28/2018
IMAGE DATE: 03/12/2011

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SAMPLE LOCATIONS AND IDENTIFICATIONS

DRAWN BY:	DMM	CHECKED BY:	JMB	APPROVED BY:	TLM*	FIGURE NO:	3C
DATE:	AUGUST 28, 2018	DWG SCALE:	1 " = 200 '	PROJECT NO:	172-367.0002		

Signature on File *

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IMAGE DATE: 03/12/2011

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ACCESSED PROPERTIES AND SAMPLING LOCATIONS (MILEPOST 1.0-1.59)

DRAWN BY: DMM	CHECKED BY: JMB	APPROVED BY: TLM*	FIGURE NO: 4
DATE: AUGUST 28, 2018	DWG SCALE: 1 " = 600 '	PROJECT NO: 172-367.0002	

Signature on File *

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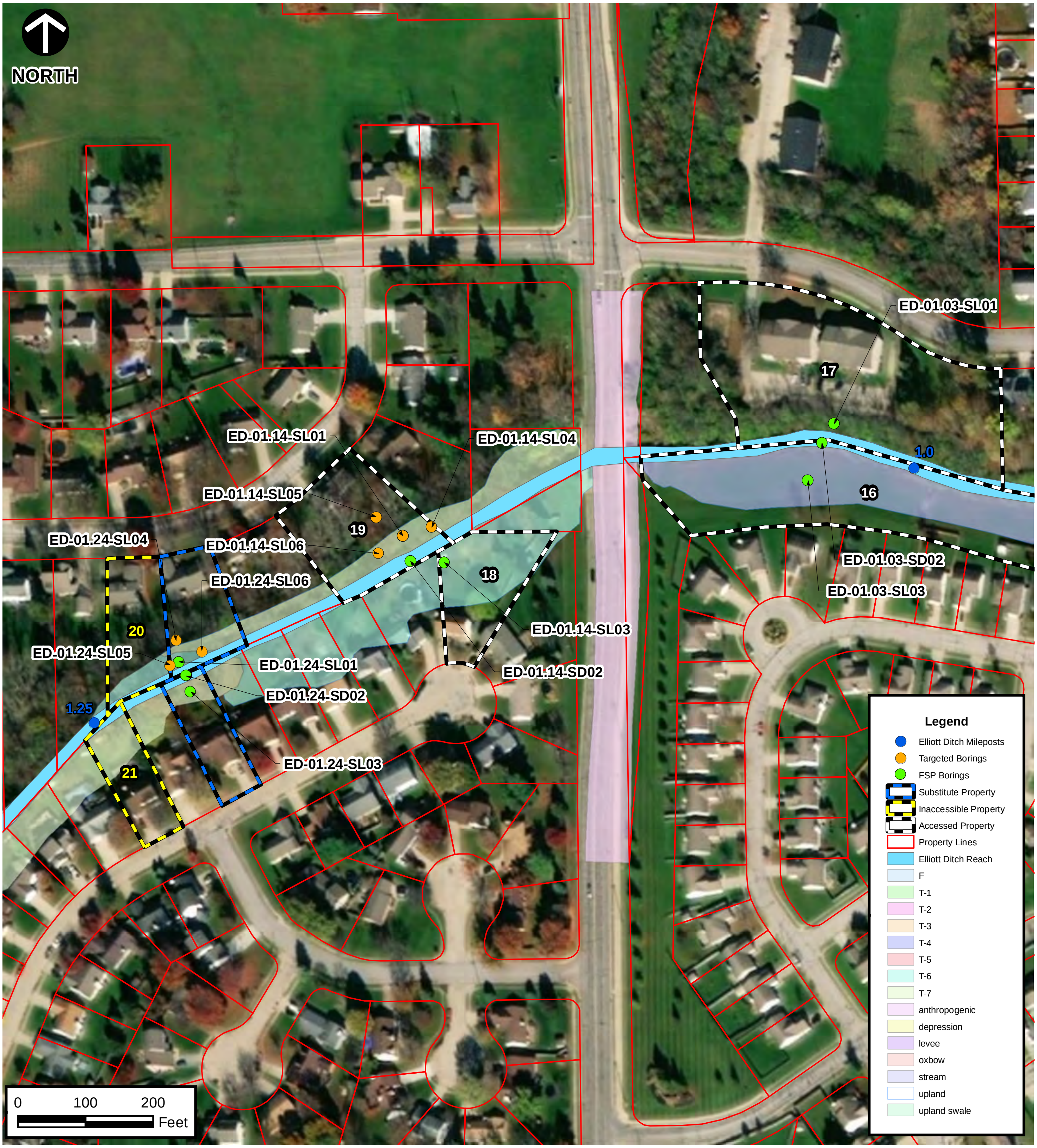

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IMAGE DATE: 03/12/2011

P:\2017\172-367\-GIS\Maps\Elliot Ditch Report Figures\172-367 Elliott Ditch Figure 4A.mxd - 8/24/2018 - 3:26:04 PM (mbruck)

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SAMPLE LOCATIONS AND IDENTIFICATIONS

DRAWN BY:	DMM	CHECKED BY:	JMB	APPROVED BY:	TLM*	FIGURE NO:	4A
DATE:	AUGUST 24, 2018	DWG SCALE:	1 " = 200 '	PROJECT NO:	172-367.0002		

Signature on File *

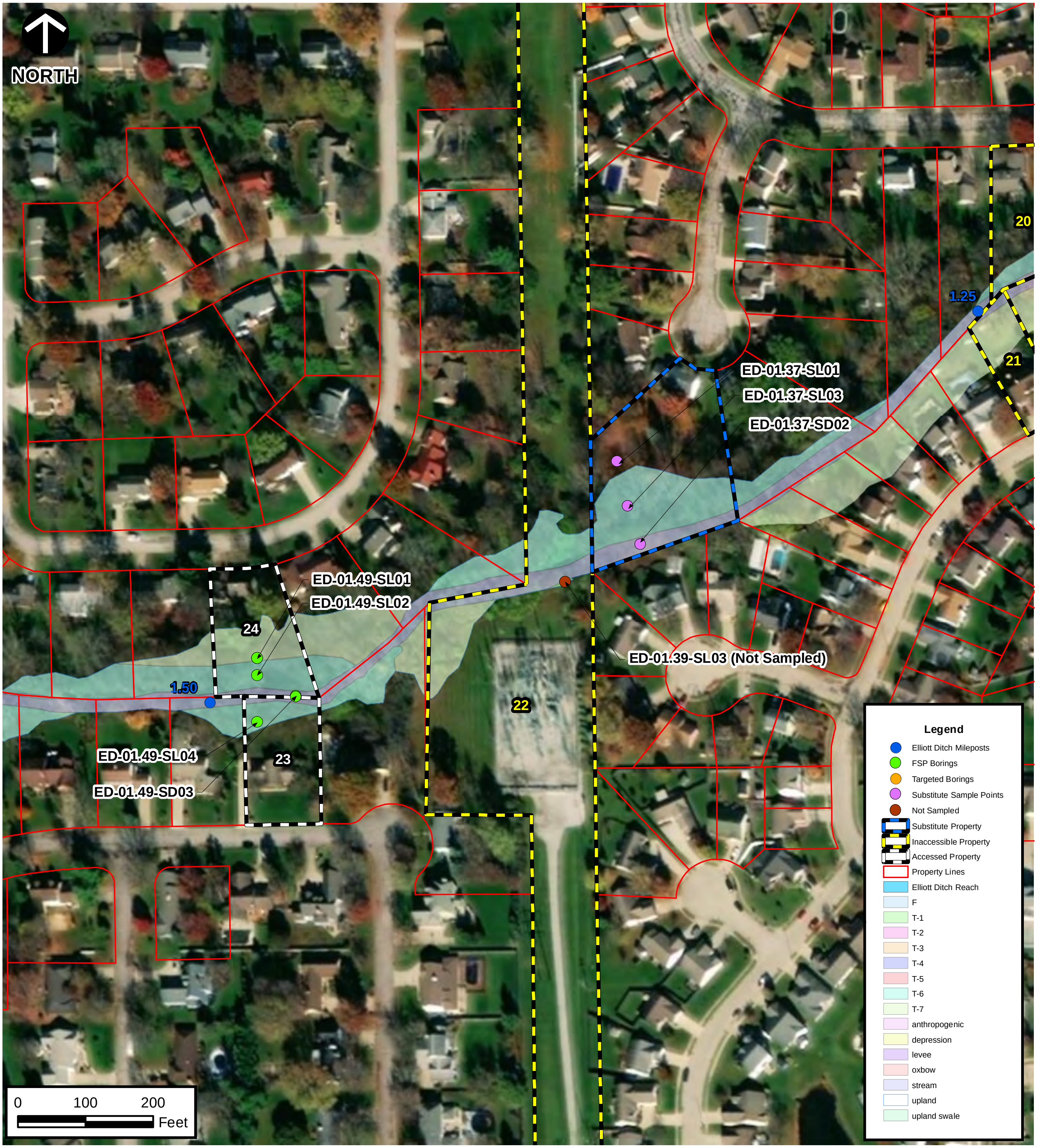

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IMAGE DATE: 03/12/2011

P:\2017\172-367\-GIS\Maps\Elliot Ditch Report Figures\172-367 Elliott Ditch Figure 4B.mxd - 8/24/2018 - 3:31:47 PM (mbruck)

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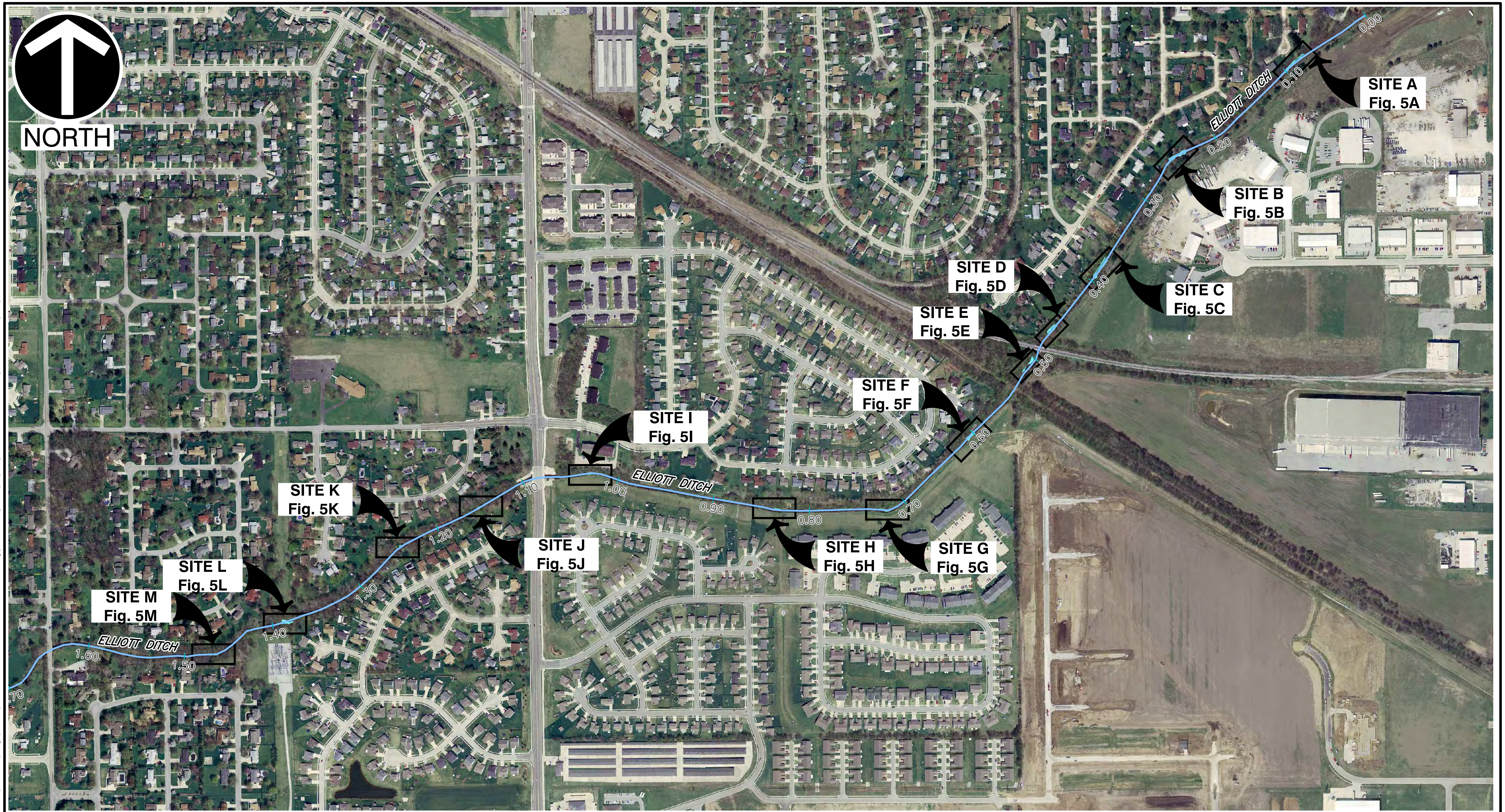
SAMPLE LOCATIONS AND IDENTIFICATIONS

DRAWN BY: DMM	CHECKED BY: JMB	APPROVED BY: TLM*	FIGURE NO:
DATE: AUGUST 24, 2018	DWG SCALE: 1 " = 200 '	PROJECT NO: 172-367.0002	4B

Signature on File *



\\svr-knoxville\projects\2017\172-367\-CADD\Dwg\EC01\172367-EC01-ISOPACH LAYOUT.dwg[KEY MAP] LS:(10/25/2017 - dmartinez) - LP: 10/25/2017 9:00 AM

LEGEND

X SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

SCALE IN FEET

0 500 1000

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LAFAYETTE, INDIANA

POLING SUMMARY MAP

DRAWN BY:	DAM	CHECKED BY:	NSO	APPROVED BY:	JMB	FIGURE NO.:	5
DATE:	OCTOBER 2017	DWG SCALE:	AS NOTED	PROJECT NO:	172-367		

PLAN VIEW
SITE A
SCALE IN FEET
0 10 20

Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	−0.0	−1.0	
2	−1.0	−2.0	
3	−2.0	−3.0	
4	−3.0	−4.0	

LEGEND

X SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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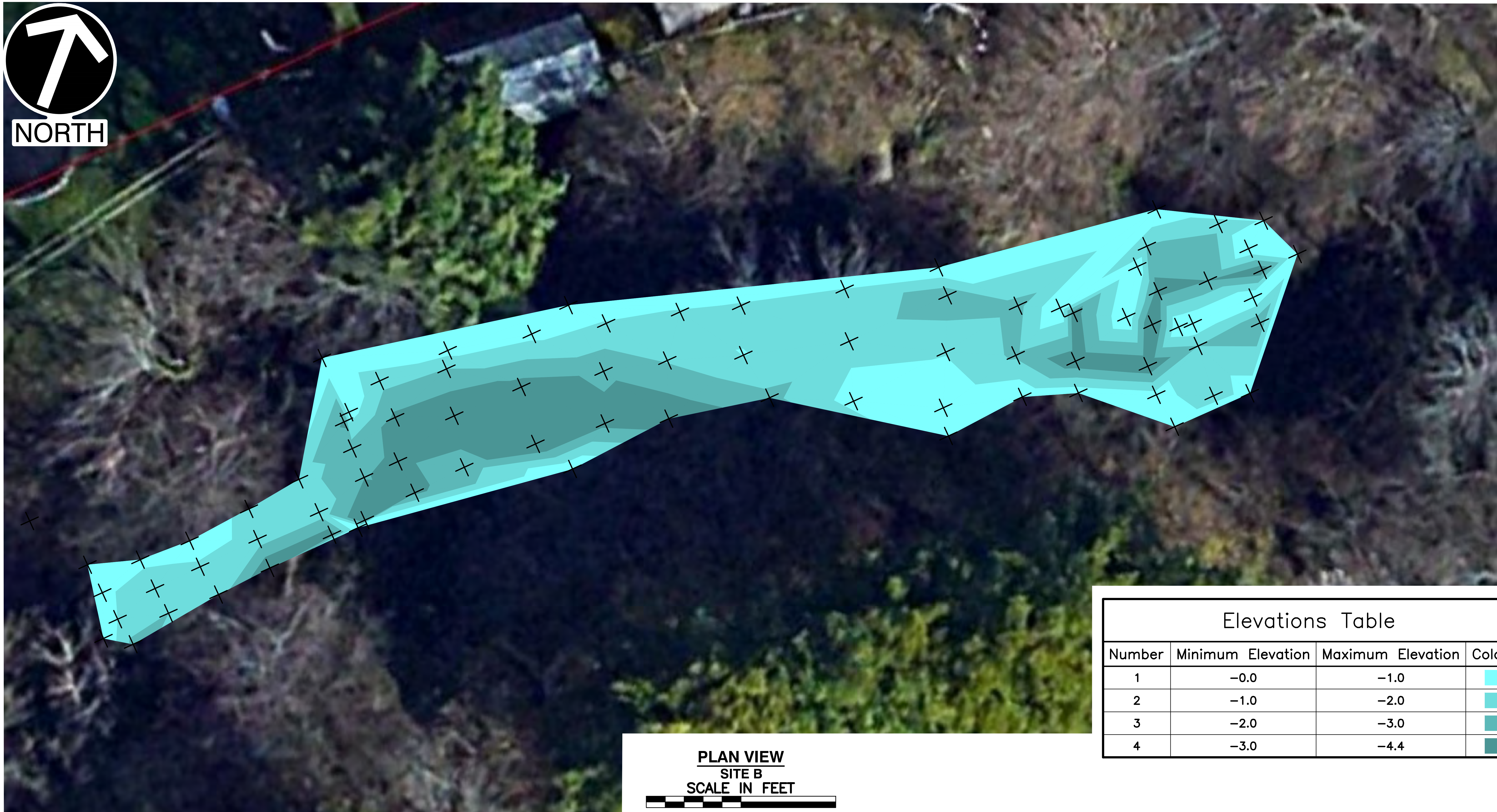
SEDIMENT POLING SITE A

DRAWN BY: DAM	CHECKED BY: NSO	APPROVED BY: JMB	FIGURE NO.: 5A
DATE: OCTOBER 2017	DWG SCALE: AS NOTED	PROJECT NO: 172-367	

\\svr-knoxville\projects\2017\172-367\-CADD\Dwg\EC01\172367-EC01-ISOPACH LAYOUT.dwg[A] LS:(10/25/2017 - dmartinez) - LP: 10/25/2017 9:00 AM



Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
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2	−1.0	−2.0	
3	−2.0	−3.0	
4	−3.0	−4.4	

PLAN VIEW
SITE B
SCALE IN FEET
0 10 20

LEGEND

X SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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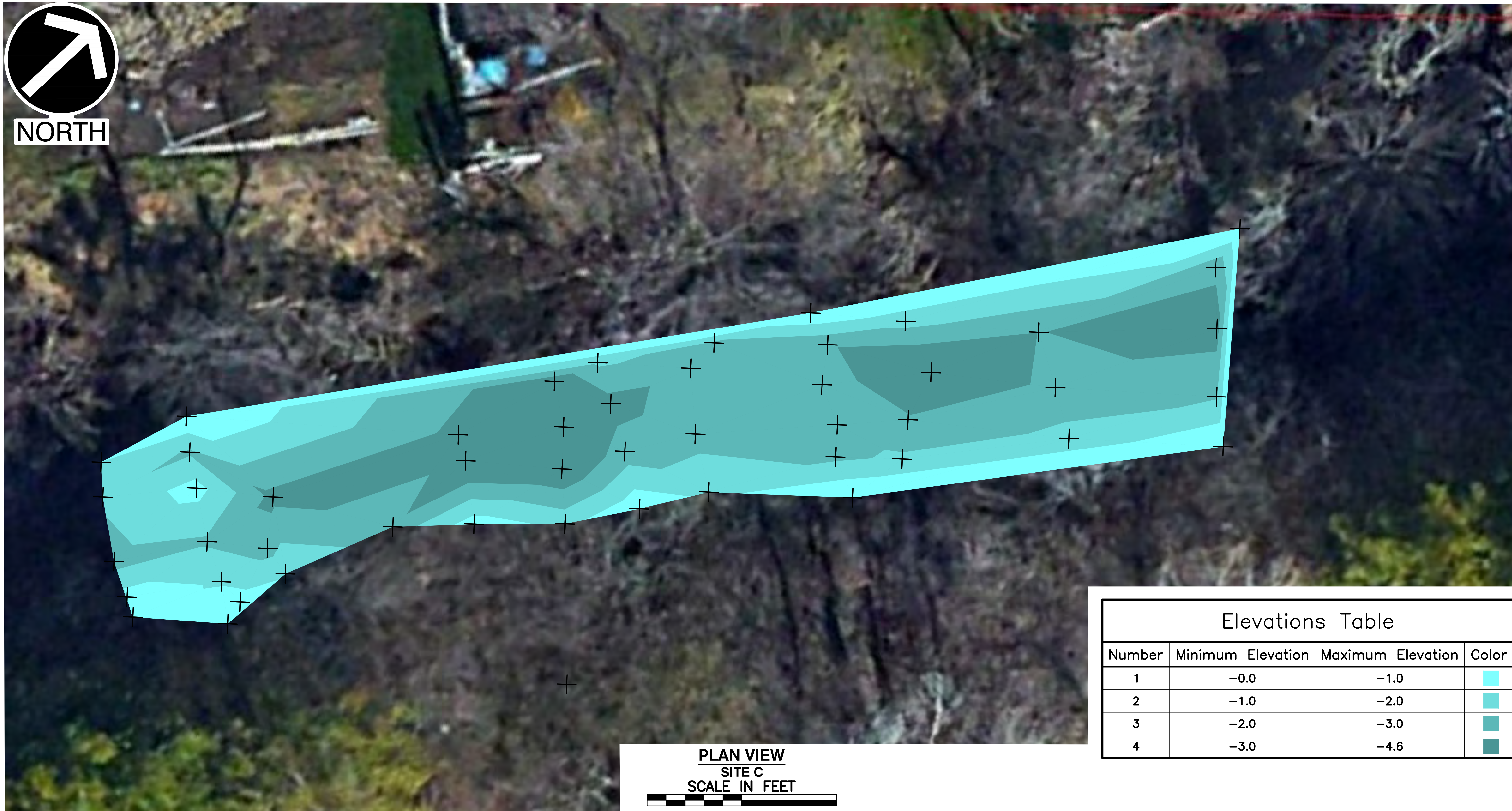
SEDIMENT POLING SITE B

DRAWN BY: DAM	CHECKED BY: NSO	APPROVED BY: JMB	FIGURE NO.: 5B
DATE: OCTOBER 2017	DWG SCALE: AS NOTED	PROJECT NO: 172-367	

\\svr-knoxville\projects\2017\172-367\-CADD\Dwg\EC01\172367-EC01-ISOPACH LAYOUT.dwg[B] LS:(10/25/2017 - dmartinez) - LP: 10/25/2017 9:00 AM



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
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2	−1.0	−2.0	
3	−2.0	−3.0	
4	−3.0	−4.6	

PLAN VIEW
SITE C
SCALE IN FEET
0 10 20

LEGEND

× SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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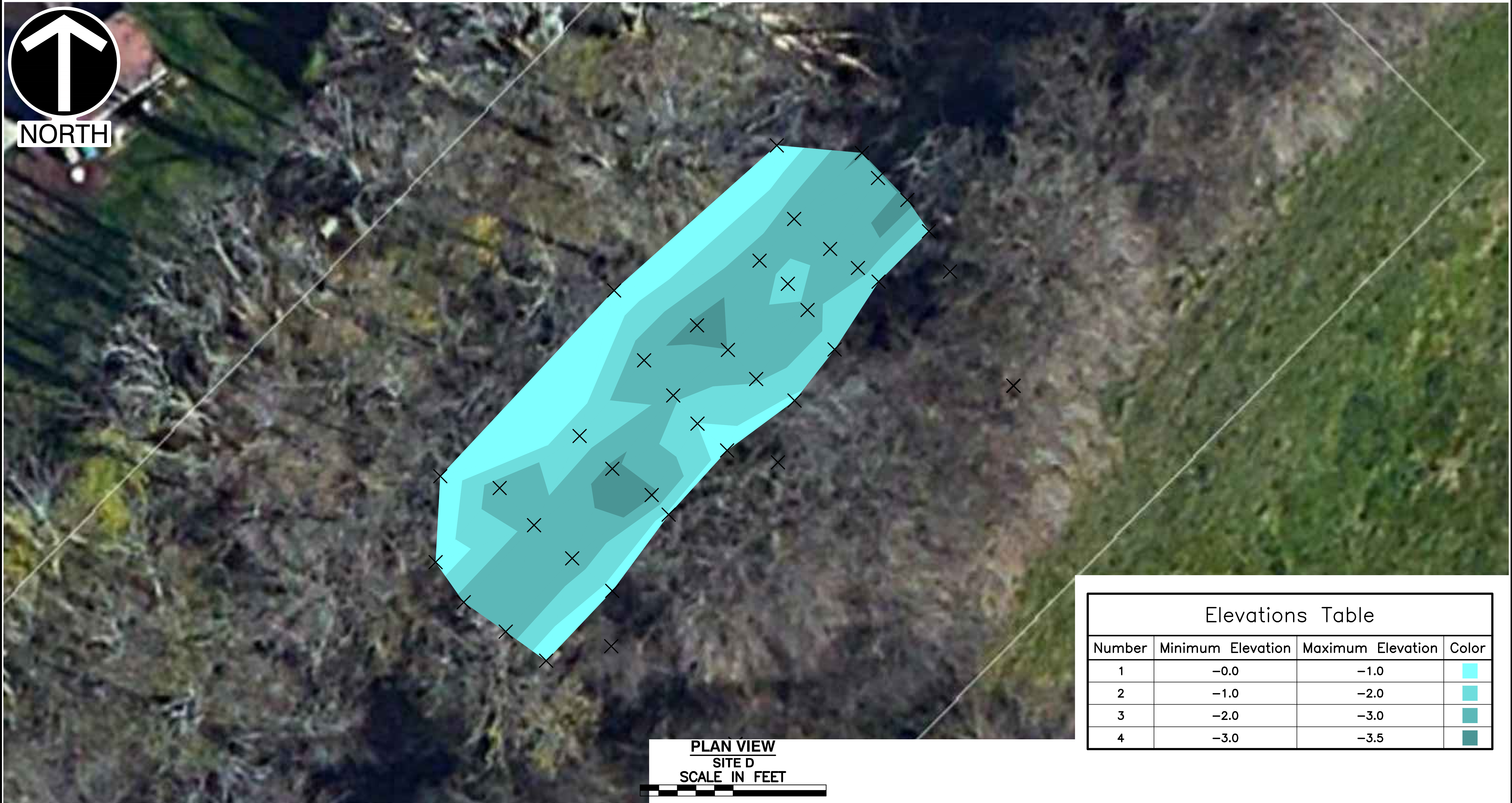
SEDIMENT POLING SITE C

DRAWN BY: DAM	CHECKED BY: NSO	APPROVED BY: JMB	FIGURE NO.: 5C
DATE: OCTOBER 2017	DWG SCALE: AS NOTED	PROJECT NO: 172-367	

\\svr-knoxville\projects\2017\172-367\--CADD\Dwg\EC01\172367-EC01-ISOPACH LAYOUT.dwg[C] LS:(10/25/2017 - dmartinez) - LP: 10/25/2017 9:01 AM



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
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2	−1.0	−2.0	
3	−2.0	−3.0	
4	−3.0	−3.5	

LEGEND

× SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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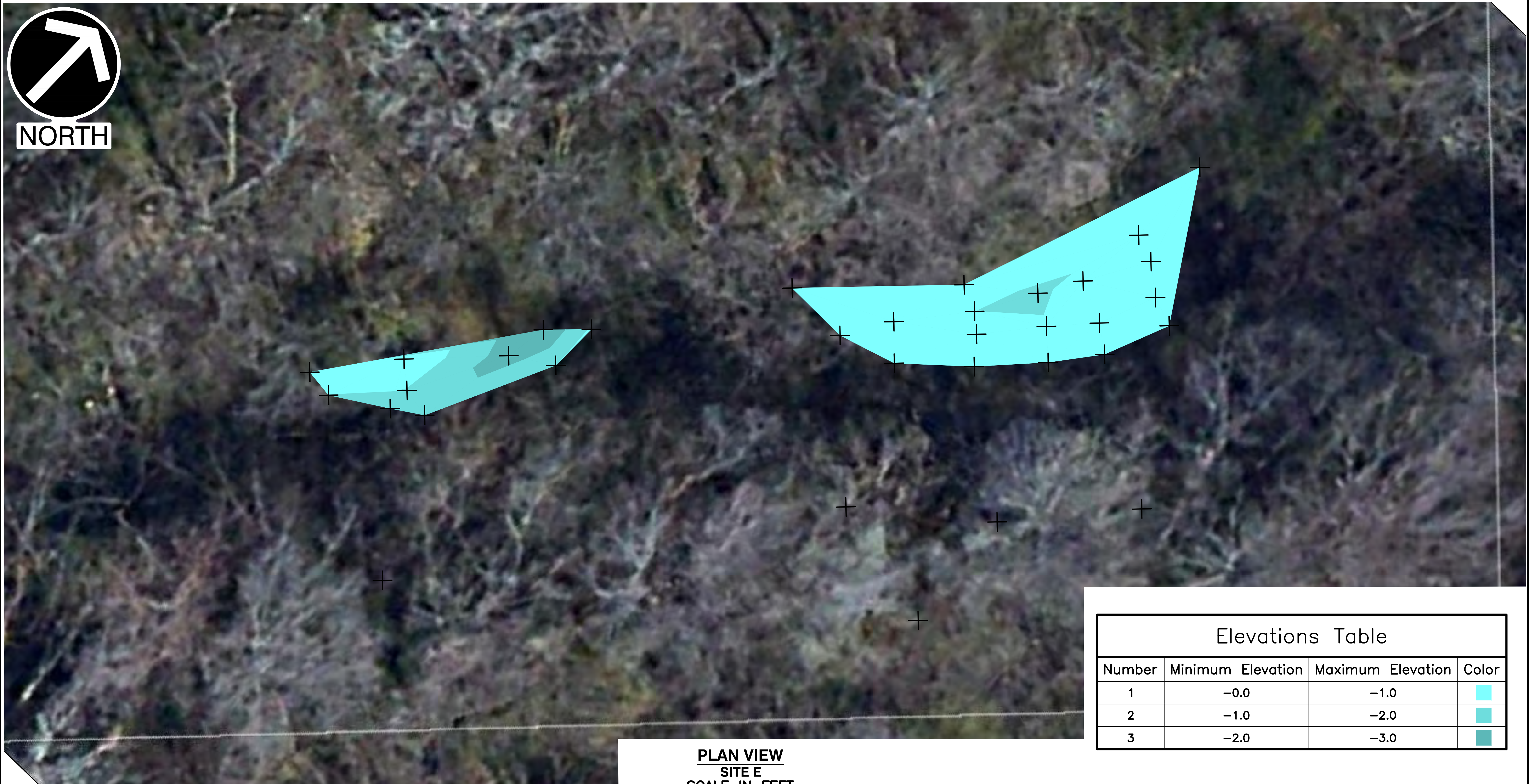
SEDIMENT POLING SITE D

DRAWN BY: DAM	CHECKED BY: NSO	APPROVED BY: JMB	FIGURE NO.: 5D
DATE: OCTOBER 2017	DWG SCALE: AS NOTED	PROJECT NO: 172-367	



Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
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2	−1.0	−2.0	
3	−2.0	−3.0	

PLAN VIEW
SITE E
SCALE IN FEET
0 10 20

LEGEND

× SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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SEDIMENT POLING SITE E

DRAWN BY:	DAM	CHECKED BY:	NSO	APPROVED BY:	JMB	FIGURE NO.:	5E
DATE:	OCTOBER 2017	DWG SCALE:	AS NOTED	PROJECT NO:	172-367		

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
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2	−1.0	−1.5	
3	−1.5	−2.0	
4	−2.0	−2.6	

PLAN VIEW

SITE F

SCALE IN FEET

0 10 20

LEGEND

SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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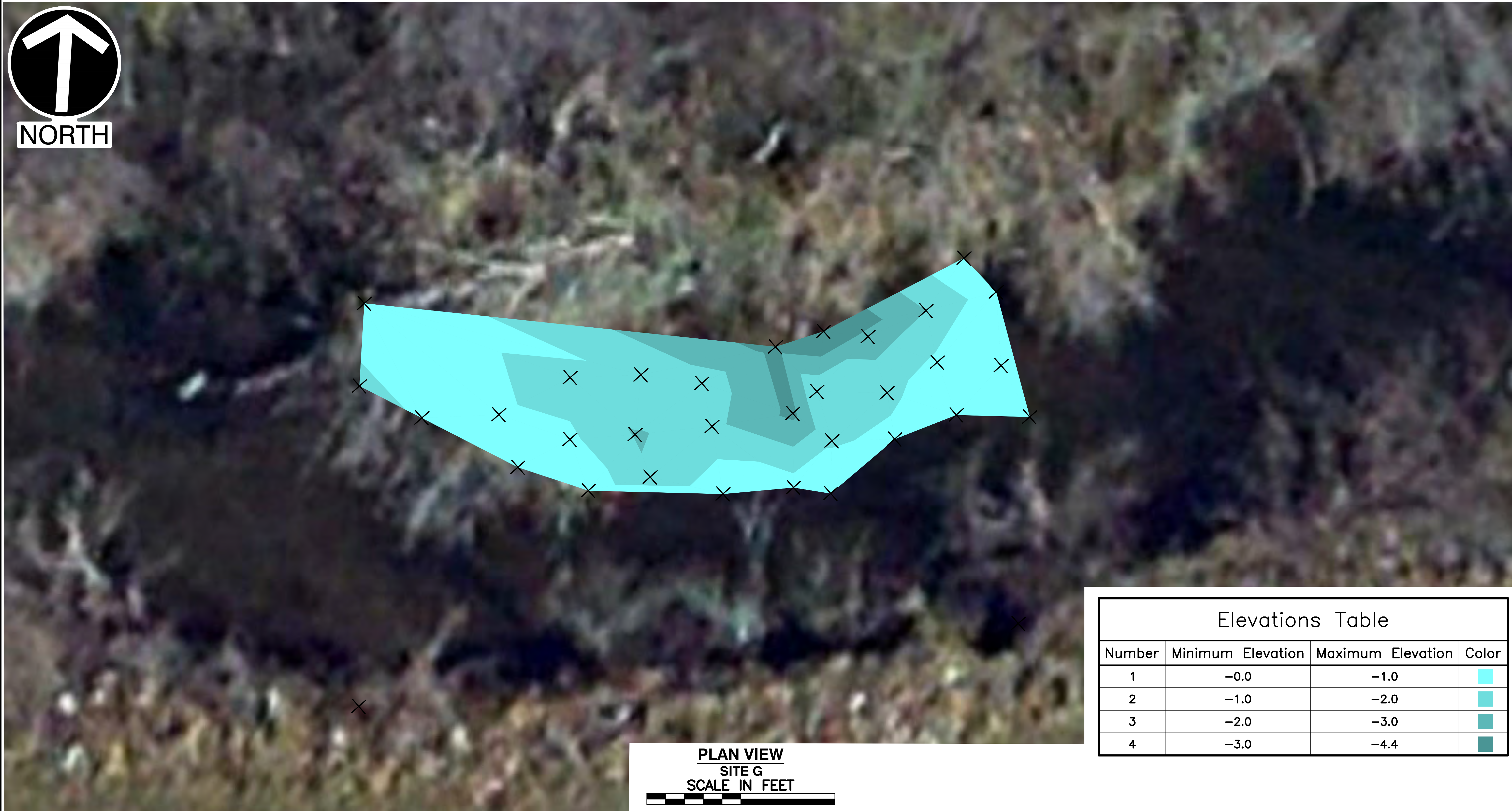
SEDIMENT POLING SITE F

DRAWN BY:	DAM	CHECKED BY:	NSO	APPROVED BY:	JMB	FIGURE NO.:	5F
DATE:	OCTOBER 2017	DWG SCALE:	AS NOTED	PROJECT NO:	172-367		

\\svr-knoxville\projects\2017\172-367\-CADD\Dwg\EC01\172367-EC01-ISOPACH LAYOUT.dwg{F} LS:(10/25/2017 - dmartinez) - LP: 10/25/2017 9:01 AM



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
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2	−1.0	−2.0	
3	−2.0	−3.0	
4	−3.0	−4.4	

PLAN VIEW
SITE G
SCALE IN FEET
0 5 10

LEGEND

× SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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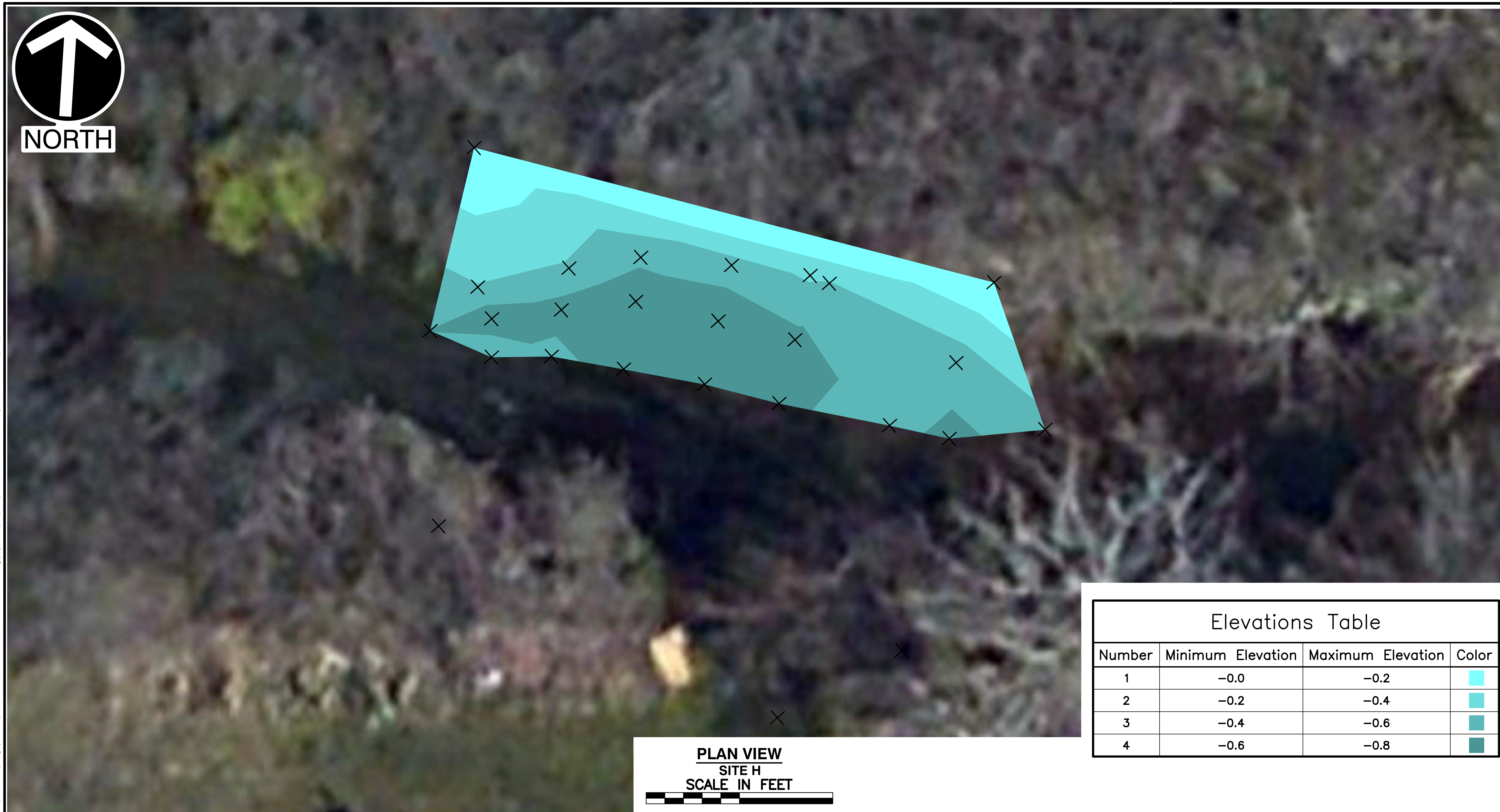
SEDIMENT POLING SITE G

DRAWN BY: DAM	CHECKED BY: NSO	APPROVED BY: JMB	FIGURE NO.: 5G
DATE: OCTOBER 2017	DWG SCALE: AS NOTED	PROJECT NO: 172-367	



Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
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2	−0.2	−0.4	
3	−0.4	−0.6	
4	−0.6	−0.8	

LEGEND

× SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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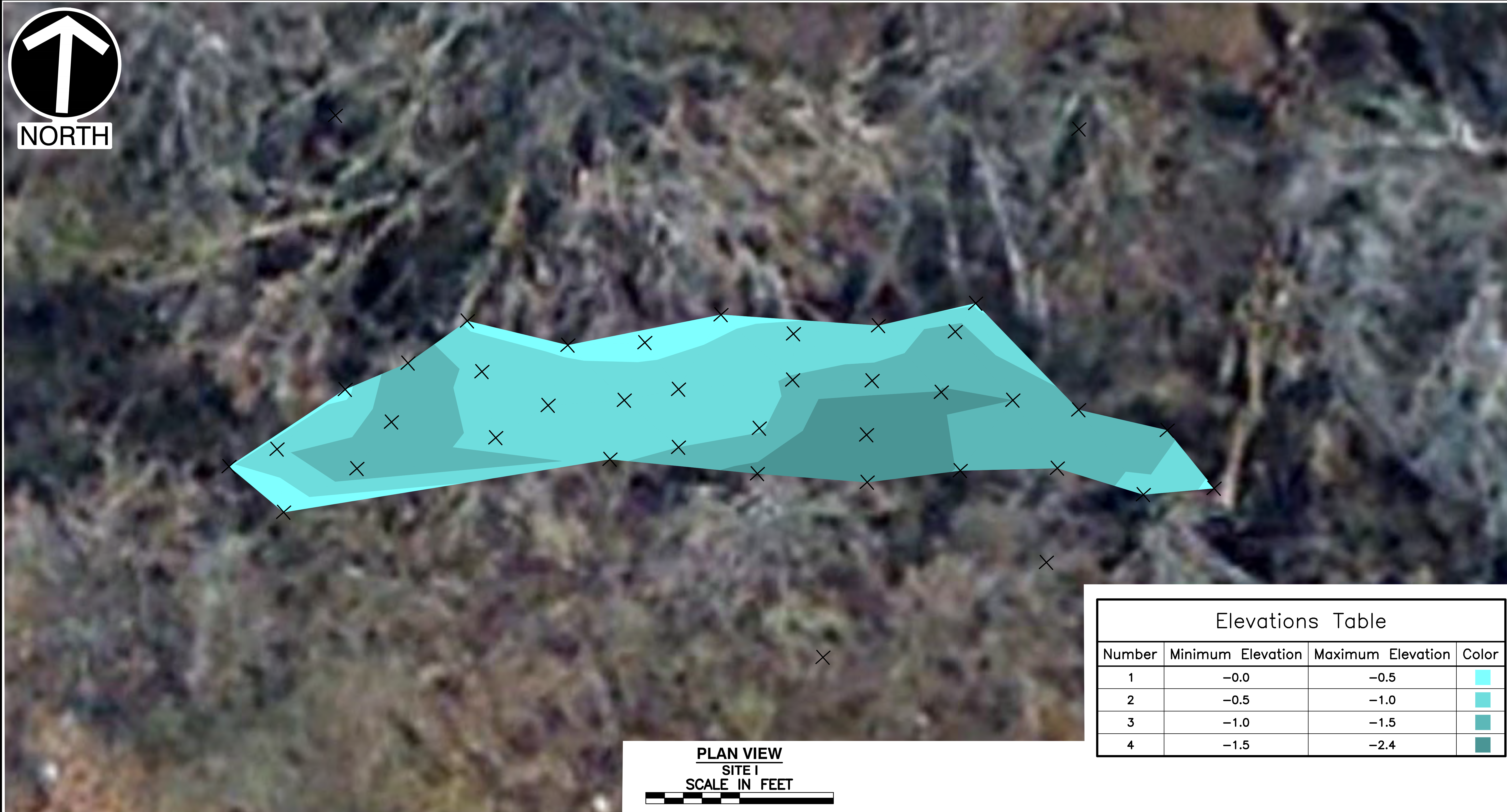
SEDIMENT POLING SITE H

DRAWN BY: DAM	CHECKED BY: NSO	APPROVED BY: JMB	FIGURE NO.: 5H
DATE: OCTOBER 2017	DWG SCALE: AS NOTED	PROJECT NO: 172-367	

\\svr-knoxville\projects\2017\172-367\-CADD\Dwg\EC01\172367-EC01-ISOPACH LAYOUT.dwg{H} LS:(10/25/2017 - dmartinez) - LP: 10/25/2017 9:02 AM



Elevations Table			
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2	−0.5	−1.0	
3	−1.0	−1.5	
4	−1.5	−2.4	

PLAN VIEW
SITE I
SCALE IN FEET
0 5 10

LEGEND

× SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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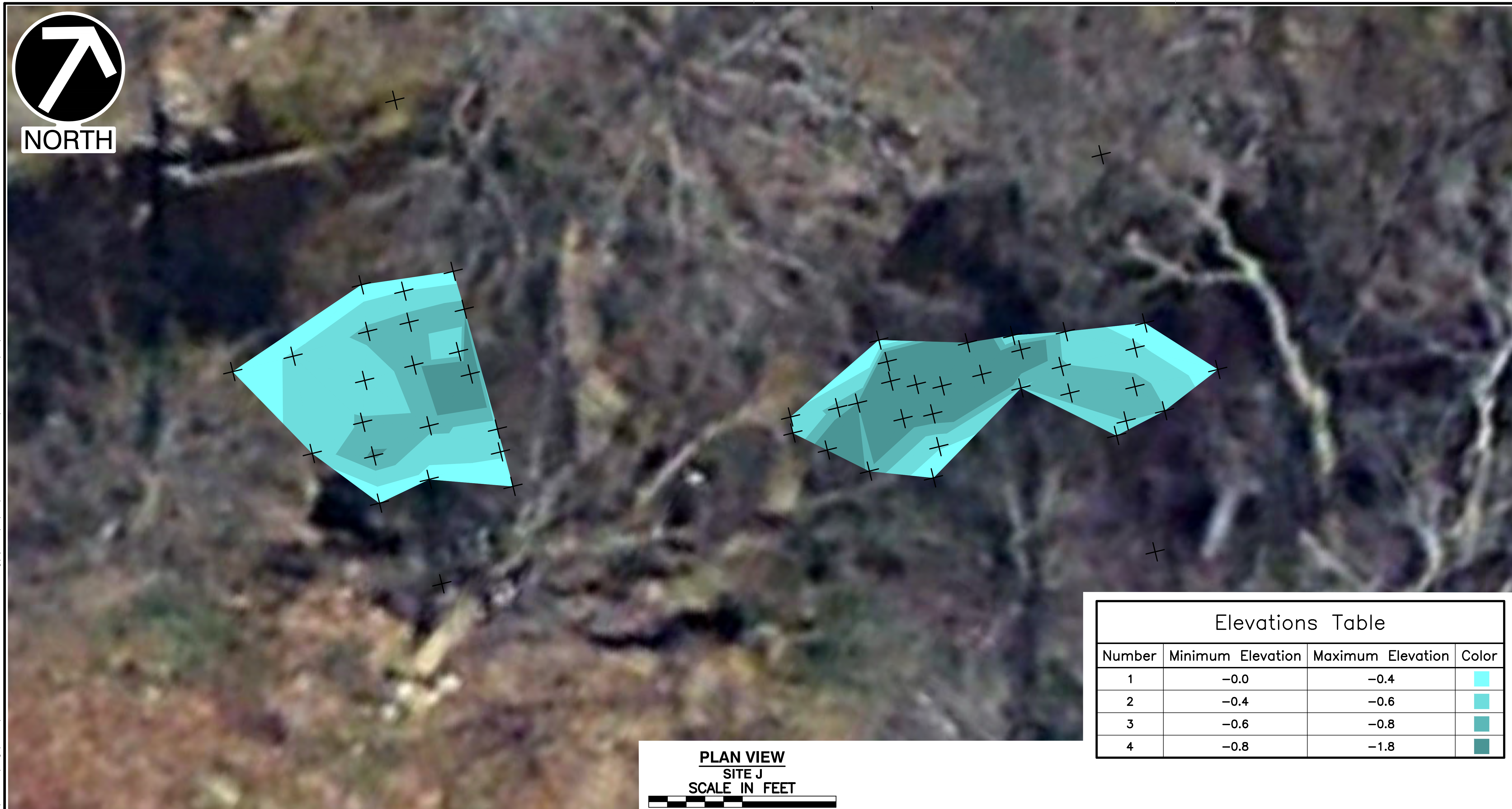
SEDIMENT POLING SITE I

DRAWN BY:	DAM	CHECKED BY:	NSO	APPROVED BY:	JMB	FIGURE NO.:	5I
DATE:	OCTOBER 2017	DWG SCALE:	AS NOTED	PROJECT NO:	172-367		

\\svr-knoxville\projects\2017\172-367\-CADD\Dwg\EC01\172367-EC01-ISOPACH LAYOUT.dwg{} LS:(10/25/2017 - dmartinez) - LP: 10/25/2017 9:02 AM



Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	−0.0	−0.4	
2	−0.4	−0.6	
3	−0.6	−0.8	
4	−0.8	−1.8	

LEGEND

SEDIMENT POLING LOCATION

REFERENCE

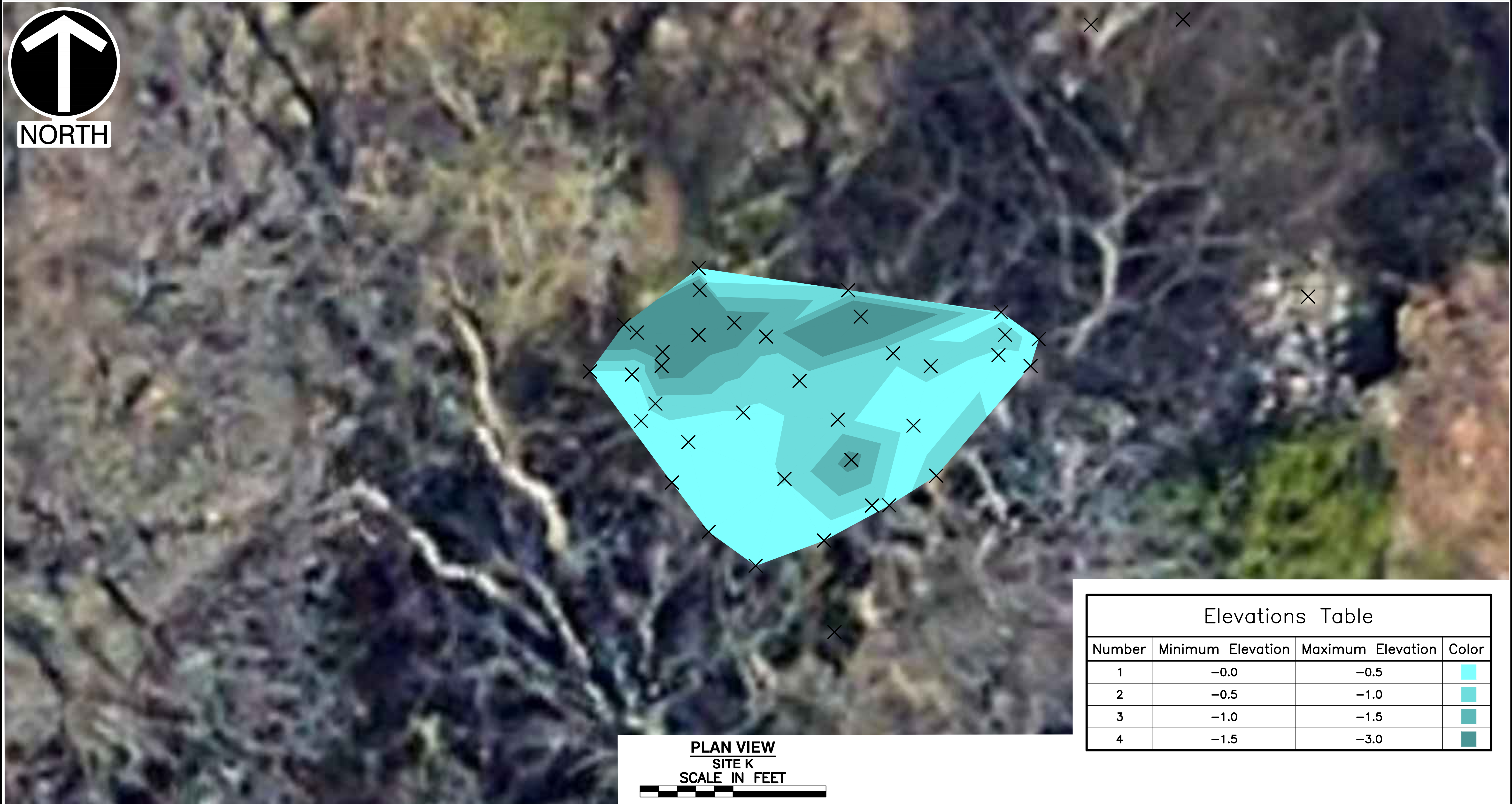
1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

Civil & Environmental Consultants, Inc.
600 Marketplace Ave · Suite 200 · Bridgeport, WV 26330
Ph: 304.933.3119 · Fax: 304.933.3327
www.cecinc.com

ARCONIC INC. - LAFAYETTE OPERATIONS
ELLIOTT DITCH
FIELD SAMPLING REPORT
LAFAYETTE, INDIANA

SEDIMENT POLING SITE J

DRAWN BY:	DAM	CHECKED BY:	NSO	APPROVED BY:	JMB	FIGURE NO.:	5J
DATE:	OCTOBER 2017	DWG SCALE:	AS NOTED	PROJECT NO:	172-367		



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
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2	−0.5	−1.0	
3	−1.0	−1.5	
4	−1.5	−3.0	

LEGEND

× SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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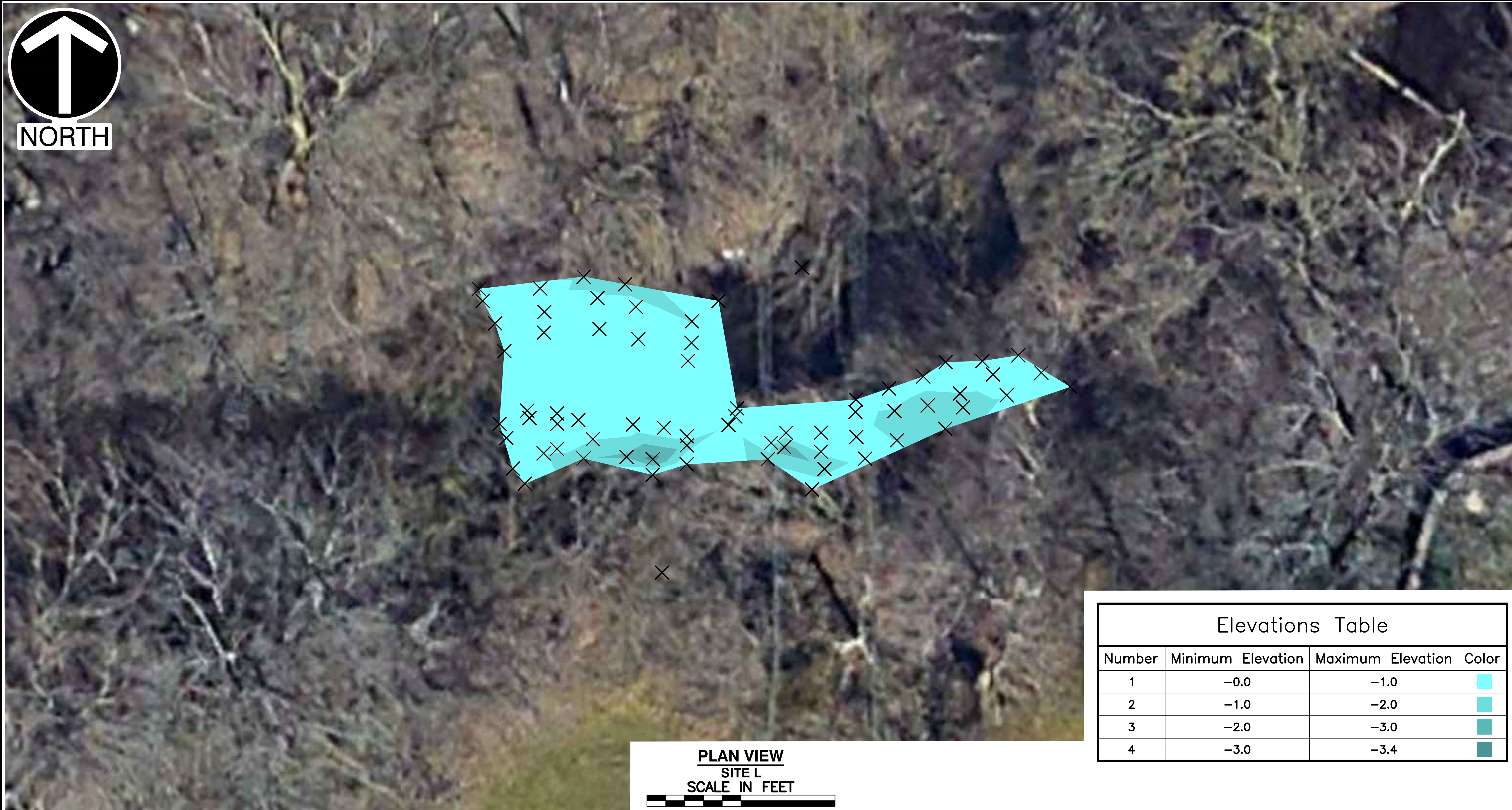
ELLIOTT DITCH
FIELD SAMPLING REPORT
LAFAYETTE, INDIANA

SEDIMENT POLING SITE K

DRAWN BY:	DAM	CHECKED BY:	NSO	APPROVED BY:	JMB	FIGURE NO.:	5K
DATE:	OCTOBER 2017	DWG SCALE:	AS NOTED	PROJECT NO:	172-367		

\\svr-knoxville\projects\2017\172-367\-CADD\Dwg\EC01\172367-EC01-ISOPACH LAYOUT.dwg{K} LS:(10/25/2017 - dmartinez) - LP: 10/25/2017 9:02 AM



Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	−0.0	−1.0	
2	−1.0	−2.0	
3	−2.0	−3.0	
4	−3.0	−3.4	

PLAN VIEW
SITE L
SCALE IN FEET
0 10 20

LEGEND

× SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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Ph: 304.933.3119 · Fax: 304.933.3327
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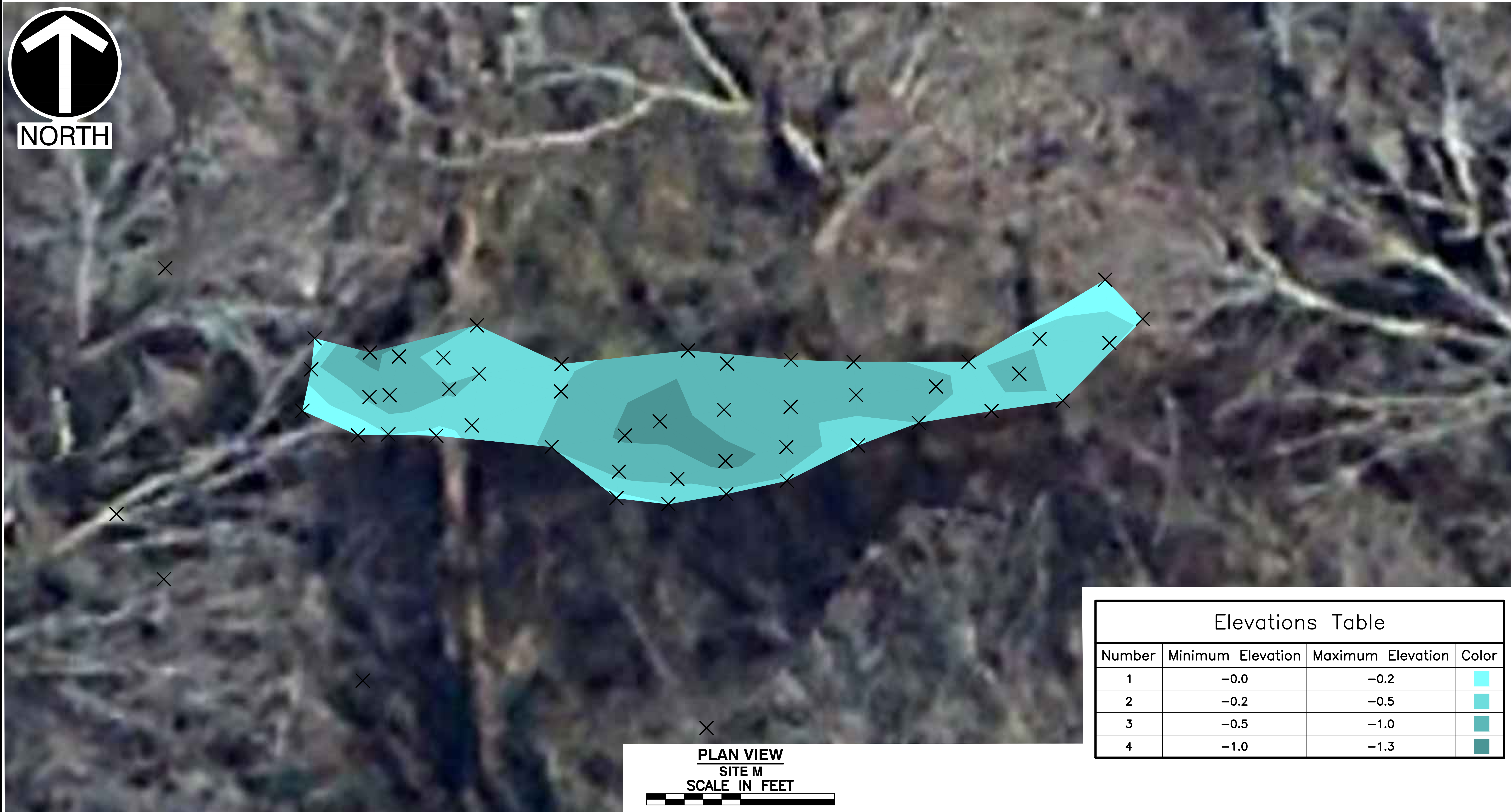
ARCONIC INC. - LAFAYETE OPERATIONS
ELLIOTT DITCH
FIELD SAMPLING REPORT
LAFAYETTE, INDIANA

SEDIMENT POLING SITE L

DRAWN BY: DAM	CHECKED BY: NSO	APPROVED BY: JMB	FIGURE NO.: 5L
DATE: OCTOBER 2017	DWG SCALE: AS NOTED	PROJECT NO: 172-367	



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	−0.0	−0.2	
2	−0.2	−0.5	
3	−0.5	−1.0	
4	−1.0	−1.3	

PLAN VIEW
SITE M
SCALE IN FEET
0 5 10

LEGEND

× SEDIMENT POLING LOCATION

REFERENCE

1. SEDIMENT COLLECTION DATA TAKEN BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC BY SURVEY CONDUCTED IN OCTOBER OF 2017.
2. IMAGERY FROM GOOGLE EARTH. IMAGERY DATE: 03/26/2016. DATE DOWNLOADED: 10/23/2017.

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ARCONIC INC. - LAFAYETTE OPERATIONS
ELLIOTT DITCH
FIELD SAMPLING REPORT
LAFAYETTE, INDIANA

SEDIMENT POLING SITE M

DRAWN BY:	DAM	CHECKED BY:	NSO	APPROVED BY:	JMB	FIGURE NO.:	5M
DATE:	OCTOBER 2017	DWG SCALE:	AS NOTED	PROJECT NO:	172-367		

APPENDIX I
STUDY AREA ACCESS PLAN

STUDY AREA ACCESS PLAN
REACHES 1, 2, AND 3 OF ELLIOTT DITCH
IMPLEMENTATION OF THE FIELD SAMPLING PLAN

PREPARED FOR:

ARCONIC

ARCONIC LAFAYETTE OPERATIONS
3131 EAST MAIN STREET
LAFAYETTE, INDIANA

PREPARED BY:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
2704 CHEROKEE FARM WAY, SUITE 101
KNOXVILLE, TENNESSEE 37920

CEC PROJECT 172-367.0002

JULY 2017

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Study Area Access Plan, or Access Plan for short, is to provide the framework for engaging private property owners whose parcels contain proposed upland soil sampling locations or preferred access points to Elliott Ditch in support of implementing the Field Sampling Plan (FSP). This plan will specify the strategy and media to be used when engaging private property owners. An Access Agreement prepared and executed by Arconic, Inc. (Arconic) will be used as the vehicle to authorize members of the project team to access private property for either reason. The Access Plan will also identify local government officials that will be informed of the project such that they can either answer questions from concerned citizens or direct them to members of the project team. Implementation of this Access Plan and procurement of the necessary Access Agreements will occur prior to the implementation of field tasks associated with the Elliott Ditch FSP.

1.2 ELLIOTT DITCH BACKGROUND

The project setting includes an approximate 1.59-mile section of Elliott Ditch starting at Arconic Outfall 001 (Milepost 0.0) and ending at Milepost 1.59. This represents the portion of the stream that appears to have been anthropogenically straightened and channelized over time. Elliott Ditch receives industrial discharges from the Arconic Lafayette Operations Outfall 001. The discharges include treated sanitary and industrial process water, as well as storm water runoff from the facility. Polychlorinated biphenyls (PCBs) are present in the Elliott Ditch watershed from historical releases at Outfall 001 and extend to the County Road 350 South Bridge based on samples collected by Anchor QEA in 2004 and 2010. The PCB concentrations range from less than 1 milligram per Kilogram (mg/Kg) to 27 mg/Kg at the previously sampled locations. The horizontal and vertical extent of PCB impacts are not currently delineated within the channel or floodplain. Arconic is subject to Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) per the Indiana Department of Environmental Management (IDEM) letter (dated February 11, 2011). As such, the FSP was prepared by TetraTech CES and approved by IDEM and the United States Environmental Protection Agency (EPA) Region 5 in support of the assessment of PCB impacts to Elliott Ditch.

1.3 GENERAL AREA DESCRIPTION

Elliott Ditch resides roughly a mile to the south of the Arconic Lafayette Operations in Lafayette, Indiana. The general area includes residential, commercial, and industrial developments. Bordering the stream in the 1.59-mile project area is primarily residential properties to the north and to the south after the railroad crossing near the Milepost 0.5. To the south of Elliott Ditch prior to the railroad crossing are properties used for commercial and industrial purposes. The residential properties appear to include both single-family dwellings as well as apartment complexes. Few properties appear to have paved access from local roads to the backsides of the dwellings, near Elliott Ditch. Close to the Milepost 1.4, there is an overhead power line right-of-way that includes a substation on the southern bank of the stream.

The dense residential development and few public access points limit access to the stream bank. Once at the stream bank, access to the stream itself is further limited by the steep banks associated with the anthropogenic straightening and overgrown vegetation within the study area. Please refer to Figure 1 for the portion of Elliott Ditch included in the implementation of this FSP and an overview of the general area.

1.4 FIELD SAMPLING PLAN SUMMARY

The FSP includes two separate field tasks. The first task includes rodding within the stream channel to assess sediment thicknesses and extents. This task will require only a few access points since the field staff will remain within the footprint of Elliott Ditch for the majority of the effort. Access in support of this task will target public points, where available, then rely on permissions from private property owners as a secondary option.

The second field effort includes the collection of soil and sediment samples from a series of transects situated throughout the targeted 1.59-mile stretch of Elliott Ditch. The transects run perpendicular to flow in the stream and, by design, target soil and sediment from different geomorphic surfaces. Many of the upland soil sampling locations are situated outside of the stream bank on private property and will require access in order to collect samples.

2.0 ACCESS PLAN

The proposed Access Plan will be followed in support of implementing the FSP. Deviations from the plan, when necessary, will be communicated to Arconic, local government, and private property owners to maintain trustworthy relationships and prevent against unauthorized access.

2.1 CONSIDERATIONS

There are a number of factors that were taken into consideration when preparing this Access Plan, as identified in the following. Each of the following factors was used to support the development of a plan that prioritizes the safety of CEC employees and engages and builds trustworthy relationships with targeted, private property owners and local government:

- Safety
- Public Access Locations
- Private Access Locations
- Proposed Sampling Locations
- Vegetation and Streambank Slope
- Field Task Requirements

2.2 RODDING

The rodding task will require CEC field staff to mobilize surveying equipment and rods into the stream to collect sediment thickness information. Ideally, the field staff would be able to park relatively close to Elliott Ditch to don chest waders and prepare equipment before accessing the stream. Based on a review of property information provided by the Tippecanoe County GIS Department, public access points on this stretch of Elliott Ditch do not exist. Therefore, access via private property will be required to support the rodding task. CEC will access Elliott Ditch in support of the rodding task from parcels that contain upland soil sampling locations such that additional access agreements are not required. The parcels targeted for use are identified in the following table. These parcels may provide paved areas near the stream that are ideal in support of this task. Other parcels with access agreements will be used if necessary.

Table 1. Properties Expected to be Accessed in Support of Rodding
Study Area Access Plan
Elliott Ditch Implementation of Field Sampling Plan
July 2017

Map ID	Parcel Address	City/Zip	Owner
5	108 COLDBROOK DR	Lafayette, 47909	BROOKS EDITH D
8	195 COLDBROOK CT	Lafayette, 47909	GRAYSON DANIEL C I SUSAN
11	50 SOUTHAVEN CT	Lafayette, 47909	BETTY BILLY W & VICKI J
15	2301 WINTERSET DR	Lafayette, 47909	FISHER BETTY M & EHRIE LISA A
17	1851 SUMMERTIME TRL	Lafayette, 47909	BUCKLEY ROBERT W TRUST ANN TRUST
20	1325 WINDMILL DR	Lafayette, 47909	KOOPMAN JACK H
22	300S	Lafayette, 47909	PSI ENERGY INC

2.3 SOIL AND SEDIMENT SAMPLING

Each of the 13 transects contain soil sampling locations on private property on both sides of the stream bank. Figures 2 and 3 show the sampling locations and the boundaries for the private properties on which they reside. Access onto these private properties will be required in order to collect the specified samples. Therefore, access agreements will be needed from at least the 21 private property owners identified in Table 2. One parcel did not contain ownership information in the Tippecanoe County GIS Department provided information. CEC will use other resources, i.e. phone books, appraisal/tax records, etc., in an attempt to identify the owner of this parcel. This parcel could have an owner other than those currently identified and require an additional agreement. There is a sampling transect proposed at the overhead power line right-of-way near Milepost 1.4 and the utility company has ownership on both sides of the bank. Also, the Mill Creek Home Owners Association (MCHOA) owns four parcels that contain sampling locations. It is expected that a single access agreement referencing each of the targeted parcels will be obtained from each the power company and the MCHOA. Should the proposed upload soil sampling locations be moved based on the geomorphological conditions encountered such that they reside on other private properties or if additional sample locations on additional private properties are required to delineate the extent of impacts, additional agreements will be needed.

Table 2. Properties Expected to be Accessed in Support of Sampling
Study Area Access Plan
Elliott Ditch Implementation of Field Sampling Plan
July 2017

Map ID	Parcel Address	City/Zip	Owner	Owner Mailing Address
1	50 OLYMPIA CT	Lafayette, 47909	RATHJE DAVID W ETAL	2454 N 27th St., Decatur, IL 62526
2	21 BRADY CT	Lafayette, 47909	SMITH KYLE & ERIKA R	Same as Parcel Address
3	30 OLYMPIA CT	Lafayette, 47909	R & B MANAGEMENT LLC	3223 Olympia Dr., Lafayette, IN 47909
4	3116 OLYMPIA DR	Lafayette, 47909	WINSTEAD LLC	3223 Olympia Dr., Lafayette, IN 47909
5	108 COLDBROOK DR	Lafayette, 47909	BROOKS EDITH D	Same as Parcel Address
6	3107 OLYMPIA DR	Lafayette, 47909	LOCAL UNION #2317 UAW BUILDING CORP	Same as Parcel Address
7	155 COLDBROOK CT	Lafayette, 47909	HOLWERDA MYRON D CAROL S	Same as Parcel Address
8	195 COLDBROOK CT	Lafayette, 47909	GRAYSON DANIEL C I SUSAN	Same as Parcel Address
9	S 250E	Lafayette, 47909	ABS REAL ESTATE LLC	3460 Concord Rd., Lafayette, IN 47909
10	BRIDGEWATER CT	Lafayette, 47909	MILL CREEK HOMEOWNERS ASSOC. INC	PO Box 2332, West Lafayette, IN 47996
11	50 SOUTHAVEN CT	Lafayette, 47909	BETTY BILLY W & VICKI J	Same as Parcel Address
12	2329 WINTERSET DR	Lafayette, 47909	KENNEDY TAMARA E	Same as Parcel Address
13	BRIDGEWATER CT	Lafayette, 47909	MILL CREEK HOMEOWNERS ASSOC. INC	PO Box 2332, West Lafayette, IN 47996
14	BRIDGEWATER CT	Lafayette, 47909	MILL CREEK HOMEOWNERS ASSOC. INC	PO Box 2332, West Lafayette, IN 47996
15	2301 WINTERSET DR	Lafayette, 47909	FISHER BETTY M & EHRIE LISA A	Same as Parcel Address
16	BRIDGEWATER CT	Lafayette, 47909	MILL CREEK HOME OWNERS ASSOC. INC	PO Box 2332, West Lafayette, IN 47996
17	1851 SUMMERTIME TRL	Lafayette, 47909	BUCKLEY ROBERT W TRUST ANN TRUST	1842 Summertime Trail Ste 17, Lafayette, IN 47909
18	3114 THOMAS DR	Lafayette, 47909	BROOKS RYAN A & SHANNON D	Same as Parcel Address
19	1337 WINDMILL DR	Lafayette, 47909	ADE GEORGE L KATY L	Same as Parcel Address
20	1325 WINDMILL DR	Lafayette, 47909	KOOPMAN JACK H	Same as Parcel Address
21	3202 THOMAS DR	Lafayette, 47909	JUDGE RUSSELL R CYNTHIA A	Same as Parcel Address
22	300S	Lafayette, 47909	PSI ENERGY INC	550 S Tryon St., Charlotte, NC 28202
23	1004 N SOUTHERNVIEW DR	Lafayette, 47909	STEWART C ROBERT & KAREN J CO-TTEES	Same as Parcel Address
24	3555 CANTERBURY DR	Lafayette, 47909	BOLLOCK JAMES M LORI L	Same as Parcel Address

CEC will access Elliott Ditch from these private properties in order to collect sediment and soil samples within its bank. This will prevent field staff from encountering unnecessary safety concerns by having to carry sampling equipment while wading through the stream.

2.4 LOCAL GOVERNMENT OUTREACH

Prior to engaging the private property owners, CEC will call local government officials. The targeted portion of Elliott Ditch resides in Lafayette, Indiana, and City of Lafayette government officials will be briefed on the project. Below is a list of the City of Lafayette Departments that will be contacted in support of this Access Plan.

- Engineering and Public Works
- Fire Department
- Parks and Recreation
- Police Department
- Stormwater Programs
- Mayor's Office
- City Council

The process will include a phone call to introduce CEC and the project, and include a follow-up e-mail with the Fact Sheet. CEC will also provide City of Lafayette officials the contact information of key project team members to be points of contact for follow-up questions. Meetings with local government officials will be provided upon their request.

2.5 PRIVATE PROPERTY OWNER OUTREACH

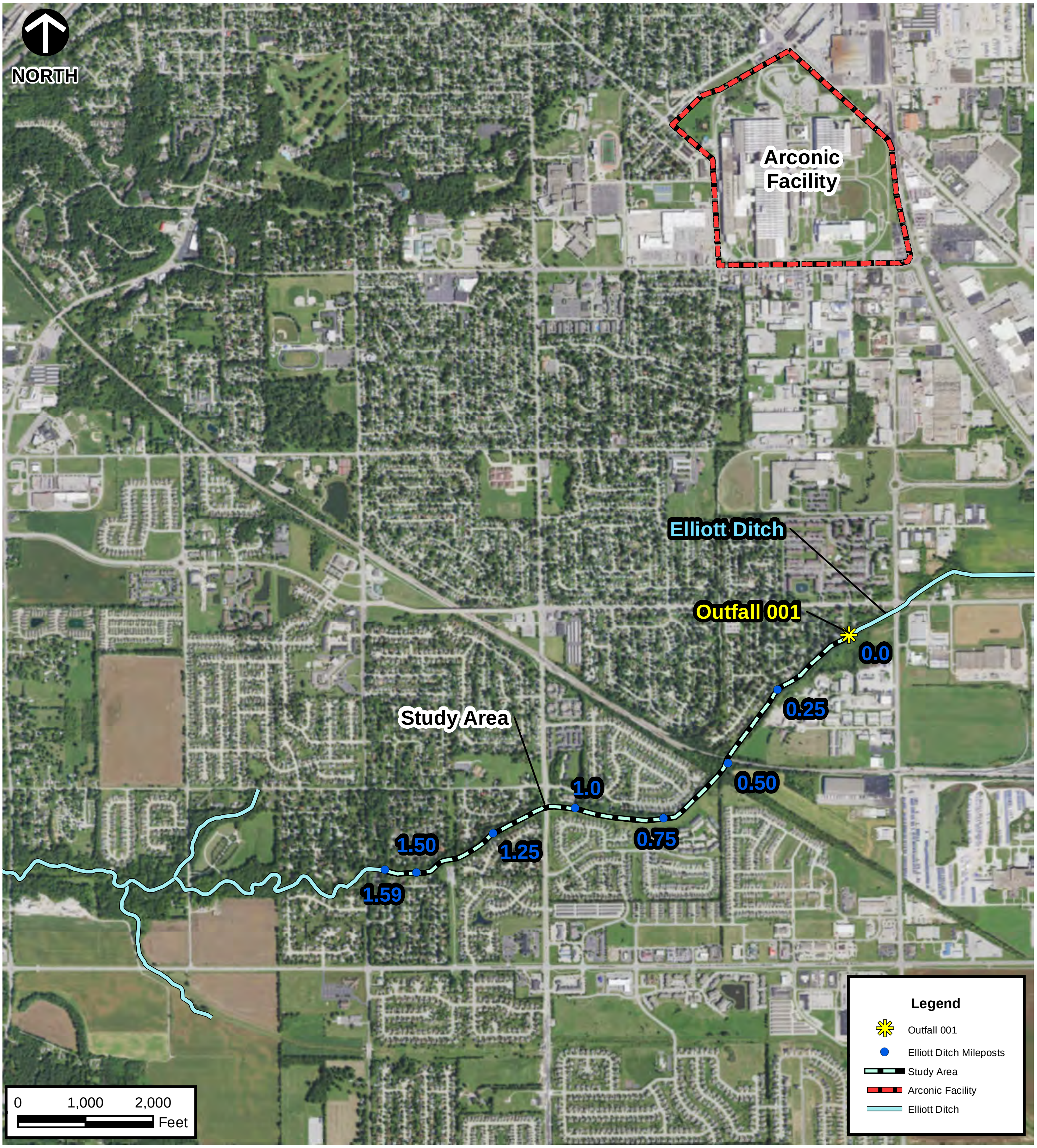
Private property owners from which CEC will request access will first be engaged either through e-mail (if an e-mail address is known) or mail. This initial correspondence will include a brief introductory letter introducing the purpose of the project, project participants (Arconic, CEC, IDEM, and USEPA), outlining the FSP, and identifying the week that field staff will be canvassing the area for face-to-face introductions. It will also include the Fact Sheet that Arconic has developed with coordination with the IDEM. Please refer to Appendix A for example e-mail or mail correspondence and Appendix B for the Fact Sheet.

CEC will follow-up with phone calls (if phone numbers are available) to property owners roughly two weeks after the mailings to try to schedule a brief meeting. Staff will be in Lafayette over the course of a week to hold these face-to-face meetings. The meeting will be used to introduce CEC staff to the private property owners, answer questions, and begin the development of a trustworthy relationship. The follow-up meeting will also be used to review the Access Agreement, as provided in Appendix C. CEC will attempt to obtain signed Access Agreements from each of the private property owners during the meetings; however, in all likelihood, follow-up e-mails or phone calls will likely be needed in support of this effort. In the event CEC encounters private property owners opposed to the project, intervention by other project participants may be needed or alternative sampling locations on other parcels may need to be considered.

3.0 RECORD KEEPING

CEC will keep a repository on its network of communications related to this Access Plan. It is expected to include at a minimum: e-mails, notes from important phone calls and meetings, and copies of executed Access Agreements. This information can be made available to Arconic upon request.

FIGURES



SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 7/24/2017
IMAGE DATE: 03/12/2011

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2704 Cherokee Farm Way, Suite 101 Knoxville, TN 37920
865-977-9997 - 865-774-7767
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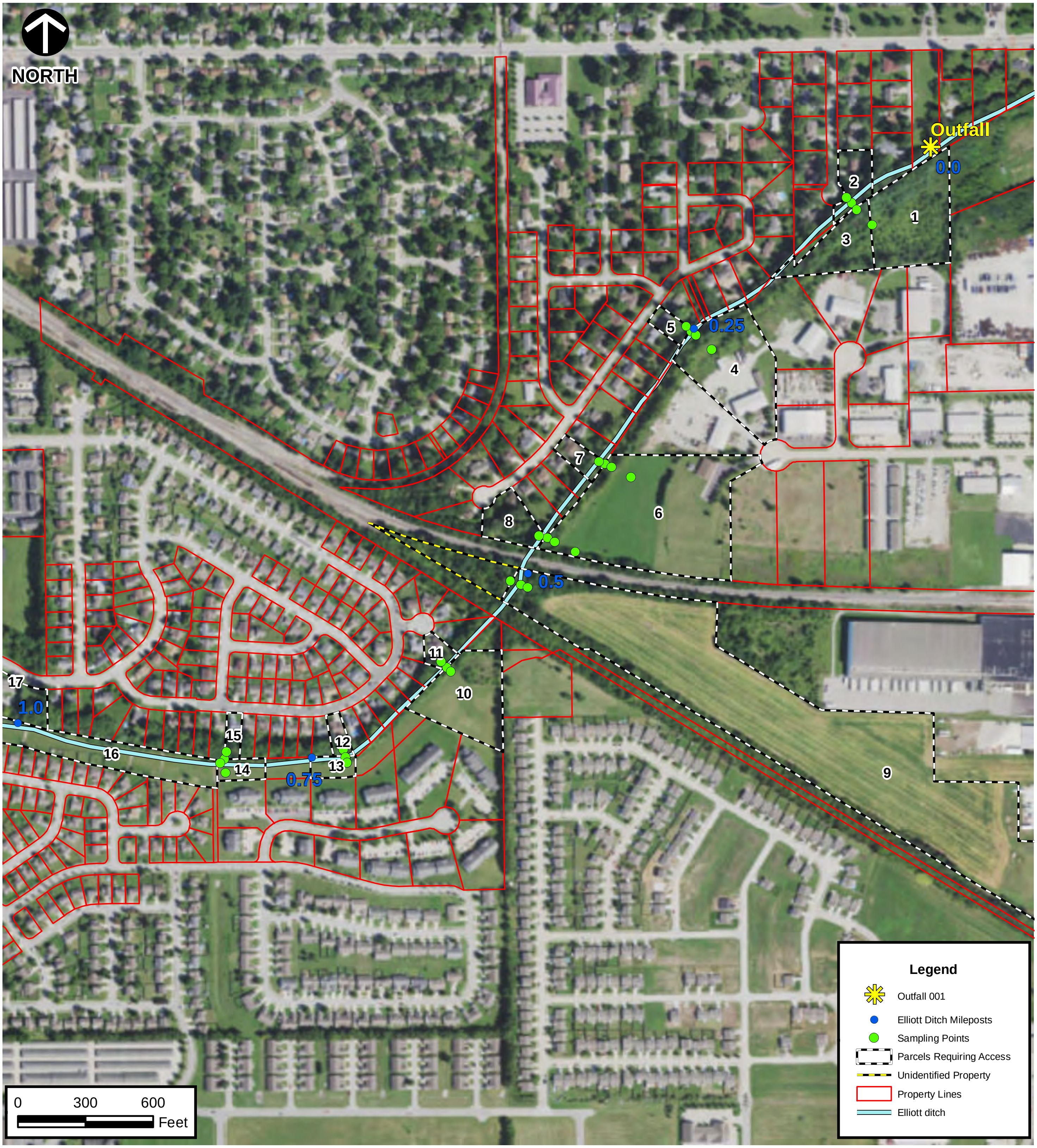
ARCONIC INC. - LAFAYETTE OPERATIONS
ELLIOTT DITCH ACCESS PLAN
FIELD SAMPLING
LAFAYETTE, INDIANA

ELLIOTT DITCH STUDY AREA

DRAWN BY: DMM	CHECKED BY: JMB	APPROVED BY: TLM*	FIGURE NO: 1
DATE: JULY 24, 2017	DWG SCALE: 1 " = 2,000 '	PROJECT NO: 172-367.0002	

Signature on File *

P:\2017\172-367\-GIS\Maps\172-367 Elliott Ditch Figure 1.mxd - 7/24/2017 - 3:20:20 PM (mbruck)



SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 7/20/2017
IMAGE DATE: 03/12/2011

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ARCONIC INC. - LAFAYETTE OPERATIONS
ELLIOTT DITCH ACCESS PLAN
FIELD SAMPLING
LAFAYETTE, INDIANA

PROPERTIES TO ACCESS MILEPOST 0.0 TO 1.0

DRAWN BY: DMM	CHECKED BY: JMB	APPROVED BY: TLM*	FIGURE NO: 2
DATE: JULY 20, 2017	DWG SCALE: 1 " = 600 '	PROJECT NO: 172-367.0002	

Signature on File *

\\svr-knoxville\projects\2017\172-367\-GIS\Maps\172-367 Elliott Ditch Figure 2.mxd - 7/20/2017 - 10:27:45 AM (mbruck)

SOURCE: ESRI WORLD IMAGERY / ARCGIS MAP SERVICE: HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY. LAST ACCESSED: 8/7/2017
IMAGE DATE: 03/12/2011

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2704 Cherokee Farm Way, Suite 101 Knoxville, TN 37920
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ARCONIC INC. - LAFAYETTE OPERATIONS
ELLIOTT DITCH ACCESS PLAN
FIELD SAMPLING
LAFAYETTE, INDIANA

PROPERTIES TO ACCESS MILEPOST 1.0 TO 1.59

DRAWN BY: DMM	CHECKED BY: JMB	APPROVED BY: TLM*	FIGURE NO: 3
DATE: AUGUST 07, 2017	DWG SCALE: 1 " = 600 '	PROJECT NO: 172-367.0002	

Signature on File *

P:\2017\172-367\-GIS\Maps\172-367 Elliott Ditch Figure 3.mxd - 8/7/2017 - 2:33:40 PM (mbruck)

APPENDICES

APPENDIX A
EXAMPLE E-MAIL OR MAIL CORRESPONDENCE

August 7, 2017

Property Owner Name
Property Address
Lafayette, Indiana 47905

Dear Property Owner:

Subject: Request for Property Access Coordination
Arconic Lafayette Operations – Elliott Ditch Field Sampling

Civil & Environmental Consultants, Inc. (CEC) on behalf of Arconic Inc. (Arconic), formerly Alcoa Inc., is providing this **[letter or e-mail]** to notify you of a need to access your property in support of an environmental assessment of Elliott Ditch (Project). The assessment is required by and conducted with oversight and approval from the United States Environmental Protection Agency (USEPA) Region 5 and the Indiana Department of Environmental Management (IDEM).

Elliott Ditch, located adjacent to your property, is a tributary to Wea Creek, which is a tributary to the Wabash River, downstream of Lafayette, Indiana. In addition to its base flow, Elliott Ditch receives industrial discharges from various industries, including an outfall from the Arconic Lafayette Operations (Facility). Historically, polychlorinated biphenyls (PCBs) were used at the Facility and unintentionally released through the outfall into Elliott Ditch. Over time, the released PCBs have collected in upland soil and sediment near and within the ditch. This environmental assessment will be used to collect information for delineating the extent of the PCBs in support of stream remediation and restoration. Please refer to the attached Elliott Ditch Field Sampling Fact Sheet for additional information regarding the Project.

As stated previously, CEC is conducting this assessment on behalf of Arconic with oversight from the EPA Region 5 and the IDEM. Arconic and CEC are committed to working with the homeowners to keep you informed of activities performed on your property and avoiding unnecessary inconvenience. CEC is a consulting firm that is recognized for providing innovative design solutions and integrated expertise in the primary practice areas of civil engineering, ecological sciences, environmental engineering and sciences, survey, waste management and water resources. The CEC staff involved with this assessment are experienced professionals and will execute the Project as such.

The information contained herein is to provide you, the property owner, an introduction and background information related to the upcoming Project and formally request access to the portions of your property located adjacent to Elliott Ditch. CEC will be in the Lafayette area from **[date1]** through **[date2]** and would like to schedule a meeting with you to discuss the Project and potential access to Elliott Ditch from your property. Access will include providing an entry point to the stream for rodding and sediment sampling purposes, as well as the collection of upland soil samples from your property. If you are open to meeting with CEC and discussing the Project, pleased contact the undersigned at 865-977-9997 or mbruck@cecinc.com.

CEC and Arconic greatly appreciate your time and effort in regards to this matter, and we look forward to speaking with you further about the upcoming assessment of Elliott Ditch.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

J. Matt Bruck, P.E. Project Manager	Thomas L. Maher, Jr. Principal

cc: Robert Prezbindowski, Arconic Inc.
Don Stilz, IDEM
Jean Greensley, USEPA Region 5

APPENDIX B
ELLIOTT DITCH FIELD SAMPLING FACT SHEET

FACT SHEET

Elliott Ditch Field Sampling

Summer of 2017

Question or Comments Call 24 hours a day (317) 613-4514

Background Information:

- Arconic Lafayette Operations (formerly Alcoa) is working with the Indiana Department of Environmental Management (IDEM) and U.S. Environmental Protection Agency (U.S. EPA) Region 5 to implement environmental remedial action for Elliott Ditch.
- Previous investigations conducted by U.S. EPA and Arconic, revealed historical polychlorinated biphenyl (PCB) impacts to some overbank and sediment deposits in Elliott Ditch.
- PCBs were used widely by electrical utilities and manufacturing industries across the nation as coolants, lubricants, electrical fluids, and in fire retardant materials from the 1950s to the early 1970s. PCBs were valued for their insulating qualities and were considered an important tool in safeguarding employees and public against fire risks. PCBs were not recognized as a contaminant at that time.
- The Company's Lafayette Operations phased out the use of PCB containing materials in the mid-1970s.

Next Steps:

- As part of the environmental remedial process for Elliott Ditch, Arconic or its consultant [Civil & Environmental Consultants, Inc. (CEC)], with oversight of IDEM and U.S. EPA Region 5, will begin field activities to collect sediment and overbank deposit samples in Elliott Ditch, from the Arconic Outfall to approximately 1.59 miles downstream (see attached figure). This work is being performed to verify current environmental conditions and determine if further action is necessary.
- Sampling is scheduled to begin late summer 2017.
- Arconic will be contacting residents and businesses to request permission to access their properties, and in some places, to access the ditch.
    - Property owners aiding in this investigation will be asked to sign a property access agreement.
    - The sampling will be conducted at no cost to the property owner and disturbed areas will be repaired.
    - The sampling will have little to no impact on residents' day-to-day activities.
    - Arconic will provide the sampling results to property owners upon request.

Environmental and Health Impacts:

Specific questions about health impacts of PCBs should be directed to the U.S. EPA or the Indiana Department of Environmental Management.

Project Contact Information:

- The public may leave a message with their questions and concerns regarding this investigation at (317) 613-4514, or contact Donald Stilz, IDEM Project Manager, at (317) 232-3409; toll free at (800) 451-6027; or by email at dstilz@idem.IN.gov. or Jean Greensley, U.S. Environmental Protection Agency Corrective Action Section 1, at (312) 353-1171; or by email at greensley.jean@epa.gov

- The news media may contact Alisha Hipwell, Arconic Inc. at (412) 553-2072 or by email at Alishsa.Hipwell@arconic.com

APPENDIX C
EXAMPLE ACCESS AGREEMENT

ARCONIC

ACCESS AND USE AGREEMENT

This Access and Use Agreement ("Agreement") is entered into this ___ day of ________________ 2017, by and between Arconic Inc. ("Arconic"), formerly known as Alcoa, and **[insert property owner]**.

In connection with an environmental cleanup project concerning Elliott Ditch in Lafayette, Indiana, which project is under the oversight of the United States Environmental Protection Agency (U.S. EPA) and the Indiana Department of Environmental Management (IDEM), your property has been identified as an appropriate location in support of the assessment, remediation, restoration, and/or monitoring of the ditch. By signing below, I represent that I am in fact the owner of the property described as **[insert property address and parcel ID]** ("Property").

This Agreement allows Arconic, its agents, consultants, or other authorized representatives including employees and authorized representatives of the U.S. EPA and the IDEM, to access your Property and perform assessment (including the collection of soil samples), remediation, restoration, and monitoring on your Property ("Permitted Activities"). At least one week in advance of accessing your Property to perform any of such Permitted Activities, Arconic will notify you and provide you with the precise locations and scope of Permitted Activities. While performing any of the Permitted Activities, Arconic will as best as possible ensure that impacts and/or other damage to your Property are minimized, and if any damage is caused, Arconic shall be responsible for repairs prior to the expiration of this Agreement.

This Agreement shall become effective on the date written above and shall expire when U.S. EPA and IDEM advise Arconic that the assessment, remediation, restoration, and/or monitoring of Elliott Ditch are no longer needed. At such time, Arconic will notify you of this and thereafter, this Agreement shall be null and void.

ARCONIC INC.	**[PROPERTY OWNER]**
______________________________	______________________________
Name: ________________________	Name: ________________________
Title: ________________________	Title (if necessary): ______________

APPENDIX II
POLING DATA SHEETS

Transect A Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
A-1	0.85	1.9	2.58	1.73	sand/silt	pool	no
A-2	0.74	1.85	2.47	1.73	sand/silt	pool	no
A-3	0.83	0.92	1.29	0.46	sand/silt	pool	no
A-4	0.56	1.06	1.2	0.64	sand/silt	pool	no
A-5	0.97	1.56	1.56	0.59	sand/silt	pool	no
A-6	1.32	2.16	3.59	2.27	sand/silt	pool	no
A-7	0.82	1.3	1.34	0.52	sand/silt	pool	no
A-8	0.75	2.16	3.11	2.36	sand/silt	pool	no
A-9	0.86	1.81	2.27	1.41	sand/silt	pool	no
A-10	0.84	2.65	2.91	2.07	sand/silt	pool	no
A-11	0.5	1.64	4.3	3.8	sand/silt	pool	no
A-12	0.93	2.05	3.29	2.36	sand/silt	pool	no
A-13	0.71	1.8	2.56	1.85	sand/silt	pool	no
A-14	0.25	1.41	1.69	1.44	sand/silt	pool	no
A-15	0.44	1.8	2.36	1.92	sand/silt	pool	no
A-16	0.86	1.3	1.46	0.6	sand/silt	pool	no
A-17	0.2	1.15	3.12	2.92	sand/silt	glide	no
A-18	0.35	1.16	3.52	3.17	sand/silt	glide	no
A-19	0.7	0.95	0.95	0.25	sand/silt	glide	no
A-20	0.18	1.18	2.6	2.42	sand/silt	glide	no
A-21	0.24	1.5	3.01	2.77	sand/silt	glide	no
A-22	0.4	1.14	1.23	0.83	sand/silt	riffle	no
A-23	0.22	1.09	1.25	1.03	sand/silt	riffle	no
A-24	0.25	1.55	2.34	2.09	sand/silt	riffle	no
A-25	0.31	0.48	0.52	0.21	sand/silt	riffle	no
A-26	0.15	0.68	1.75	1.6	sand/silt	riffle	no
A-27	0.23	1.01	1.67	1.44	sand/silt	riffle	no
A-28	0.29	0.55	0.97	0.68	sand/silt	riffle	no
A-29	0.31	2.36	3.45	3.14	sand/silt	riffle	no
A-30	0.18	0.62	1.56	1.38	sand/silt	riffle	no
A-31	0.24	0.86	0.98	0.74	sand/silt	riffle	no
A-32	0.21	1.36	2.26	2.05	sand/silt	riffle	no
A-33	0.15	1.62	3.8	3.65	sand/silt	riffle	no
A-34	0.19	0.93	2.76	2.57	sand/silt	riffle	no
A-35	0.76	1.5	3.03	2.27	sand/silt	central bar	no
A-36	0.3	2.36	3.14	2.84	sand/silt	central bar	no
A-37	0.15	1.54	3.89	3.74	sand/silt	central bar	no
A-38	0.19	0.5	3.69	3.5	sand/silt	central bar	no
A-39	0.34	0.49	0.61	0.27	sand/silt	central bar	no
A-40	0.2	1.24	3.46	3.26	sand/silt	central bar	no
A-41	0.26	1.24	3.95	3.69	sand/silt	central bar	no
A-42	0.5	1.54	1.54	1.04	sand/silt	central bar	no
A-43	0.34	0.66	0.66	0.32	sand/silt	central bar	no
A-44	0.26	1.12	1.19	0.93	sand/silt	central bar	no
A-45	0.28	1.15	1.49	1.21	sand/silt	central bar	no
A-46	0.4	1.26	2.87	2.47	sand/silt	central bar	no
A-47	0.4	0.7	2.02	1.62	sand/silt	central bar	no
A-48	0.2	1.45	3.15	2.95	sand/silt	central bar	no
A-49	0.35	2.76	3.2	2.85	sand/silt	central bar	no

Transect A Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
A-50	0.34	0.53	0.6	0.26	sand/silt	central bar	no
A-51	0	1.3	3.17	3.17	sand/silt	central bar	no
A-52	0.3	1.15	2.9	2.6	sand/silt	central bar	no
A-53	0.25	0.88	1.25	1	sand/silt	central bar	no
A-54	0	0.4	3.18	3.18	sand/silt	central bar	no
A-55	0.27	2.25	3.05	2.78	sand/silt	central bar	no
A-56	0.13	1.25	2.15	2.02	sand/silt	central bar	no
A-57	0.12	1.55	3.55	3.43	sand/silt	central bar	no
A-58	0.43	2.28	2.6	2.17	sand/silt	central bar	no
A-59	0.13	1.64	1.94	1.81	sand/silt	central bar	no
A-60	0	1.4	3	3	sand/silt	central bar	no
A-61	0.41	1.39	2.42	2.01	sand/silt	riffle	no

Transect B Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
B-01	0	1.45	2.3	2.3	Sand	Head of Riffle/PB	NO
B-02	0.5	1.45	1.5	1	Sand	TWG	NO
B-03	0.5	1.23	1.25	0.75	Sand	TWG	NO
B-04	0.54	0.84	0.84	0.3	Sand	TWG	NO
B-05	1.1	1.53	1.8	0.7	Sand	Point Bar	NO
B-06	0.35	1.2	2.09	1.74	Sand	Point Bar	NO
B-07	0	1.15	2	2	Sand	Point Bar	NO
B-08	1.15	1.43	1.45	0.3	Sand	Point Bar	NO
B-09	0.5	1.3	1.68	1.18	Sand	Point Bar	NO
B-10	0	0.4	1.4	1.4	Sand	Point Bar	NO
B-11	0.7	1.9	1.98	1.28	Sand	Point Bar	NO
B-12	0.58	1.84	2	1.42	Sand	Point Bar	NO
B-13	0.25	0.58	4.2	3.95	Sand	Point Bar	NO
B-14	1.05	2.4	2.55	1.5	Sand	Point Bar	NO
B-15	0.48	1.88	1.88	1.4	Sand	Point Bar	NO
B-16	0	1.8	3.55	3.55	Sand	Point Bar	NO
B-17	1.2	3.3	3.7	2.5	Sand	Point Bar	NO
B-18	1.4	3.38	4.55	3.15	Sand	Point Bar	NO
B-19	1.6	1.78	2	0.4	Sand	Point Bar	NO
B-20	0.6	2.81	3.55	2.95	Sand	Point Bar	NO
B-21	0.05	0.65	4.03	3.98	Sand/Silt	Point Bar	NO
B-22	0.81	2.11	2.39	1.58	Sand	Point Bar	NO
B-23	1.25	3.29	4.49	3.24	Sand	Point Bar	NO
B-24	0.6	2.46	3.81	3.21	Sand	Point Bar	NO
B-25	0.05	2.8	3.3	3.25	Sand		NO
B-26	0.74	1.7	2.74	2	Sand		NO
B-27	0.41	0.78	0.97	0.56	Sand		NO
B-28	0.85	3.96	4.92	4.07	Sand		NO
B-29	0.39	2.76	2.81	2.42	Sand		NO
B-30	0.45	1.09	1.09	0.64	Sand		NO
B-31	0.93	2.24	4.4	3.47	Sand		NO
B-32	0.56	1.34	4.81	4.25	Sand		NO
B-33	0.7	1.35	1.8	1.1	Sand		NO
B-34	1.2	2.24	4	2.8	Sand		NO
B-35	0.6	2.55	3.9	3.3	Sand		NO
B-36	0.8	1.54	1.94	1.14	Sand		NO
B-37	1	1.94	2.91	1.91	Sand		NO
B-38	0.9	2.3	4.73	3.83	Sand		NO
B-39	0.95	1.85	2.08	1.13	Sand		NO
B-40	1.03	1.83	2.01	0.98	Sand		NO
B-41	1.3	3.09	3.57	2.27	Sand/Silt	Longitudinal Bar	NO
B-43	0.89	1.9	1.9	1.01	Sand/Silt	Longitudinal Bar	NO
B-44	0.69	1.95	2	1.31	Sand/Silt	Longitudinal Bar	NO
B-45	1.24	1.75	1.85	0.61	Sand/Silt	Longitudinal Bar	NO
B-46	1.35	2.89	4.09	2.74	Sand/Silt	Longitudinal Bar	NO
B-47	0.8	1.79	1.87	1.07	Sand/Silt	Longitudinal Bar	NO
B-48	0.6	0.6	0.65	0.05	Sand/Silt	Longitudinal Bar	NO
B-49	0.84	2.52	3.15	2.31	Sand		NO

Transect B Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
B-50	0.65	2.81	2.83	2.18	Sand		NO
B-51	0.59	0.71	0.71	0.12	Sand		NO
B-52	0	1.34	3.5	3.5	Sand	Longitudinal Bar	NO
B-53	0.15	1.61	3.89	3.74	Sand	Longitudinal Bar	NO
B-54	0.45	0.64	0.78	0.33	Sand	Longitudinal Bar	NO
B-55	0.39	1.64	2.45	2.06	Sand		NO
B-56	0	0.89	3.41	3.41	Sand		NO
B-57	0.15	0.21	4.51	4.36	Sand/Silt		NO
B-58	0.21	1.1	4.02	3.81	Sand/Silt		NO
B-59	0.3	0.5	0.87	0.57	Sand/Silt	TWG	NO
B-60	0.34	1.55	2.14	1.8	Sand/Silt	TWG	NO
B-61	0	1.38	3	3	Sand/Silt	Longitudinal Bar	NO
B-62	0.3	2.1	2.3	2	Sand/Silt	Longitudinal Bar	NO
B-63	0.2	1.82	1.95	1.75	Sand/Silt	TWG	NO
B-64	0.59	1.35	1.44	0.85	Sand/Silt	TWG	NO
B-65	0	1.53	3.7	3.7	Sand/Silt	Longitudinal Bar	NO
B-66	0	1.87	2.8	2.8	Sand/Silt	Longitudinal Bar	NO
B-67	0.2	0.59	0.59	0.39	Sand/Silt	TWG	NO

Transect C Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
C-01	1.19	1.68	1.75	0.56	Silt/Clay		NO
C-02	1.35	1.9	1.9	0.55	Silt/Clay		NO
C-03	1.25	3.54	3.65	2.4	Sand		NO
C-04	1.53	2.8	3.35	1.82	Sand		NO
C-05	1.36	2.18	2.37	1.01	Sand		NO
C-06	0.7	1.04	1.29	0.59	Clay		NO
C-07	1.18	2.29	2.29	1.11	Clay		NO
C-08	1.05	2.1	3.2	2.15	Sand		NO
C-09	1.09	1.59	1.7	0.61	Sand		NO
C-10	0.91	2.65	3.05	2.14	Sand/Silt		NO
C-11	0.91	1	2.05	1.14	Sand/Silt		NO
C-12	1.5	3.76	3.9	2.4	Sand		NO
C-13	0.73	1.82	4	3.27	Sand	Point Bar/Inner Berm	NO
C-14	0.74	1.56	3.4	2.66	Sand	Point Bar/Inner Berm	NO
C-15	0.53	0.95	1	0.47	Sand	twg	NO
C-16	0.44	1.55	4.79	4.35	Sand	Point Bar/Inner Berm	NO
C-17	0.65	3.44	3.91	3.26	Sand	Point Bar/Inner Berm	NO
C-18	0.46	1.43	1.75	1.29	Clay	twg	NO
C-19	0.44	2.7	4.44	4	Sand	Point Bar/Inner Berm	NO
C-20	0.5	1.5	4.87	4.37	Sand		NO
C-21	0.6	1.35	4.45	3.85	Sand/Silt		NO
C-22	0.4	0.6	0.6	0.2	Sand		NO
C-23	0.4	2.55	2.95	2.55	Sand		NO
C-24	0.55	1.94	3.94	3.39	Sand		NO
C-25	0.67	1.25	2.51	1.84	Sand		NO
C-26	0.45	1.46	1.73	1.28	Silt/Clay		NO
C-27	0.59	2.56	2.95	2.36	Sand		NO
C-28	0.4	1.7	2.99	2.59	Sand		NO
C-29	0.5	2.35	2.74	2.24	Sand/Silt		NO
C-30	0.58	2.09	2.79	2.21	Sand		NO
C-31	0.55	1.35	3.01	2.46	Sand		NO
C-32	0.45	2.5	2.69	2.24	Sand		NO
C-33	0.37	1.88	3.2	2.83	Sand		NO
C-34	0.7	1.61	2.53	1.83	Sand/Silt		NO
C-35	0.53	1.3	3.35	2.82	Sand	Point Bar/Inner Berm	NO
C-36	0.2	1.5	1.84	1.64	Sand	Point Bar/Inner Berm	NO
C-37	0	2	4.6	4.6	Sand	Point Bar/Inner Berm	NO
C-38	0.97	1.67	2.69	1.72	Sand/Silt		NO
C-39	0.7	1.45	3.29	2.59	Sand	Point Bar/Inner Berm	NO
C-40	0.2	1.94	3.18	2.98	Sand	Point Bar/Inner Berm	NO
C-41	0.2	2.25	3.02	2.82	Sand	Point Bar/Inner Berm	NO
C-42	0.4	1.65	3.85	3.45	Sand	Point Bar/Inner Berm	NO
C-43	1	3.05	3.1	2.1	Sand	twg	NO

Transect D Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
D-01	1.66	1.73	1.8	0.14	Sand		No
D-02	1.93	3.36	4.6	2.67	Sand/Silt		No
D-03	1.91	3.42	4.35	2.44	Sand/Silt		No
D-04	1.68	1.91	1.92	0.24	Sand		No
D-05	1.8	3.21	4.49	2.69	Sand		No
D-06	1.96	3.44	4.31	2.35	Sand/Silt		No
D-07	1.77	2.54	4.46	2.69	Sand/Silt		No
D-08	1.54	2.13	2.13	0.59	Sand/Clay		No
D-09	1.67	2.22	2.4	0.73	Sand/Clay		No
D-10	1.94	3.85	5.11	3.17	Sand/Clay		No
D-11	2.13	3.84	5.37	3.24	Sand/Clay		No
D-12	1.9	2.67	3.19	1.29	Sand/Clay		No
D-13	2.1	2.21	2.51	0.41	Clay		No
D-14	2.26	2.89	3.24	0.98	Sand/Clay	Point Bar	No
D-15	2.18	3.5	4.39	2.21	Sand	Point Bar	No
D-16	1.6	2.5	4.39	2.79	Sand	Inner Berm	No
D-17	2.31	2.98	3.09	0.78	Sand/Clay		No
D-18	2.36	4.09	4.48	2.12	Sand		No
D-19	2.24	3.8	5.23	2.99	Sand		No
D-20	1.49	2.5	4.78	3.29	Sand		No
D-21	1.68	2.57	4.3	2.62	Sand		No
D-22	2.45	3.76	3.99	1.54	Sand		No
D-23	2.58	4.32	4.8	2.22	Sand/Gravel		No
D-24	2.05	2.48	3.86	1.81	Clay		No
D-25	2.11	3.29	3.3	1.19	Sand		No
D-26	2.8	5.1	5.38	2.58	Sand/Silt		No
D-27	2.6	4.74	5	2.4	Sand/Silt		No
D-28	1.89	2.79	4.6	2.71	Sand/Silt		No
D-29	1.8	3.44	4.9	3.1	Sand/Silt		No
D-30	2.65	4.56	4.62	1.97	Sand		No
D-31	2.5	5.05	6.03	3.53	Sand/Silt		No
D-32	2.38	3.23	3.34	0.96	Sand/Silt		No

Transect E Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
E-01	1.39	1.79	1.84	0.45	Sand	Large Debris Jam	No
E-02	1.51	2.05	2.2	0.69	Sand	Large Debris Jam	No
E-03	1.57	2.12	2.25	0.68	Clay	Large Debris Jam	No
E-04	1.1	1.37	1.38	0.28	Sand	Large Debris Jam	No
E-05	1.48	1.56	1.56	0.08	Sand	Large Debris Jam	No
E-06	1.1	2	2.02	0.92	Sand	Large Debris Jam	No
E-07	1.8	2.04	2.08	0.28	Sand	Large Debris Jam	No
E-08	1.3	1.35	1.35	0.05	Sand	Large Debris Jam	No
E-09	0.95	1.67	1.76	0.81	Sand	Large Debris Jam	No
E-10	0.41	1.77	1.77	1.36	Sand	Large Debris Jam	No
E-11	1.15	1.4	1.41	0.26	Sand	Large Debris Jam	No
E-12	0.56	1.24	1.34	0.78	Sand	Large Debris Jam	No
E-13	0.46	1.45	1.45	0.99	Sand	Large Debris Jam	No
E-14	0.89	1.15	1.15	0.26	Sand	Large Debris Jam	No
E-15	0.45	0.94	1.02	0.57	Sand	Large Debris Jam	No
E-16	0.43	0.78	0.81	0.38	Sand	Large Debris Jam	No
E-17	1.16	2.11	2.19	1.03	Sand	Small Debris Jam	No
E-18	0.25	1.4	3.25	3	Sand/Silt	Small Debris Jam	No
E-19	1.14	1.78	1.97	0.83	Sand/Silt	Small Debris Jam	No
E-20	0	0.8	2.5	2.5	Sand/Silt	Small Debris Jam	No
E-21	0.35	1.2	1.49	1.14	Sand/Silt	Small Debris Jam	No
E-22	0.43	1.48	1.5	1.07	Sand	Small Debris Jam	No
E-23	0.6	1.4	2.13	1.53	Sand	Small Debris Jam	No
E-24	0.24	1.26	1.26	1.02	Sand	Small Debris Jam	No
E-25	0	1	1	1	Sand/Silt	Small Debris Jam	No

Transect F Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
F-01	1.35	1.84	3.2	1.85	Sand		NO
F-02	1.3	2.48	2.54	1.24	Sand		NO
F-03	1.29	1.94	3.91	2.62	Sand		NO
F-04	1.23	1.7	1.75	0.52	Sand/Clay		NO
F-05	1.35	1.94	2.85	1.5	Sand		NO
F-06	1.04	1.99	2.24	1.2	Sand		NO
F-07	1.4	2.4	3.2	1.8	Sand		NO
F-08	1.3	2.41	2.49	1.19	Sand		NO
F-09	1.27	2.7	3	1.73	Sand		NO
F-10	1.42	2.37	3.35	1.93	Sand		NO
F-11	1.29	2.03	2.3	1.01	Sand		NO
F-12	1.72	2.35	2.4	0.68	Sand		NO
F-13	1.48	2.9	3.09	1.61	Sand		NO
F-14	1.4	2.1	3.28	1.88	Sand/Silt		NO
F-15	1.25	2.25	2.48	1.23	Sand		NO
F-16	1.22	2.28	2.6	1.38	Sand		NO
F-17	1.49	2.03	3	1.51	Sand		NO
F-18	1.37	2.07	3.24	1.87	Sand		NO
F-19	1.25	1.97	2.35	1.1	Sand		NO
F-20	1.35	2.26	2.65	1.3	Sand		NO
F-21	1.06	2.04	2.64	1.58	Sand		NO
F-22	1.37	2.04	3.09	1.72	Sand		NO
F-23	1.4	2.03	2.24	0.84	Sand		NO
F-24	1.3	2.3	2.4	1.1	Sand		NO
F-25	1.33	2.48	3.23	1.9	Sand		NO
F-26	1.29	1.57	3.85	2.56	Sand/Silt		NO
F-27	1.48	2.02	2.1	0.62	Sand		NO
F-28	1.52	2.39	3.18	1.66	Sand		NO
F-29	1.45	2.73	3.12	1.67	Sand		NO
F-30	1.36	1.7	2.8	1.44	Sand		NO
F-31	1.4	2.3	3.33	1.93	Sand		NO
F-32	1.54	2.48	2.63	1.09	Sand		NO
F-33	1.64	2.32	3.15	1.51	Sand		NO
F-34	1.35	1.66	2.43	1.08	Sand		NO
F-35	1.36	2.03	2.15	0.79	Sand		NO
F-36	1.5	2.28	2.41	0.91	Sand		NO
F-37	1.6	2.03	2.05	0.45	Sand/Gravel		NO
F-38	1.3	2.18	3.17	1.87	Sand/Clay		NO
F-39	1.64	2.8	3.48	1.84	Sand		NO
F-40	1.57	2.9	2.96	1.39	Sand		NO
F-41	1.54	2.28	2.36	0.82	Sand		NO

Transect G Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
G-01	1.96	2.18	2.22	0.26	Sand	Point Bar	NO
G-02	1.97	2.33	2.41	0.44	Sand	Point Bar	NO
G-03	1.61	1.94	1.94	0.33	Sand	Point Bar	NO
G-04	1.7	2.05	2.07	0.37	Sand	Point Bar	NO
G-05	1.39	2.1	2.16	0.77	Sand	Point Bar	NO
G-06	1.09	2.03	3.09	2	Sand	Point Bar	NO
G-07	1.36	2.18	2.18	0.82	Sand	Point Bar	NO
G-08	1.2	2.11	2.37	1.17	Sand	Point Bar	NO
G-09	0.99	2	3.57	2.58	Sand	Point Bar	NO
G-10	1.68	2	2.03	0.35	Sand	Point Bar	NO
G-11	1.28	2.2	2.38	1.1	Sand	Point Bar	NO
G-12	0.98	2	2.11	1.13	Sand	Point Bar	NO
G-13	0.4	1.3	4.74	4.34	Sand/Silt	Point Bar	NO
G-14	1.64	2.01	2.1	0.46	Sand	Point Bar	NO
G-15	1	2.35	4.25	3.25	Sand/Silt	Point Bar	NO
G-16	0.4	1.77	3.7	3.3	Sand	Point Bar	NO
G-17	1.78	1.95	2	0.22	Sand	Point Bar	NO
G-18	0.97	2.2	2.7	1.73	Sand	Point Bar	NO
G-19	0.66	1.89	2.04	1.38	Sand	Point Bar	NO
G-20	1.44	1.85	3.36	1.92	Sand	Point Bar	NO
G-21	1.1	2.03	3.16	2.06	Sand/Silt	Point Bar	NO
G-22	0.86	1.98	2.1	1.24	Sand	Point Bar	NO
G-23	1.55	1.84	1.84	0.29	Sand	Point Bar	NO
G-24	1.3	2	2.09	0.79	Sand	Point Bar	NO
G-25	0.5	1.1	2	1.5	Sand/Silt	Point Bar	NO
G-26	1.58	1.86	2.21	0.63	Sand	Point Bar	NO
G-27	1.12	1.81	1.94	0.82	Sand	Point Bar	NO
G-28	0.85	1.55	1.7	0.85	Sand	Point Bar	NO
G-29	0.5	0.9	1.9	1.4	Sand	Point Bar	NO

Transect H Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
H-01	0.95	1.27	1.45	0.5	Sand	Longitudinal Bar	No
H-02	0.65	1.15	1.3	0.65	Sand	Longitudinal Bar	No
H-03	1	1.49	1.52	0.52	Sand	Longitudinal Bar	No
H-04	0.59	0.97	1	0.41	Sand	Longitudinal Bar	No
H-05	0.61	1.08	1.14	0.53	Sand	Longitudinal Bar	No
H-06	0.6	1.16	1.23	0.63	Sand	Longitudinal Bar	No
H-07	0.6	1.22	1.26	0.66	Sand	Longitudinal Bar	No
H-08	0.47	0.84	0.84	0.37	Sand	Longitudinal Bar	No
H-09	0.35	0.83	0.85	0.5	Sand	Longitudinal Bar	No
H-10	0.35	1.04	1.1	0.75	Sand	Longitudinal Bar	No
H-11	0.54	1.18	1.19	0.65	Sand	Longitudinal Bar	No
H-12	0.64	1.26	1.35	0.71	Sand	Longitudinal Bar	No
H-13	0.25	1	1.05	0.8	Sand	Longitudinal Bar	No
H-14	0.47	0.89	1.01	0.54	Sand	Longitudinal Bar	No
H-15	0.58	1	1	0.42	Sand	Longitudinal Bar	No
H-16	0.45	1.1	1.14	0.69	Sand	Longitudinal Bar	No
H-17	0.72	1.22	1.25	0.53	Sand	Longitudinal Bar	No
H-18	0.8	1.21	1.21	0.41	Sand	Longitudinal Bar	No
H-19	0.58	1.26	1.32	0.74	Sand	Longitudinal Bar	No
H-20	0.8	1.18	1.21	0.41	Sand	Longitudinal Bar	No
H-21	0.89	1.45	1.5	0.61	Sand	Longitudinal Bar	No

Transect I Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
I-01	2.05	2.35	2.42	0.37	Sand		No
I-02	2.04	2.26	3.17	1.13	Sand		No
I-03	1.95	2.7	2.89	0.94	Clay		No
I-04	2.08	3.24	3.24	1.16	Sand		No
I-05	1.78	2.28	2.9	1.12	Sand		No
I-06	2	2.25	3.5	1.5	Sand/Gravel		No
I-07	1.55	2.46	3	1.45	Sand/Gravel		No
I-08	1.85	3.3	3.37	1.52	Sand/Gravel		No
I-09	2.1	3.3	3.35	1.25	Sand/Gravel		No
I-10	2.05	2.42	2.47	0.42	Sand		No
I-11	2.22	2.85	2.85	0.63	Sand		No
I-12	1.9	3.06	3.08	1.18	Sand		No
I-13	1.75	3.48	4.1	2.35	Sand/Clay		No
I-14	1.52	2.27	3.48	1.96	Sand/Clay		No
I-15	2.2	2.84	2.86	0.66	Sand/Clay		No
I-16	1.91	2.94	2.95	1.04	Sand/Clay		No
I-17	1.68	2.59	2.6	0.92	Sand/Clay		No
I-18	1.65	2.9	3.35	1.7	Sand/Clay		No
I-19	2.34	2.68	2.69	0.35	Sand		No
I-20	2.08	2.79	2.8	0.72	Sand/Silt		No
I-21	1.6	2.38	2.6	1	Clay		No
I-22	2.19	2.34	2.56	0.37	Sand		No
I-23	1.85	2.56	2.6	0.75	Sand		No
I-24	1.4	2.26	2.3	0.9	Sand		No
I-25	2.06	2.42	2.46	0.4	Sand		No
I-26	1.75	2.64	2.65	0.9	Sand		No
I-27	1.39	1.98	2.2	0.81	Sand		No
I-28	1.78	2.53	2.58	0.8	Sand		No
I-29	2.09	2.44	2.51	0.42	Sand		No
I-30	1.9	3.36	3.36	1.46	Sand/Clay		No
I-31	1.66	3.09	3.09	1.43	Sand/Clay		No
I-32	0.93	2	2.35	1.42	Sand/Clay		No
I-33	2.04	2.37	2.4	0.36	Sand/Clay		No
I-34	1.24	2	2.15	0.91	Sand		No
I-35	1.05	1.4	1.49	0.44	Clay		No

Transect J Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
J-01	0.63	0.74	0.8	0.17	Sand	UPS of Debris Jam	No
J-02	0.75	1.38	1.39	0.64	Sand	UPS of Debris Jam	No
J-03	0.72	1.09	1.14	0.42	Sand	UPS of Debris Jam	No
J-04	0.76	1.44	1.5	0.74	Sand	UPS of Debris Jam	No
J-05	1.05	1.68	1.68	0.63	Sand	UPS of Debris Jam	No
J-06	1.4	1.68	1.75	0.35	Sand	UPS of Debris Jam	No
J-07	1	1.72	1.79	0.79	Sand	UPS of Debris Jam	No
J-08	0.8	1.3	1.45	0.65	Sand	UPS of Debris Jam	No
J-09	0.89	1.24	1.44	0.55	Sand	UPS of Debris Jam	No
J-10	1	1.4	2.18	1.18	Sand	UPS of Debris Jam	No
J-11	1.2	1.76	1.82	0.62	Sand	UPS of Debris Jam	No
J-12	1.3	2.34	2.95	1.65	Sand	UPS of Debris Jam	No
J-13	1.25	2.2	2.8	1.55	Sand	UPS of Debris Jam	No
J-14	1.46	2.6	2.82	1.36	Sand	UPS of Debris Jam	No
J-15	1.64	2.47	2.64	1	Sand	UPS of Debris Jam	No
J-16	1.54	1.91	1.94	0.4	Sand	UPS of Debris Jam	No
J-17	1.48	2.25	2.5	1.02	Sand	UPS of Debris Jam	No
J-18	1.35	2.02	3.19	1.84	Sand	UPS of Debris Jam	No
J-19	1.32	2.08	2.15	0.83	Sand	UPS of Debris Jam	No
J-20	1.43	2.02	2.23	0.8	Sand	UPS of Debris Jam	No
J-21	1.2	1.89	2.29	1.09	Sand	UPS of Debris Jam	No
J-22	1.28	1.89	2	0.72	Sand	UPS of Debris Jam	No
J-23	1.05	1.41	1.42	0.37	Sand	UPS of Debris Jam	No
J-24	1.42	1.71	2.75	1.33	Sand	UPS of Debris Jam	No
J-25	1.2	1.91	2.66	1.46	Sand	UPS of Debris Jam	No
J-26	1.8	1.81	1.81	0.01	Sand	UPS of Debris Jam	No
J-27	1.05	1.3	1.35	0.3	Sand	UPS of Debris Jam	No
J-28	0.8	0.93	1	0.2	Sand	UPS of Debris Jam	No
J-29	1.58	1.66	1.71	0.13	Sand	UPS of Debris Jam	No
J-30	1.05	1.39	1.49	0.44	Sand	UPS of Debris Jam	No
J-31	0.75	1.15	1.2	0.45	Sand	DS of Debris Jam	No
J-32	0.37	0.87	0.87	0.5	Sand	DS of Debris Jam	No
J-33	0.76	1.98	2.1	1.34	Sand	DS of Debris Jam	No
J-34	1.06	1.46	1.5	0.44	Sand	DS of Debris Jam	No
J-35	0.92	1.58	1.68	0.76	Sand	DS of Debris Jam	No
J-36	1.63	1.81	1.81	0.18	Sand	DS of Debris Jam	No
J-37	1.13	1.48	1.5	0.37	Sand	DS of Debris Jam	No
J-38	0.7	1.4	1.45	0.75	Sand	DS of Debris Jam	No
J-39	1.05	1.75	1.8	0.75	Sand	DS of Debris Jam	No
J-40	0.35	1	1.05	0.7	Sand	DS of Debris Jam	No
J-41	0.75	1	1	0.25	Sand	DS of Debris Jam	No
J-42	1.05	1.05	1.05	0	Sand	DS of Debris Jam	No
J-43	0.9	1	1	0.1	Sand	DS of Debris Jam	No
J-44	0.28	0.98	1.15	0.87	Sand	DS of Debris Jam	No
J-45	0.49	1.02	1.15	0.66	Sand	DS of Debris Jam	No
J-46	0.54	1	1.02	0.48	Sand	DS of Debris Jam	No
J-47	0.83	1.15	1.28	0.45	Sand	DS of Debris Jam	No
J-48	0.45	1.14	1.15	0.7	Sand	DS of Debris Jam	No

Transect J Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
J-49	1.06	1.19	1.24	0.18	Sand	DS of Debris Jam	No
J-50	0.44	0.85	0.85	0.41	Sand	DS of Debris Jam	No
J-51	0.44	0.6	0.62	0.18	Sand	DS of Debris Jam	No

Transect K Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
K-01	1.25	1.44	1.54	0.29	Sand	Debris Jam/Pool	No
K-02	1.25	1.85	1.97	0.72	Sand	Debris Jam/Pool	No
K-03	1.25	1.47	1.6	0.35	Sand	Debris Jam/Pool	No
K-04	1.3	1.51	1.6	0.3	Sand	Debris Jam/Pool	No
K-05	1.12	1.35	1.52	0.4	Sand	Debris Jam/Pool	No
K-06	0.91	1.4	1.53	0.62	Sand	Debris Jam/Pool	No
K-07	1.18	1.6	1.75	0.57	Sand	Debris Jam/Pool	No
K-08	1.3	2.09	4.2	2.9	Sand	Debris Jam/Pool	No
K-09	1.5	2	2.1	0.6	Sand	Debris Jam/Pool	No
K-10	1.04	1.21	1.21	0.17	Sand	Debris Jam/Pool	No
K-11	1.22	1.92	1.95	0.73	Sand	Debris Jam/Pool	No
K-12	1.65	1.91	1.94	0.29	Sand	Debris Jam/Pool	No
K-13	0.45	0.81	2.2	1.75	Sand	Debris Jam/Pool	No
K-14	1	1.56	1.59	0.59	Sand	Debris Jam/Pool	No
K-15	1.4	1.96	2.06	0.66	Sand	Debris Jam/Pool	No
K-16	1.3	2.47	2.5	1.2	Sand	Debris Jam/Pool	No
K-17	1.36	2.91	3.26	1.9	Silt	Debris Jam/Pool	No
K-18	1.43	3.26	3.3	1.87	Silt	Debris Jam/Pool	No
K-19	1.33	3.2	3.22	1.89	Sand/Silt	Debris Jam/Pool	No
K-20	1.51	1.68	1.84	0.33	Sand	Debris Jam/Pool	No
K-21	1.51	1.71	2.27	0.76	Sand	Debris Jam/Pool	No
K-22	1.26	1.34	1.42	0.16	Sand	Debris Jam/Pool	No
K-23	1.33	1.71	1.76	0.43	Sand	Debris Jam/Pool	No
K-24	0.99	1.47	1.51	0.52	Sand	Debris Jam/Pool	No
K-25	1.54	1.6	1.62	0.08	Sand	Debris Jam/Pool	No
K-26	1.68	2.11	2.15	0.47	Sand	Debris Jam/Pool	No
K-27	1.14	1.3	1.32	0.18	Sand	Debris Jam/Pool	No
K-28	0.91	1.16	1.16	0.25	Sand	Debris Jam/Pool	No
K-29	1.04	1.2	1.2	0.16	Sand	Debris Jam/Pool	No
K-30	1.45	1.5	1.5	0.05	Sand	Debris Jam/Pool	No
K-31	1.54	3.41	3.41	1.87	Silt	Debris Jam/Pool	No
K-32	1.1	3.3	3.3	2.2	Silt	Debris Jam/Pool	No
K-33	0.7	1.09	3.4	2.7	Silt	Debris Jam/Pool	No
K-34	1.1	1.5	1.59	0.49	Silt	Debris Jam/Pool	No
K-35	0.65	0.84	3.65	3	Silt	Debris Jam/Pool	No

Transect L Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
L-01	2.7	2.9	2.9	0.2	Clay	Point Bar 1	NO
L-02	2.01	2.76	2.76	0.75	Clay	Point Bar 1	NO
L-03	1.3	1.44	1.44	0.14	Clay	Point Bar 1	NO
L-04	3.1	3.15	3.15	0.05	Clay	Point Bar 1	NO
L-05	2.85	3.4	3.55	0.7	Clay	Point Bar 1	NO
L-06	1.8	2.65	2.7	0.9	Clay	Point Bar 1	NO
L-07	3.3	3.35	3.38	0.08	Clay	Point Bar 1	NO
L-08	2.81	3.36	3.4	0.59	Silt/Clay	Point Bar 1	NO
L-09	1.91	2.29	2.29	0.38	Silt/Clay	Point Bar 1	NO
L-10	3.29	3.3	3.3	0.01	Silt/Clay	Point Bar 1	NO
L-11	1.42	2.49	3.34	1.92	Sand/Clay	Point Bar 1	NO
L-12	2.46	3.3	3.4	0.94	Clay	Point Bar 1	NO
L-13	1.5	2.94	3.69	2.19	Clay	Point Bar 1	NO
L-14	2.95	3.25	3.25	0.3	Clay	Point Bar 1	NO
L-15	0.35	2.78	3.71	3.36	Clay	Point Bar 1	NO
L-16	3.13	3.2	3.2	0.07	Gravel	Point Bar 1	NO
L-17	1.78	3.25	3.25	1.47	Silt/Clay	Point Bar 1	NO
L-18	2.7	2.9	3.05	0.35	Gravel	Point Bar 1	NO
L-19	2.15	2.52	2.95	0.8	Sand/Silt	Point Bar 1	NO
L-20	2.67	3.2	3.25	0.58	Sand/Silt	Point Bar 1	NO
L-21	2.44	2.45	2.45	0.01	Sand/Clay	Point Bar 1	NO
L-22	2.05	2.45	2.5	0.45	Sand/Clay	Point Bar 1	NO
L-23	1.61	2.5	2.95	1.34	Sand/Silt	Point Bar 1	NO
L-24	0.94	2.13	3.45	2.51	Sand	Point Bar 1	NO
L-25	2.28	2.5	2.51	0.23	Sand	Point Bar 1	NO
L-26	2.15	2.65	2.7	0.55	Sand	Point Bar 1	NO
L-27	1.61	2.45	2.45	0.84	Sand/Silt	Point Bar 1	NO
L-28	1.5	2.05	3.21	1.71	Clay	Point Bar 1	NO
L-29	2.56	3.2	3.4	0.84	Sand	Point Bar 1	NO
L-30	2.9	3.1	3.15	0.25	Sand	Point Bar 1	NO
L-31	1.94	2.6	2.85	0.91	Silt	Point Bar 1	NO
L-32	1.78	2.26	2.3	0.52	Silt	Point Bar 1	NO
L-33	2.96	3.2	3.3	0.34	Sand	Point Bar 1	NO
L-34	2.39	3.1	3.5	1.11	Sand	Point Bar 1	NO
L-35	2.09	2.9	3.1	1.01	Silt/Clay	Point Bar 1	NO
L-36	3.28	3.7	3.75	0.47	Sand/Gravel	Point Bar 1	NO
L-37	2.52	3.52	4.05	1.53	Silt	Point Bar 1	NO
L-38	1.71	2.45	3.2	1.49	Silt	Point Bar 1	NO
L-39	3.34	3.72	3.72	0.38	Gravel	Point Bar 1	NO
L-40	1.95	2.85	2.96	1.01	Silt	Point Bar 1	NO
L-41	1.68	2.7	2.81	1.13	Sand/Silt	Point Bar 1	NO
L-42	1.5	2.44	2.44	0.94	Sand	Point Bar 1	NO
L-43	1.54	2.3	2.4	0.86	Sand	Point Bar 1	NO
L-44	1.9	2.3	2.39	0.49	Gravel	Point Bar 1	NO
L-45	2.01	2.14	2.14	0.13	Gravel	Point Bar 1	NO
L-46	1.15	1.3	1.3	0.15	Clay	Point Bar 1	NO
L-47	1.51	1.68	1.72	0.21	Clay	Point Bar 1	NO
L-48	2.25	2.84	3.29	1.04	Sand	Point Bar 2/3	NO

Transect L Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
L-49	2.5	3.1	3.11	0.61	Sand	Point Bar 2/3	NO
L-50	3.9	4.3	4.3	0.4	Sand/Gravel	Point Bar 2/3	NO
L-51	3.11	3.35	3.4	0.29	Sand	Point Bar 2/3	NO
L-52	2.25	2.8	2.8	0.55	Sand	Point Bar 2/3	NO
L-53	1.3	2.7	2.78	1.48	Silt	Point Bar 2/3	NO
L-54	3.04	3.29	3.3	0.26	Sand	Point Bar 2/3	NO
L-55	2.04	2.81	2.86	0.82	Silt/Clay	Point Bar 2/3	NO
L-56	1.1	1.98	2.41	1.31	Silt/Clay	Point Bar 2/3	NO
L-57	2.8	3	3.15	0.35	Sand/Gravel	Point Bar 2/3	NO
L-58	1.95	2.3	2.44	0.49	Clay	Point Bar 2/3	NO
L-59	0.95	1	1	0.05	Clay	Point Bar 2/3	NO
L-60	2.71	2.86	2.94	0.23	Gravel	Point Bar 2/3	NO
L-61	0.31	0.4	0.45	0.14	Clay	Point Bar 2/3	NO
L-62	0.94	0.95	0.95	0.01	Clay	Point Bar 2/3	NO

Transect M Poling Data

Point	Water Depth (Feet)	Soft Push (Feet)	Hard Push (Feet)	Total Depth (Feet)	Sediment Type	Geomorphic Feature	Aquatic Veg
M-01	3.23	3.25	3.26	0.03	Sand	Point Bar	No
M-02	2.97	3.34	3.34	0.37	Sand	Point Bar	No
M-03	3.49	3.49	3.49	0	Clay	Point Bar	No
M-04	3.15	3.18	3.18	0.03	Sand	Point Bar	No
M-05	2.6	3.15	3.16	0.56	Sand	Point Bar	No
M-06	2.49	2.36	3.7	1.21	Sand/Clay	Point Bar	No
M-07	2.5	3.15	3.21	0.71	Sand/Clay	Point Bar	No
M-08	2.36	3	3.09	0.73	Sand	Point Bar	No
M-09	2.8	3.04	3.05	0.25	Sand	Point Bar	No
M-10	2.63	2.79	2.8	0.17	Sand	Point Bar	No
M-11	2.2	2.7	2.75	0.55	Sand	Point Bar	No
M-12	2.34	2.6	2.6	0.26	Sand	Point Bar	No
M-13	2.48	2.77	2.8	0.32	Sand	Point Bar	No
M-14	2.1	2.54	2.6	0.5	Sand	Point Bar	No
M-15	2.33	2.75	2.8	0.47	Silt/Clay	Point Bar	No
M-16	2.25	2.5	2.79	0.54	Sand	Point Bar	No
M-17	2.25	2.74	2.75	0.5	Sand	Point Bar	No
M-18	1.92	2.3	2.3	0.38	Sand/Clay	Point Bar	No
M-19	2	3	3.09	1.09	Gravel	Point Bar	No
M-20	2.25	2.8	2.85	0.6	Gravel	Point Bar	No
M-21	2.5	2.6	2.65	0.15	Gravel	Point Bar	No
M-22	2.24	2.7	2.8	0.56	Gravel	Point Bar	No
M-23	2.46	2.6	2.7	0.24	Gravel	Point Bar	No
M-24	1.8	2.35	3.1	1.3	Sand	Point Bar	No
M-25	1.56	2.19	2.36	0.8	Clay	Point Bar	No
M-26	2.39	2.7	2.75	0.36	Gravel	Point Bar	No
M-27	2	2.65	3.2	1.2	Silt/Gravel	Point Bar	No
M-28	1.69	2.34	2.4	0.71	Sand/Gravel	Point Bar	No
M-29	1.65	2.34	2.35	0.7	Sand/Silt	Point Bar	No
M-30	2.3	2.64	2.7	0.4	Gravel	Point Bar	No
M-31	1.95	2.64	2.75	0.8	Sand/Silt	Point Bar	No
M-32	1.74	2.38	2.45	0.71	Sand	Point Bar	No
M-33	1.54	2.29	2.3	0.76	Sand	Point Bar	No
M-34	1.9	2.09	2.1	0.2	Gravel	Point Bar	No
M-35	1.65	2.35	2.36	0.71	Sand	Point Bar	No
M-36	1.74	2.3	2.35	0.61	Sand	Point Bar	No
M-37	1.7	2.05	2.2	0.5	Gravel	Point Bar	No
M-38	1.69	2.3	2.3	0.61	Sand	Point Bar	No
M-39	1.55	1.9	1.91	0.36	Sand	Point Bar	No
M-40	1.65	1.79	1.9	0.25	Sand	Point Bar	No
M-41	1.4	2.15	2.15	0.75	Sand	Point Bar	No
M-42	1.45	1.69	1.85	0.4	Sand	Point Bar	No
M-43	1.65	1.88	2	0.35	Sand	Point Bar	No
M-44	1.45	1.85	1.95	0.5	Sand	Point Bar	No
M-45	1.45	1.6	1.61	0.16	Clay	Point Bar	No