Plantasie Creek Floodplain Soil Investigation Work Plan

Hercules, Inc. Site #356001
Port Ewen, New York

Prepared for:

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August 2022

Table of Contents

List of Tables

List of Figures

Acronyms

ASTM	American Society for Testing and Materials
bgs	below ground surface
CO	Consent Order
COC	chain-of-custody
DDNP	diazodinitrophenol
ECSM	ecological conceptual site model
EPC	exposure point concentration
FEMA	Federal Emergency Management Agency
ft	feet
ft^2	square feet
FWRIA	Fish and Wildlife Resources Impact Analysis
GE	General Electric Company
GPS	geographic positioning system
HASP	Health and Safety Plan
HMX	cyclotetramethylene tetranitramine
LMNR	lead mononitro-resorcinol
mg/kg	milligrams per kilogram
MS/MSD	matrix spike/matrix spike duplicate
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PBX	polymer bound explosive
PETN	pentaerythritol tetranitrate
PSA	Project Safety Analysis
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RDX	cyclotrimethylene trinitramine
SCOs	Soil Cleanup Objectives
SGVs	sediment guidance values
SSL	Soil Screening Level
SWMU	Solid Waste Management Unit
TOC	total organic carbon

1 Introduction

This *Plantasie Creek Floodplain Soil Investigation Work Plan* ("Work Plan") was developed on behalf of Hercules Incorporated ("Hercules"), a wholly owned subsidiary of Ashland, Inc. ("Ashland"), and Dyno Nobel, Inc. ("Dyno Nobel") to present the approach for floodplain soil sampling in Plantasie Creek downstream of the Dyno Nobel Port Ewen Site ("Site") in accordance with New York State Department of Environmental Conservation (NYSDEC) Administrative Order on Consent [Consent Order (CO)] Index # CO 3-20180508-85 effective August 3, 2018. The Site is located at 161 Ulster Avenue, approximately one mile south of the Village of Port Ewen in Ulster County, New York (**Figure 1**) and is listed on the New York State Inactive Hazardous Waste Site Index as Site No. 356001.

The Work Plan was prepared consistent with NYSDEC *Technical Guidance for Site Investigation and Remediation* ("DER-10"; NYSDEC, 2010) and submitted as draft to NYSDEC in January 2022. NYSDEC provided comments on the draft Work Plan on February 24, 2022, and EHS Support responded to NYSDEC comments on April 1, 2022. The Work Plan has been revised in accordance with the responses to NYSDEC comments submitted by EHS Support on April 1, 2022 and additional NYSDEC comments received on July 13, 2022.

Ecological investigations have been on-going at the Site since 2007 as part of a NYSDEC Fish and Wildlife Resources Impact Analysis (FWRIA). The scope of FWRIA investigations includes the characterization and delineation of target metals, specifically copper, mercury, selenium, and zinc, that may have migrated from the Site and deposited in sediments within Plantasie Creek downstream of the Solid Waste Management Unit (SWMU) 1/22 Wetland Complex at the Site. The results of the phased sediment delineation sampling were reported to NYSDEC in the *Plantasie Creek Phase 1 and 2 Sediment Sampling Report* (EHS Support, 2020).

Sediment sampling and substrate survey results from multiple phases of investigation within Plantasie Creek provide the basis for the delineation of target metal concentrations in sediment exceeding NYSDEC Class C freshwater sediment guidance values (SGVs; EHS Support, 2020; NYSDEC, 2014). The results of the downstream sediment delineation sampling indicated decreasing concentrations of target metals in sediment with increasing distance downstream of the Site. The greatest concentrations of target metals within the extent of sediment delineation sampling were observed in samples collected within the reach from the downstream Site boundary to Salem Street, approximately one mile downstream of the Site (**Figure 2**). The findings of these investigations were used to support a ecological conceptual site model (ECSM) regarding the deposition of target metals in fine-grained sediments within Plantasie Creek downstream of the SWMU 1/22 Wetland Complex (EHS Support, 2020).

Sediment investigations conducted within Plantasie Creek have adequately characterized and delineated the extent of target metal concentrations exceeding NYSDEC Class C SGVs. However, the potential overbank transport and deposition of target metals onto surficial soils within the floodplain of Plantasie Creek have not been investigated. The *Plantasie Creek Phase 1 and 2 Sediment Sampling Report* recommended the development of a soil sampling program designed to characterize concentrations of target metals in surficial soils within the extent of the floodplain that may be regularly inundated by overbank flow from Plantasie Creek (EHS Support, 2020). The results of the soil sampling program will be used to evaluate potential human health and ecological exposure to target metals in floodplain soils based on comparisons to NYSDEC Soil Cleanup Objectives (SCOs; NYSDEC, 2006a and b), and if warranted, to provide recommendations for Site-specific evaluations of potential human health or ecological exposure. The need for surface soil sampling within the Plantasie Creek floodplain was directed by NYSDEC in a meeting on December 11, 2019, and in comments on the *Plantasie Creek Phase 1 and 2 Sediment Sampling Report* (EHS Support, 2020) that were provided by NYSDEC in a letter dated April 19, 2021.

1.1 Investigation Objectives

This Work Plan was developed to satisfy the recommendations of the *Plantasie Creek Phase 1 and 2 Sediment Sampling Report* (EHS Support, 2020) and to address NYSDEC comments regarding the potential downstream migration of target metals from on-site sources to the surficial soils within the Plantasie Creek floodplain downstream of the Site via overbank transport and deposition. Specific objectives of the floodplain soil investigation described in the Work Plan are:

- Characterize the nature and extent of target metal concentrations in surface soils within the Plantasie Creek floodplain downstream of the Site that may be regularly inundated by overbank flow.
- Evaluate spatial patterns in the distribution of target metal concentrations in surface floodplain soils, including potential longitudinal gradients from source areas, to assess potential overbank transport and deposition as a potential migration pathway.
- Evaluate vertical concentration gradients of target metal concentrations in surface floodplain soils to assess potential overbank transport and deposition as a potential migration pathway.
- Evaluate soil characteristics potentially affecting metal mobility and bioavailability [e.g., pH, total organic carbon (TOC)].
- Assess potential human health and ecological exposure to target metal concentrations in surface floodplain soils based on comparisons to relevant NYSDEC SCOs (NYSDEC, 2006a and b), and if warranted, provide recommendations for Site-specific evaluations of potential human health or ecological exposure.

Section 2 through **Section 5** present additional background for the floodplain soil investigation, describe the sampling, analysis, and reporting approach, and provide detail regarding the implementation of the investigation activities specified in the Work Plan.

2 Investigation Background

Section 2.1 and **Section 2.2** provide information on the operational history at the Site and the ECSM for the potential overbank transport and deposition of target metals from potential on-site sources onto surficial soils within the floodplain of Plantasie Creek downstream of the Site.

2.1 Operational History

Historical manufacturing operations at the Site involved the manufacture of blasting cap components, consisting primarily of metal shells, insulated wire, and plastic tubing, and the assembly of these components into various types of blasting caps or initiating devices using purchased explosives. Raw materials procured from off-site sources included explosives, chemicals, uncoated wire, and metal sheets. Raw explosives were stored as powders under water (to reduce the possibility of explosion) in wooden vats located within an underground concrete vault in the Tank House. As of 1991, explosive materials used at the facility included pentaerythritol tetranitrate (PETN), diazodinitrophenol (DDNP), cyclotrimethylene trinitramine (RDX), cyclotetramethylene tetranitramine (HMX), polymer bound explosive (PBX), tetryl, tetrazene, black powder, nitrocellulose, double base propellant, lead azide, lead mononitro-resorcinol (LMNR), and lead styphnate. These explosive materials were combined with barium salts, chromates, lead oxides, perchlorates, molybdenum, tungsten, silicon, zirconium, and boron powders to make the desired product. Additional starting materials, including selenium, tellurium, and lead powders, were used in product designs prior to 1988. Mercury fulminate was formerly used on-site in the production of certain devices prior to the late 1950s.

During the 1980s and 1990s, production at the facility dropped sharply. In 2003, the number of employees was significantly reduced following a merger of Dyno Nobel with a subsidiary of Ensign-Bickford Industries. The detonator manufacturing ceased at the Site on June 28, 2010. Dyno Nobel personnel who supported other company operations continued to occupy the Site administrative buildings. In 2012, Dyno Nobel began leasing the facility to Maine Drilling and Blasting, a joint venture with Dyno Nobel, who provides blasting services for the construction and quarry markets. Maine Drilling and Blasting operations involve the blending of emulsions and ammonium nitrate, storage and distribution of packaged explosives and bulk blasting agents, and on-site maintenance and repairs to company delivery vehicles.

2.2 Plantasie Creek Conceptual Site Model

An ECSM presented in the *Fish and Wildlife Impact Analysis Step IIC Investigation Report* (URS, 2011) describes the potential migration of target metals from Site operations to downstream areas of Plantasie Creek. A summary of the ECSM for relevant transport and ecological exposure pathways from the Site to Plantasie Creek is presented as follows.

The SWMU 1/22 Wetland Complex represents the primary source of target metals from Site operations to Plantasie Creek. The SWMU 1/22 Wetland Complex drains to Plantasie Creek, a tributary to Rondout Creek (**Figure 2**). the SWMUs located within and adjacent to the wetland are potential sources of target metals to the SWMU 1/22 Wetland Complex and subsequently to the off-site portion of Plantasie Creek. SWMU 22 is a former landfill located near the center of the wetland complex; waste material disposed in this landfill represents a potential source of target metals to the adjacent wetland. SWMU 1 is a former shooting pond used to detonate off-specification explosives. Historical underwater detonation of explosives in SWMU 1 represents a potential source of target metals to the surrounding areas. SWMUs located within the Active Plant Area of the Site represent secondary sources of target metals to the SWMU 1/22 Wetland Complex. Target metals may migrate from the SWMU 1/22 Wetland Complex to the downstream reach of Plantasie Creek primarily through transport via surface water erosion/runoff pathways.

The findings from phased sediment sampling and substrate surveys further refined the ECSM regarding the distribution and exposure to target metals in sediment downstream of the Site (EHS Support, 2020). Substrate mapping survey findings indicate that the distribution of fine-grained depositional sediment within the extent of the delineation sampling is consistent with stream slope. As illustrated in the longitudinal stream profile of Plantasie Creek (**Figure 3**), the reach of Plantasie Creek from the Site boundary to Salem Street is a low-gradient (0.2 percent slope) depositional reach, resulting in the accumulation and storage of fine-grained sediment overlying a native clay layer. At Salem Street, there is an abrupt increase in gradient, with slope increasing to 3.9 percent between Salem Street and Mill Brook Drive. This high-gradient reach is erosional, with minimal sediment deposition and storage. The substrate in this reach is primarily characterized by bedrock, with boulder, cobble, gravel, and fine-medium sand substrates. Finer-grained sediments are limited to shallow, channel margin deposits that are spatially limited within the reach between Salem Street and Mill Brook Drive. The extent of the 100-year floodplain within this reach is relatively narrow, constrained by steep slopes adjacent to Plantasie Creek. From Mill Brook Drive downstream to Rondout Creek, the slope of Plantasie Creek decreases to 0.3 percent resulting in a depositional sediment environment, with fine-grained sediments overlying a native clay layer. The floodplain from Mill Brook Drive downstream to Rondout Creek broadens and is predominantly influence by inundation by floodwater in Rondout Creek.

The findings of the phased sediment delineation sampling program indicate that the distribution of target metals is consistent with the distribution of fine-grained depositional sediment, as described based on stream slope (**Figure 4A and Figure 4B**). Target metal concentrations decreased with increasing distance from the Site. The greatest concentrations of target metals were observed within the low-gradient reach (0.2 percent slope) from the Site boundary to Salem Street, which was characterized as a depositional reach containing predominantly fine-grained sediments overlying a native clay layer. From Salem Street to Mill Brook Drive, there is limited sediment storage due to increased channel slope (3.6 percent slope) and increased flow velocity, resulting in spatially-limited and shallow channel margin sediment deposits that contained lower target metal concentrations relative to concentrations observed between the Site boundary and Salem Street (**Figure 4A and Figure 4B**). In fine-grained sediments sampled in the low-gradient reach (0.3 percent slope) from Mill Brook Drive to the downstream extent of the delineation sampling, target metal concentrations were lower relative to the concentrations observed between the Site boundary and Salem Street. Based on the updated ECSM, the greatest potential in-stream exposure to target metals in Plantasie Creek sediments downstream of the Site was identified within the reach from the Site boundary to Salem Street (EHS Support, 2020).

Based on the ECSM, the greatest potential for overbank transport and deposition of target metals in surficial soils within the Plantasie Creek floodplain would be within the reach from the Site boundary to Salem Street where the greatest in-stream sediment concentrations were observed during the phased delineation sampling. Typical floodplain depositional patterns from source areas indicate greater concentrations in floodplain soils nearest to the source areas, with decreasing concentrations in floodplain soils with increasing distance downstream from the source area (Saint-Laurent, et al., 2013). The deposition of target metals on surface floodplain soils through overbank transport would also be expected to result in greater concentrations near the top of bank in the frequently inundated zone and decreasing concentrations moving laterally from the top of bank as the floodplain elevations increase and the frequency of inundation decreases. As a result, floodplain geomorphology and associated floodplain elevation is a more important factor than distance from the riverbank in determining the disposition of fine-grained sediment and the accumulation of particulate-sorbed metals in surficial floodplain soils (Szabo et al., 2020).

3 Investigation Approach

The approach for investigating the potential downstream migration of target metals from on-site sources to the surficial soils within the Plantasie Creek floodplain was developed based on the ECSM described in the previous section. **Section 3.1** through **Section 3.3** presents the investigation objectives, sampling design, and implementation of sampling activities.

3.1 Sampling Design

Soil sampling will be conducted at 10 transects placed along approximately 1.5-miles of the floodplain of Plantasie Creek, from the Site north to immediately upstream of Mill Brook Road (**Figure 5**). As indicated in **Section 2.2** and illustrated on **Figure 4A and Figure 4B**, the reach of stream from the Site to Salem Street is characterized as a low gradient, depositional environment that contains the greatest concentrations of target metals in instream sediment (EHS Support, 2020). Based on the conceptual sediment transport and deposition within Plantasie Creek, the greatest potential for overbank transport and deposition of target metals in off-site floodplain soils is expected within this reach. As stated in the ECSM, typical floodplain depositional patterns indicate greater concentrations in floodplain soils nearest to the source areas, with floodplain soil concentrations decreasing with increasing distance downstream from the source area (Saint-Laurent, et al., 2013).

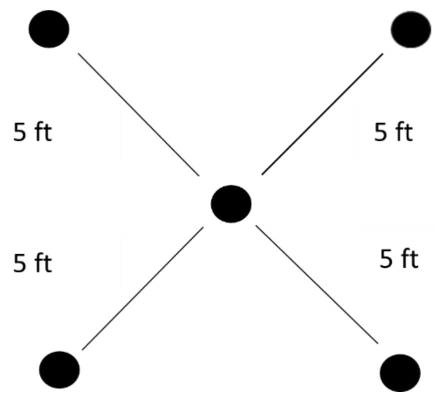
Based on conceptual transport and floodplain depositional patterns, characterization of the potential downstream and overbank transport and subsequent deposition of target metals will be initially focused on the floodplain within the reach from the Site to immediately upstream of Mill Brook Road (Transect 10). As stated in the response to NYSDEC comments (April 1, 2022), the need for an additional transect(s) downstream of Transect 10 will be determined based on a holistic review of target metal concentrations measured in floodplain soil samples collected from the Site to Transect 10 as part of the initial floodplain soil characterization. The results of the initial nature and extent characterization will be presented to NYSDEC and recommendations regarding the need for further soil sampling within the floodplain downstream of Transect 10 will be provided based on comparisons of target metal concentrations to NYSDEC SCOs for Unrestricted and Residential Use for the protection of human health and NYSDEC SCOs for the Protection of Ecological Resources (See **Section 4.0** for further discussion). As stated in **Section 4.0**, comparisons to SCOs will also consider representative background concentrations for target metals in soils. Consultation with NYSDEC will be initiated immediately upon review of the initial floodplain soil data and if additional downstream sampling is warranted, an effort will be made to complete the additional sampling within the same sampling season, as permitted by field conditions at the time of the consultation.

Floodplain sampling stations will be placed on transects aligned perpendicular to the Plantasie Creek channel (**Figure 3**). The 100-year floodplain, as mapped by the Federal Emergency Management Agency (FEMA, 2009), provides the lateral boundary for sampling, which is consistent with other floodplain soil investigations conducted in New York [Parsons, 2011; General Electric Company (GE) and USEPA, 2014]. The soil sampling stations along each transect will be positioned based on the floodplain elevation and distance from the channel, which are indicative of flood frequency and potential overbank transport and deposition (Szabo et al., 2020; Middelkoop and van der Perk, 2007; GE and USEPA, 2014). **Figure 5A to Figure 5H** present the proposed soil sampling stations within the eight sampling transects. The sampling stations will start at top of bank and extend out to the mapped extent of the 100-year floodplain to characterize distribution of the target metal concentrations along each transect.

3.2 Sampling Approach

Target constituents in floodplain soils will be characterized at each proposed sampling station using a composite sampling approach. DER-10 (NYSDEC, 2010) indicates that composite sampling is generally not acceptable when establishing nature and extent over presumably large areas as part of a site characterization or remedial investigation. However, the composite sampling proposed for soil sampling within the Plantasie Creek floodplain is intended to characterize target metal concentrations on a small spatial scale [approximately 25 square feet(ft^2)] immediately surrounding the proposed sampling station. A composite approach is recommended for floodplain sampling to provide a more representative sample of target metal concentrations in floodplain soils than discrete samples that may be biased by inherent heterogeneity and potential influence of anomalies in the sample (e.g., debris).

Composite samples will be collected based on five representative soil samples from proposed sampling stations along each transect. The composite sample design will be centered on the proposed sampling station, with four additional subsamples collected approximately 5 ft from the proposed sampling station as shown below:



Surficial soil samples will be collected using a decontaminated soil auger or dedicated soil auger liner from five soil subsampling points at each proposed sampling location, as illustrated above. An undisturbed soil core will be retrieved at each subsampling location from 0 to 24 inches below the vegetative cover. Following sample collection, the position of the center sampling point will be recorded with a sub-meter geographic positioning system (GPS) unit.

Consistent with DER-10 (NYSDEC, 2010) and NYSDEC comments received on July 13, 2022, soil cores will be subsampled into the following depth intervals to support specific data objectives (**Table 1**):

- 0–6 inches below the vegetative cover: This interval will be evaluated for ecological exposure and for human health exposure via incidental soil ingestion, inhalation of soil, or dermal contact.
- 6–12 inches below the vegetative cover: Characterization of target metal concentrations to 12 inches bgs is consistent with USEPA guidance on biologically-relevant sampling intervals for ecological risk assessments in terrestrial habitats (USEPA, 2015).
- 12–24 inches below vegetative cover: As recommended by DER-10, a deeper soil horizon will be collected.

Aliquots containing approximately equal soil sample volumes of each of the five subsamples at each proposed soil sampling station will be homogenized to similar color and texture. The homogenized soil composite of the five aliquots for each sampling interval will be transferred to a laboratory-supplied container for target metals analysis: copper, mercury, selenium, and zinc (**Table 1 and Table 2**). Following the collection of samples for target metals, aliquots containing approximately equal soil sample volumes of the composite samples from the 0–6-inch and 6-12-inch interval will be composited into a single composite sample for analyses of pH, TOC, and grain size distribution (sieve analysis only; **Table 1**). TOC, pH, and grain size distribution are ancillary parameters that will be used to support the interpretation of target metals results. Soil lithology will be described using the Unified Soil Classification System, which is set forth in American Society for Testing and Materials (ASTM) D2488 (NYSDEC, 2010; ASTM, 2017). Field observations of soil characteristics will be noted in the field logbook or field data sheets.

Samples will be stored on ice for shipment to the laboratory. Decontamination of non-dedicated sampling equipment will be conducted between sample collection.

3.3 Project Quality Control and Quality Assurance

Sections 3.3.1 through **3.3.5** provide information on sample management, laboratory analytical requirements, quality assurance/quality control (QA/QC) of samples and analyses, analytical data validation, and project documentation to support the data objectives (**Table 1**).

3.3.1 Sample Identification, Handling, and Chain-of-Custody

Analytical samples will be identified, handled, and recorded as described below. Each sample container will have a sample label affixed to the outside, and documentation will be completed in waterproof ink. Each label will be marked using waterproof ink with the following information:

- Project name
- Sample identification number
- Date and time of collection
- Initials of sampling technician
- Requested analysis
- Method of preservation

Sample containers will be packed in bubble wrap to minimize breakage and placed in plastic coolers. Ice will be placed around sample containers, and additional cushioning material will be added to the cooler, if necessary. A temperature blank will be included in each cooler. Paperwork will be placed in a sealable plastic bag and placed on top of the sample containers or taped to the inside lid of the cooler. The cooler will be sealed, and signed custody seals will be affixed to two sides of the cooler. Laboratory address labels will be placed on top of the cooler.

Sample coolers will be packaged and shipped as environmental samples in accordance with applicable federal and state regulations. Standard procedures applicable to the shipment of environmental samples to the analytical laboratory are outlined below:

- Environmental samples will be transported to the laboratory by field personnel, shipped through Federal Express or equivalent overnight service, or picked up by a laboratory courier. Shipments will be scheduled to meet holding time requirements (**Table 2**).

- The laboratory will be notified prior to receipt of samples. If the number, type, or date of shipment changes due to Site constraints or program changes, the laboratory will be informed in advance to allow adequate time to prepare.
- The transfer of custody of field collected samples will follow an established sample chain-of-custody (COC) program. The primary purpose of COC procedures is to ensure that sample traceability is maintained from collection through shipping, storage, and analysis to data reporting and disposal.
- Tracking sample custody will be accomplished by using the COC record. A COC entry will be recorded for every sample, and a COC record will accompany every sample shipment to the laboratory. At a minimum, the COC record will contain the following information for each sample:
  - Project name and number
  - Sample number and identification of sampling point
  - Sample media
  - Sample number and identification of sampling point
  - Date and time of collection
  - Sample type
  - Number, type, and volume of sample container(s)
  - Sample preservative
  - Analysis requested
  - Name, address, and phone number of laboratory or laboratory contact
  - Signature, dates, and times of persons in possession
  - Any necessary remarks or special instructions

Once the COC is complete and the samples are prepared for shipment, the COC will be placed inside the shipping container, and the container will be sealed. Samples are considered to be in custody if they are within sight of the individual responsible for their security or locked in a secure location. Each person who takes possession of the samples, except the shipping courier, is responsible for sample integrity and safekeeping. A copy of each COC form will be retained by the sampling team for the project file. Bills of lading will also be retained as part of the COC record.

3.3.2 Analytical Requirements

Soil samples will be analyzed by a laboratory accredited pursuant to the New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program and the laboratory will provide Category B electronic data deliverables (NYSDEC, 2006b).

Soil-specific analytical requirements have been established to confirm that laboratory reporting limits are adequate to satisfy the data objectives stated for the investigation. **Table 2** provides a comparison of soil-specific analytical requirements to analytical reporting limits provided by the laboratory. Soil-specific analytical requirements were based on the minimum of the human health and ecological NYSDEC SCOs, adjusted to the rural soil background concentrations for habitats, as presented in **Table 3** (NYSDEC, 2006a and b).

3.3.3 Analytical QA/QC Samples

Field QA/QC samples are designed to help identify and minimize potential sources of sample contamination due to field procedures and to evaluate potential error introduced by sample collection and handling. Four types of QA/QC samples will be collected as part of the proposed sediment delineation sampling effort:

- Field (rinsate) blank samples: A field blank sample is intended to indicate potential contamination from sampling equipment. A field blank sample will be collected by rinsing laboratory supplied organic-free deionized water over decontaminated sampling apparatus into a laboratory-supplied sample bottle. The field blank sample is assigned a distinct identification number and will be handled, transported, and analyzed in the same manner as the samples collected that day. Field blanks will be collected at a rate of one per day per sample matrix. A field blank does not need to be collected when dedicated or disposable sampling equipment is used.
- Duplicate samples: Blind field duplicate samples will be collected to evaluate the consistency of field techniques and laboratory analysis. Duplicate samples will be obtained by simultaneously filling aliquots of homogenized sample media into two sets of bottle ware: the investigative set and the duplicate set. The duplicate sample will be handled in the same manner as the primary sample, assigned distinct sample identification, and submitted to the laboratory with its primary sample. Duplicate samples will be collected at a rate of 5 percent of the total samples collected for each matrix. Locations selected for the collection of duplicates will be based on professional judgment of the field team leader.
- Matrix spike/matrix spike duplicate (MS/MSD) samples: MS/MSD samples are prepared at the laboratory by dividing a control sample into two aliquots, then spiking each with identical concentrations of specific analytes. The spike samples are then analyzed separately, and the results are compared to evaluate the effects of the sample matrix on the analytical accuracy and precision. At sampling locations where MS/MSD samples are to be collected, a sufficient volume of sampling material, as required by the laboratory will be collected. MS/MSD samples will be labeled and shipped to the laboratory along with the primary sample from which it was collected. MS/MSD samples will be collected at a rate of 5 percent of the total number of samples in each matrix.
- Temperature blank: A temperature blank will be included in each cooler shipped in wet ice. A temperature blank is a vial of water shipped with samples and is used by the laboratory to measure the temperature of the cooler upon receipt at the laboratory. The temperature blank is not analyzed.

3.3.4 Analytical Data Validation

Data quality and usability depend on many factors, including sampling method, sample preparation, analytical method, quality control, and documentation. Data quality will be evaluated through validation procedures that assess the accuracy, precision, representativeness, completeness, comparability (method compliance) and sensitivity of the sediment sample data to determine if it is adequate for its intended use. Data will be validated in accordance with the Quality Assurance Project Plan (QAPP; URS, 2010). See **Table 2** for updated analytical requirements, laboratory reporting limits, and analytical methods. Upon completion of the validation effort, a report will be submitted covering the overall assessment of the data quality. The report will include:

- A general assessment of the data package as it pertains to completeness and compliance.

- Descriptions of any deviations from the required protocol.
- As assessment of outliers and the effect of outliers on overall usability of the data; and
- Identification of applicable data qualifiers.

3.3.5 Project Documentation

All information pertinent to the investigation will be recorded in a bound field logbook and/or field data sheets. Field logbooks will serve as a daily record of events, observations, and measurements during field activities. The logbooks are bound with pages numbered sequentially. Entries will include the following, as applicable:

- Project name and number
- Sampler's and field personnel names
- Date and time of entry and exit
- Location of sampling activity
- Observations at the sampling site such as weather conditions
- Date and time of sample collection
- Sample identification number, location, volume, and depth
- Sampling method
- Sampling media
- Sample type (grab or composite)
- Sample physical characteristics
- Sample method of preservation
- Field measurements
- Laboratory analyses requested
- Summary of daily tasks and information concerning sampling changes and scheduling modifications dictated by field conditions

Field investigation situations vary widely. No general rules can include every type of information that must be entered in a logbook or data sheet for a particular site.

Laboratory and field data sheets will be included as an appendix to the sediment delineation sampling report. Site-specific recording will include sufficient information so that the sampling activity can be reconstructed without relying on the memory of field personnel. At the completion of the field activities, the logbooks will be maintained in the central project file.

3.4 Project Health and Safety Planning

Field activities will be conducted in accordance with the *Health and Safety Plan (HASP) Hercules, Inc. Site #356001* (EHS Support, 2021). A review of the proposed field investigation activities will be completed prior to the start of field sampling activities. Field activities will be conducted in accordance with the HASP and any addenda that are approved for the Site at the time of sampling.

A Project Safety Analysis (PSA) will be performed by the project manager prior to field mobilization to ensure that predictable hazards are identified and addressed before work begins. A PSA form will be completed by the project manager and sent to the field team prior to start of work. The project manager will hold a health and safety kickoff meeting with the field team before field mobilization to review the PSA form together and address any questions.

Once the field team mobilizes to the Site, a daily tailgate meeting will be held at the start of each field day. The field team leader will discuss work being performed that day, the potential hazards associated with those tasks, and how the field team will mitigate those hazards. The field team leader will also address any changes to methodology, based on observations from the previous day, to reduce potential hazards.

4 Data Analysis and Reporting

Section 4.1 through **Section 4.3** present data analysis and reporting objectives, the data analysis approach, and proposed reporting for the floodplain soil investigation.

4.1 Objectives

Analytical results will be evaluated based on the investigation objectives described in **Section 1.1**:

- Characterize the nature and extent of target metal concentrations in surface soils within the Plantasie Creek floodplain downstream of the Site that may be regularly inundated by overbank flow.
- Evaluate the horizontal and vertical distribution of target metal concentrations in surface floodplain soils to assess overbank transport and deposition as a potential migration pathway. The distribution of target metals will be evaluated to identify potential concentration gradients, if observed, that may be indicative of overbank transport and deposition:
    - Longitudinal concentration gradients from source areas
    - Lateral concentration gradients from the channel into the floodplain
    - Vertical concentration gradients from surficial to deeper sampling intervals.
- Evaluate soil characteristics potentially affecting metal mobility and bioavailability (e.g., pH, TOC).
- Assess potential human health and ecological exposure to target metal concentrations in surface floodplain soils based on comparisons to relevant NYSDEC SCOs (NYSDEC, 2006a and b), and if warranted, provide recommendations for site-specific evaluations of potential human health or ecological exposure.

Results of the floodplain analyses will be used to provide a preliminary assessment of human health and ecological exposure to target metals in surface soils on the Plantasie Creek floodplain.

4.2 Data Analyses

Following the receipt of the laboratory analytical data for the target metals and subsequent data validation, the soil analytical data will be evaluated for the above objectives.

Soil results will be posted on figures to illustrate the nature and extent of target metals in surface soils within the Plantasie Creek floodplain downstream of the Site. The evaluation of spatial patterns in target metal concentrations will be presented graphically to assess longitudinal gradients from potential source areas and potential lateral gradients from the channel to the extent of floodplain soil sampling. In additional, vertical concentration gradients within the soil column at each sampling station will be evaluated graphically.

Potential relations between target metal concentrations and soil characteristics potentially influencing the spatial distribution or bioavailability of metals (e.g., pH, TOC, grain size distribution) will be evaluated graphically. If supported by the available data, statistical analyses, including regression analyses, may also be used to describe potential relations between target metal concentrations and soil characteristics potentially influencing the spatial distribution or bioavailability of metals.

To support preliminary risk characterization, soil target metal concentrations will be tabulated and initially compared to the NYSDEC human health and ecological SCOs (NYSDEC, 2006a and b), as summarized in **Table 3** for target metals.

- Human Health: NYSDEC SCOs for Unrestricted Use and Restricted Use.
- Ecological: NYSDEC SCOs for the Protection of Ecological Resources
- Background: Ecological SCOs below background concentrations estimated using remote or habitat samples collected in the *Statewide Rural Surface Soil Survey* (NYSDEC, 2005) have been adjusted to the background levels as presented in the *Technical Support Document* (NYSDEC, 2006b).

Soil analytical data may also be directly compared to background concentrations of target metals (NYSDEC, 2005).

Target metal results exceeding SCOs will be posted on figures to illustrate the nature and extent of target metals exceedances in surface soils within the Plantasie Creek floodplain. Target metal concentrations exceeding SCOs at the extent of the sampling within the floodplain, laterally into the floodplain from the channel and longitudinally within the sampling extent, will be identified to assess the characterization of nature and extent of SCO exceedances in floodplain soils within the study area.

As discussed in NYSDEC *Soil Cleanup Guidance* (CP-51), SCOs will be used as a screening tool to identify the extent of soil contamination. However, the exceedance of one or more applicable SCOs alone will not trigger the need for remediation or identify unacceptable concentrations of target metals. Consistent with Approach 4 presented in the *Soil Cleanup Guidance* (CP-51), Site-specific SCOs protective of public health and the environment may be developed for target metals, as warranted, to reflect exposure scenarios expected for floodplain soils. Review of the derivation of the existing SCOs indicated instances where conservative factors were incorporated that may not be representative of likely exposure scenarios in this environmental setting:

- The toxicity reference dose applied in the calculation of human health SCOs for copper [270 milligrams per kilogram (mg/kg)] is based on an acute toxicity exposure scenario in a study that was unable to identify a point-of-departure (corresponding to an estimated low-level effect or no effect), which suggests the SCO may be lower than a SCO derived using a chronic toxicity reference dose.
- For ecological endpoints, Site-specific cleanup values may be developed based on an evaluation of updated toxicity endpoints and model calculations to identify soil concentrations protective of direct contact toxicity and wildlife ingestion exposure pathways. Existing ecological SCOs for copper (50 mg/kg) and zinc (50 mg/kg) are below Ecological Soil Screening Level (Eco-SSL) benchmark concentrations that are intended for screening purposes and not for the establishment of SCOs. As stated in the *Technical Approach Document*, NYSDEC has determined that ecological SCOs should be based on a low level of overall risk rather than a no-risk level. Therefore, the approach for deriving Site-specific cleanup values will be consistent with the framework established in the *Technical Support Document* using updated toxicity data and incorporating metal bioavailability, as applicable, from literature sources.

Summary statistics will be prepared for target metal concentrations, which will include minimum concentration, maximum concentration, mean concentration, detection frequency, and frequency of exceedance of ecological or human health SCOs.

4.3 Reporting

As stated in **Section 3.1**, the results of the initial nature and extent characterization will be presented to NYSDEC and recommendations regarding the need for further soil sampling within the floodplain downstream of Transect 10 will be provided based on comparisons of target metal concentrations to NYSDEC SCOs for Unrestricted and Residential Use for the protection of human health and NYSDEC SCOs for the Protection of Ecological Resources (See **Section 4.0** for further discussion). As stated in **Section 4.0**, comparisons to SCOs will also consider representative background concentrations for target metals in soils. Consultation with NYSDEC will be initiated immediately upon review of the initial floodplain soil data, and if additional downstream sampling is warranted, an effort will be made to complete the additional sampling within the same sampling season, as permitted by field conditions at the time of the consultation.

Upon completion of the floodplain soil investigation, a Plantasie Creek Floodplain Soil Investigation Report ("Report") will be prepared and submitted to NYSDEC for review and approval. The Report will incorporate the analytical data from samples collected pursuant to this Work Plan. The results of data analyses presented in **Section 4.2** will be used to support a refined ECSM for the target metals on the Plantasie Creek floodplain within the study area. The refined ECSM will evaluate potential overbank transport and deposition as a potential migration pathway from the Site to floodplain soils. The refined ECSM will also evaluate potentially complete exposure pathways to floodplain soils to support a preliminary evaluation of human health and ecological risk to target metals. The refined ECSM and preliminary risk evaluation will be used to present recommendations for the path forward for the investigation of target metals in soils within the Plantasie Creek floodplain downstream of the Site.

5 Work Plan Implementation

Section 5.1 through **Section 5.3** provide information on key contacts for the project, access agreements, and investigation schedule.

5.1 Project Organization

This Work Plan will be implemented for the Parties by EHS Support, an environmental contractor ("Contractor"), who will arrange for field investigation and analytical services and provide an on-site field representative(s) to oversee all subcontractors under the direction of the NYSDEC. EHS Support will also perform the data interpretation and reporting tasks. Key contacts for this project are as follows:

Hercules Project Manager
Edward Meeks
Ashland LLC
Ashland Research Center
500 Hercules Road
Wilmington, DE 19808-1599
Telephone: (302) 955-3433
Email: edmeeks@ashland.com

Dyno Nobel Project Managers
Fred Jardinico
Dyno Nobel, Inc.
660 Hopmeadow Street
Simsbury, CT 06070
Telephone: (860) 408-1812
Email: fred.jardinico@am.dynonobel.com

Kathleen Blessing
Dyno Nobel, Inc.
660 Hopmeadow Street
Simsbury, CT 06070
Telephone: (860)408-1845
Email: kathleen.blessing@am.dynonobel.com

Contractor Client/Technical Manager
Andrew Patz, CHMM
EHS Support LLC
Telephone: (412) 215-7703
Email: andy.patz@ehs-support.com

Contractor Project Director/Project Engineer
Kristin A. VanLandingham, P.E.
EHS Support LLC
Telephone: (850) 251-0582
Email: k.vanlandingham@ehs-support.com

5.2 Access Agreements

EHS Support will use its best efforts to obtain access agreements from the present owners. Once a property has been identified, county tax records will be reviewed to determine the current ownership and contact information. EHS Support will reach out the owners by mailing letters to request access, by reaching out in-person, or by other methods. If access agreements are unable to be obtained, EHS

Support will notify NYSDEC. NYSDEC may need to assist in reaching out to the owners to obtain the access approval.

5.3 Investigation Schedule

Within 30 days of the NYSDEC approval of the final Work Plan, the Parties will develop project schedule, in cooperation with the NYSDEC project manager, for submittal to NYSDEC. This schedule will become part of the approved Work Plan. The Parties and their technical consultants will establish routine communication with the NYSDEC technical staff to assist resolving any issues that may delay the schedule. The Parties cannot be held responsible for any delays due to inclement weather, COVID-19 travel restrictions, NYSDEC review and approval time, applicable citizen participation requirements, or any other delays outside of the Parties' control.

Implementation of the schedule is contingent upon securing access agreements as discussed in preceding section.

6 References

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Tables

Table 1
Summary of Soil Sampling Objectives
Plantasie Creek Floodplain Soil Investigation Work Plan
Dyno Nobel Port Ewen Site
Port Ewen, NY

<table>
<tr><th rowspan="2">Floodplain Soil Sampling Interval</th><th rowspan="2">Specific Data Objectives</th><th colspan="2">Requested Laboratory Analyses</th></tr>
<tr><th>Primary</th><th>Ancillary</th></tr>
<tr><td>0 - 6-inches</td><td>1) Evaluate SCOs protective of human health incidental soil ingestion, inhalation of soil, or dermal contact with soil.
2) Provide representative concentrations to 0 - 12-inches bgs to evaluate ecological exposure. A depth-weighted average of sample results from the 0–6-inch and 6–12-inch sampling interval will be calculated to establish soil EPCs for ecological exposure pathways in the floodplain.
3) Evaluate the vertical distribution of target metals in soils with the conceptual overbank transport and surface deposition pathway.</td><td>Copper
Mercury
Selenium
Zinc</td><td rowspan="2">pH
TOC
Grain Size</td></tr>
<tr><td>6 - 12-inches</td><td>1) Provide representative concentrations to 0 - 12-inches bgs to evaluate ecological exposure. A depth-weighted average of sample results from the 0–6-inch and 6–12-inch sampling interval will be calculated to establish soil EPCs for ecological exposure pathways in the floodplain.
2) Evaluate the vertical distribution of target metals in soils with the conceptual overbank transport and surface deposition pathway.</td><td>Copper
Mercury
Selenium
Zinc</td></tr>
<tr><td>12 - 24-inches</td><td>1) Characterization of target metal concentrations below exposure intervals recommmended by DER-10.
2) Evaluate the vertical distribution of target metals in soils with the conceptual overbank transport and surface deposition pathway.</td><td>Copper
Mercury
Selenium
Zinc</td><td>NA</td></tr>
</table>

Notes:
bgs = below ground surface
EPC = exposure point concentration
SCO = Soil Cleanup Objectives
TOC = Total Organic Carbon

Table 2
Summary of Analytical Methods and Sample Handling Requirements
Plantasie Creek Floodplain Soil Investigation Work Plan
Dyno Nobel Port Ewen Site
Port Ewen, NY

Analysis	Method Reference	Units	RL	MDL	Minimum SCO	Minimum Sample Volume Requirement	Hold Time	Sample Container	Preservation
Target Metals									
Mercury	USEPA 7471B	mg/kg	0.0165	0.0106	0.18	100 gram	365 days	Glass or plastic	Cool to 4°C
Copper	USEPA 6020B	mg/kg	0.1	0.057	50	100 gram	180 days	Glass or plastic	Cool to 4°C
Selenium	USEPA 6020B	mg/kg	0.25	0.061	3.9				
Zinc	USEPA 6020B	mg/kg	0.25	0.167	109				
pH	USEPA 9045D	Standard Units	NA	NA	NA	20 gram	7 days	Glass or plastic	Cool to 4°C
Grain size distribution	ASTM D422 (Sieve Only)	% Passing	0.5	0.5	NA	500 gram	NA	Glass or plastic	NA
TOC	Lloyd Kahn	mg/kg	1000	746	NA	100 gram	14 days	Glass or plastic	Cool to 4°C

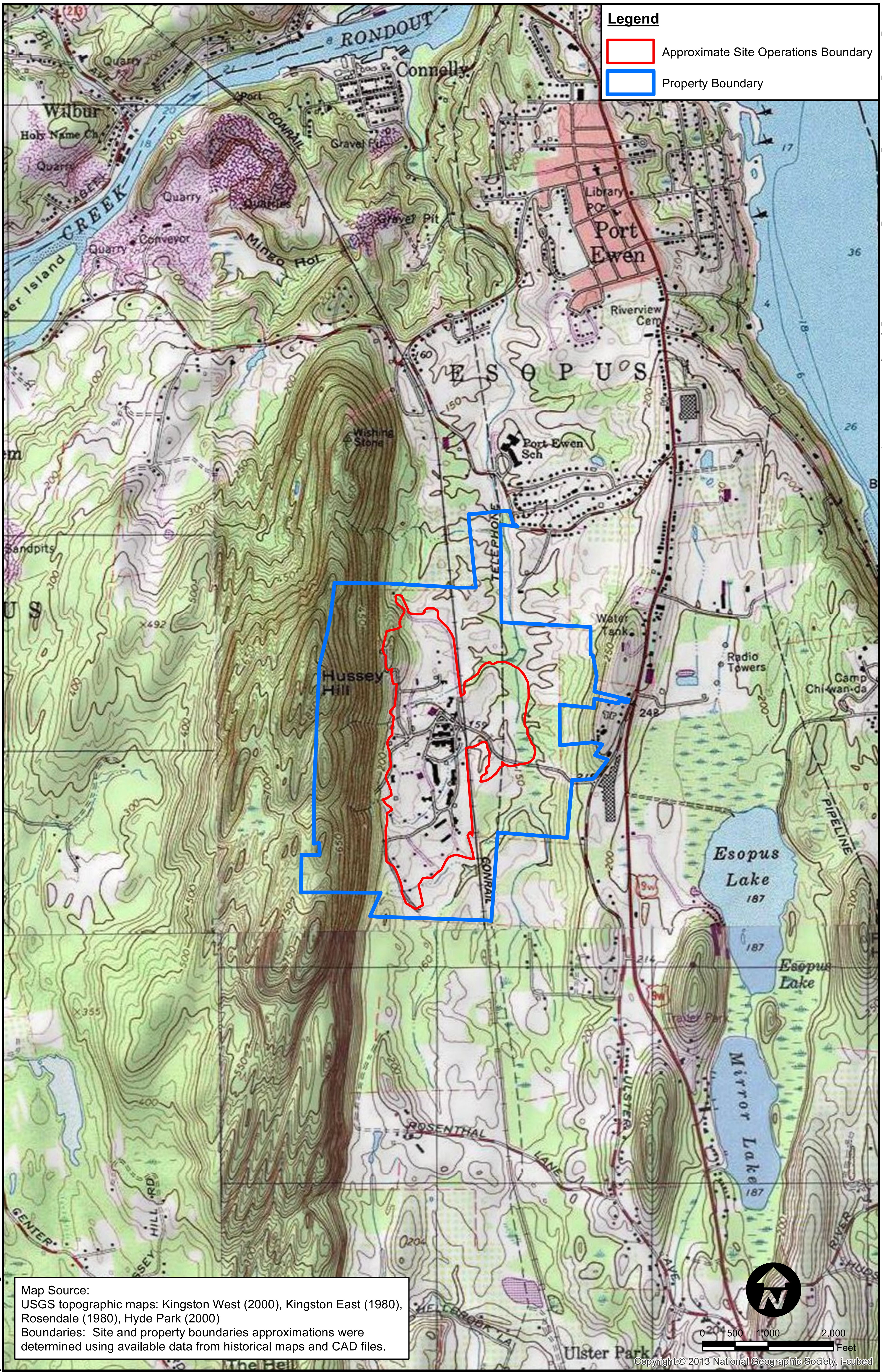
Notes:
% = percent
MDL = Method Detection Limit
mg/kg = milligrams per kilogram
°C = degrees Celsius
RL = Reporting Limit
SCO = Soil Cleanup Objective
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

Table 3
Summary of Soil Cleanup Objectives
Plantasie Creek Floodplain Soil Investigation Work Plan
Dyno Nobel Port Ewen Site
Port Ewen, NY

Analyte	Human Health SCOs		ESCOs (mg/kg)	RSBCs (mg/kg)
	Unrestricted Soil Use SCOs (mg/kg)	Restricted Use SCOs (mg/kg)		
Copper	270	270	50	33
Mercury	0.12	1.2	0.1	0.18
Selenium	18	36	1	3.9
Zinc	1100	2200	50	109

Notes:
SCOs = Soil Cleanup Objectives
ESCOs = Ecological Soil Cleanup Objectives
RSBCs = Rural Soil Background Concentrations
mg/kg = milligrams per kilogram
Source: NYSDEC (2006) New York State Brownfield Cleanup Program Development of Soil Cleanup Objectives Technical Support Document

Figures



Reviewed By: K. VanLandingham

EHS Support

HERCULES INC. SITE
ULSTER COUNTY, NEW YORK
REGISTRY NO. 356001

SITE LOCATION MAP

FIGURE 1

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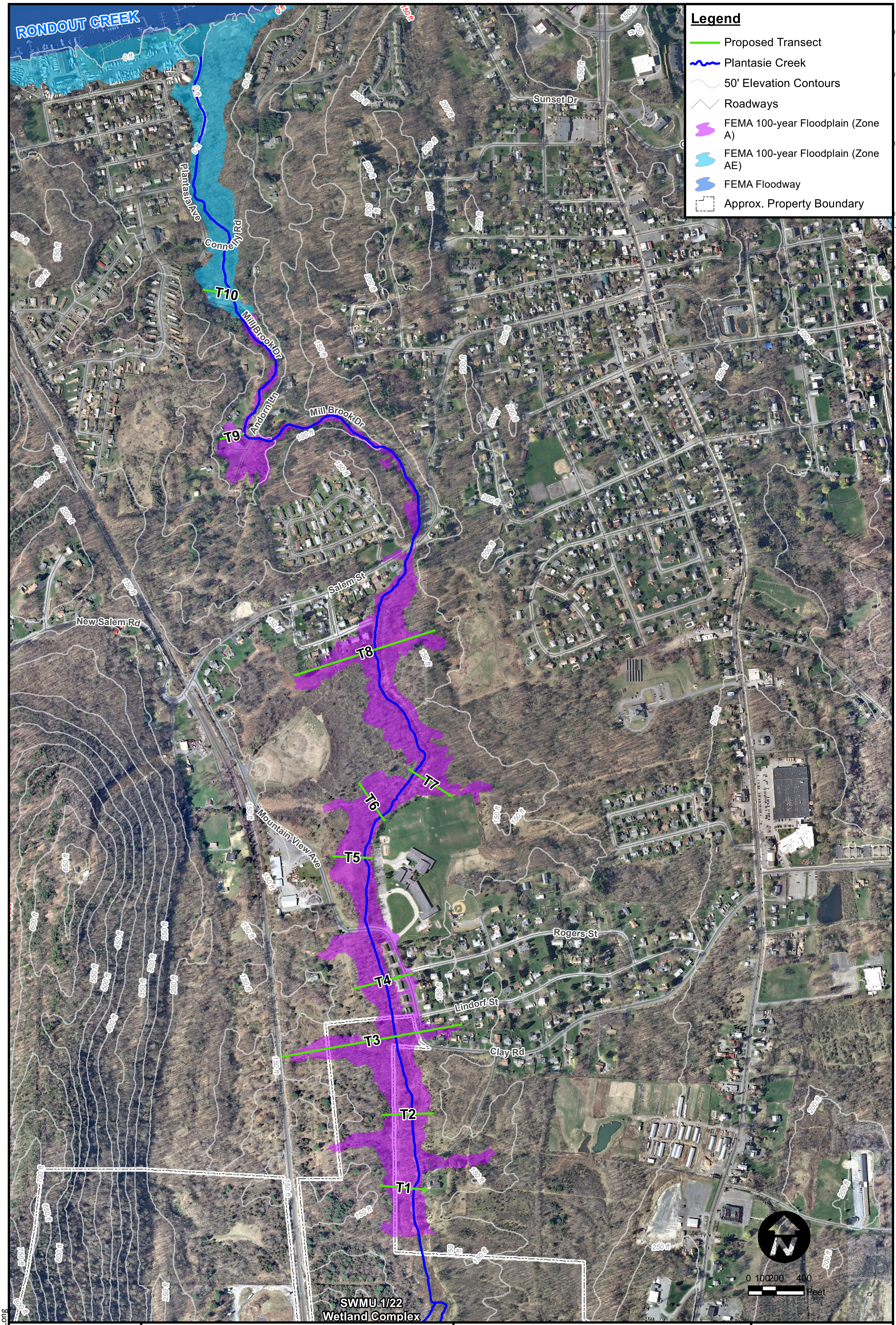

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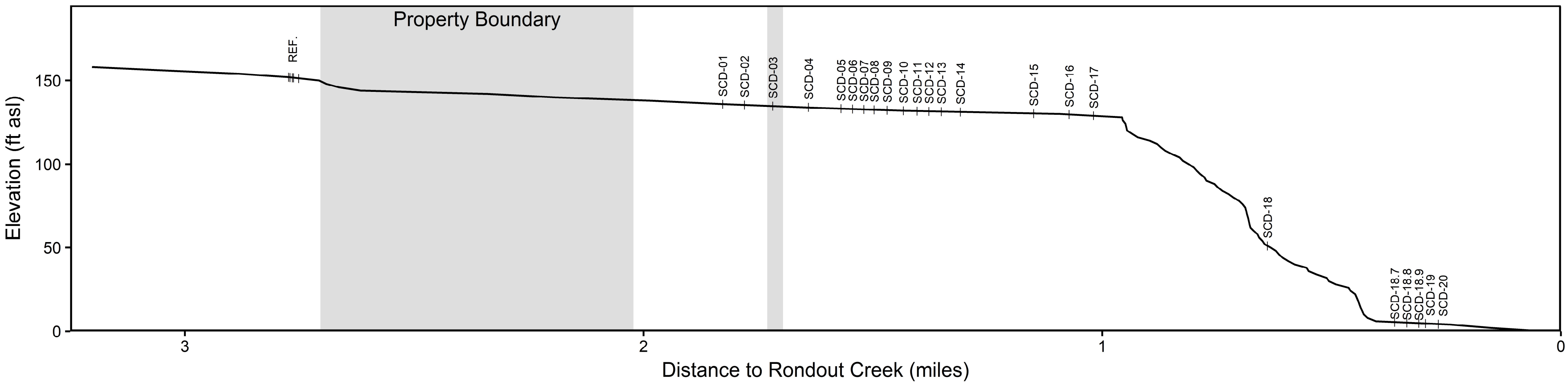
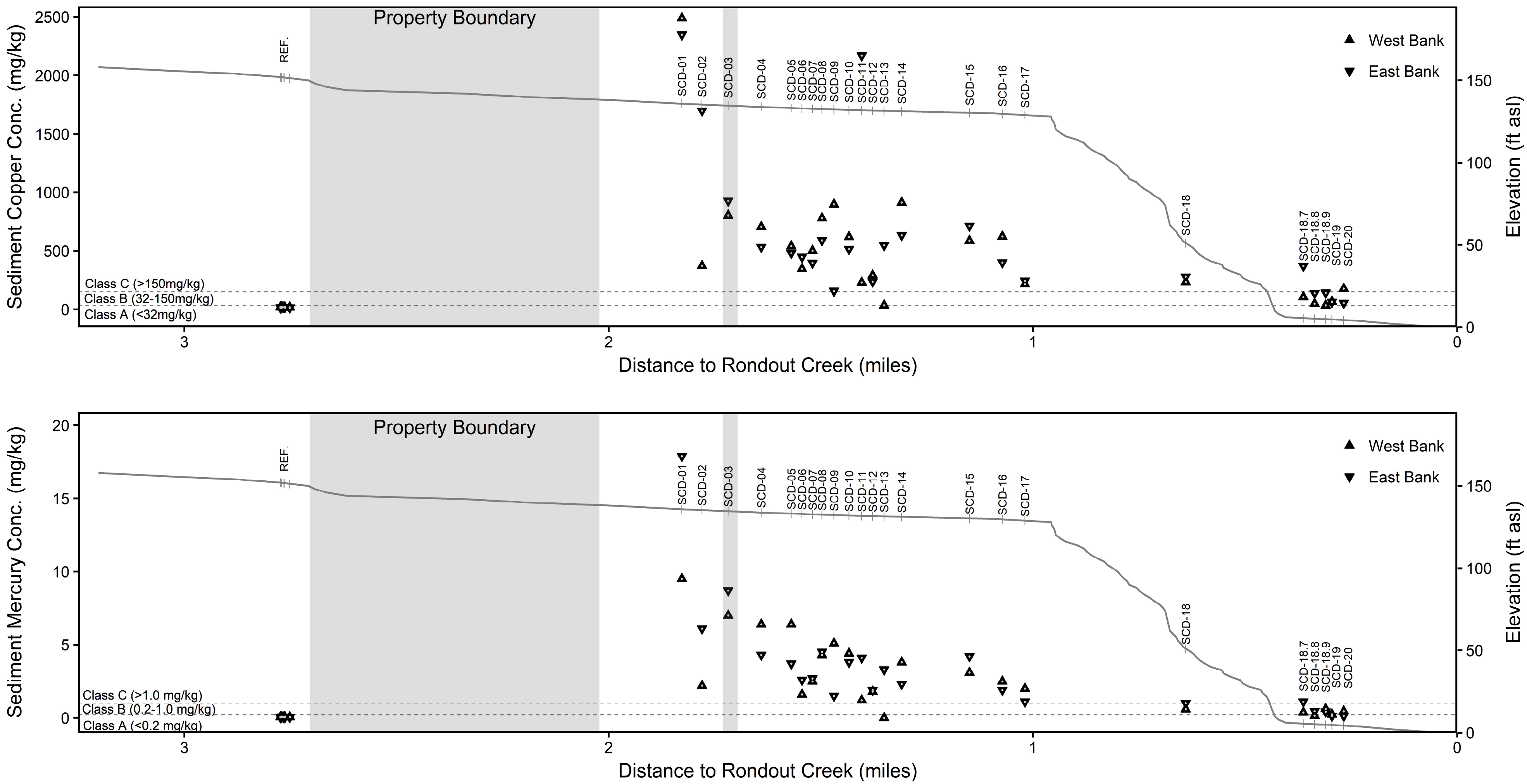
Reviewed By: G. Long

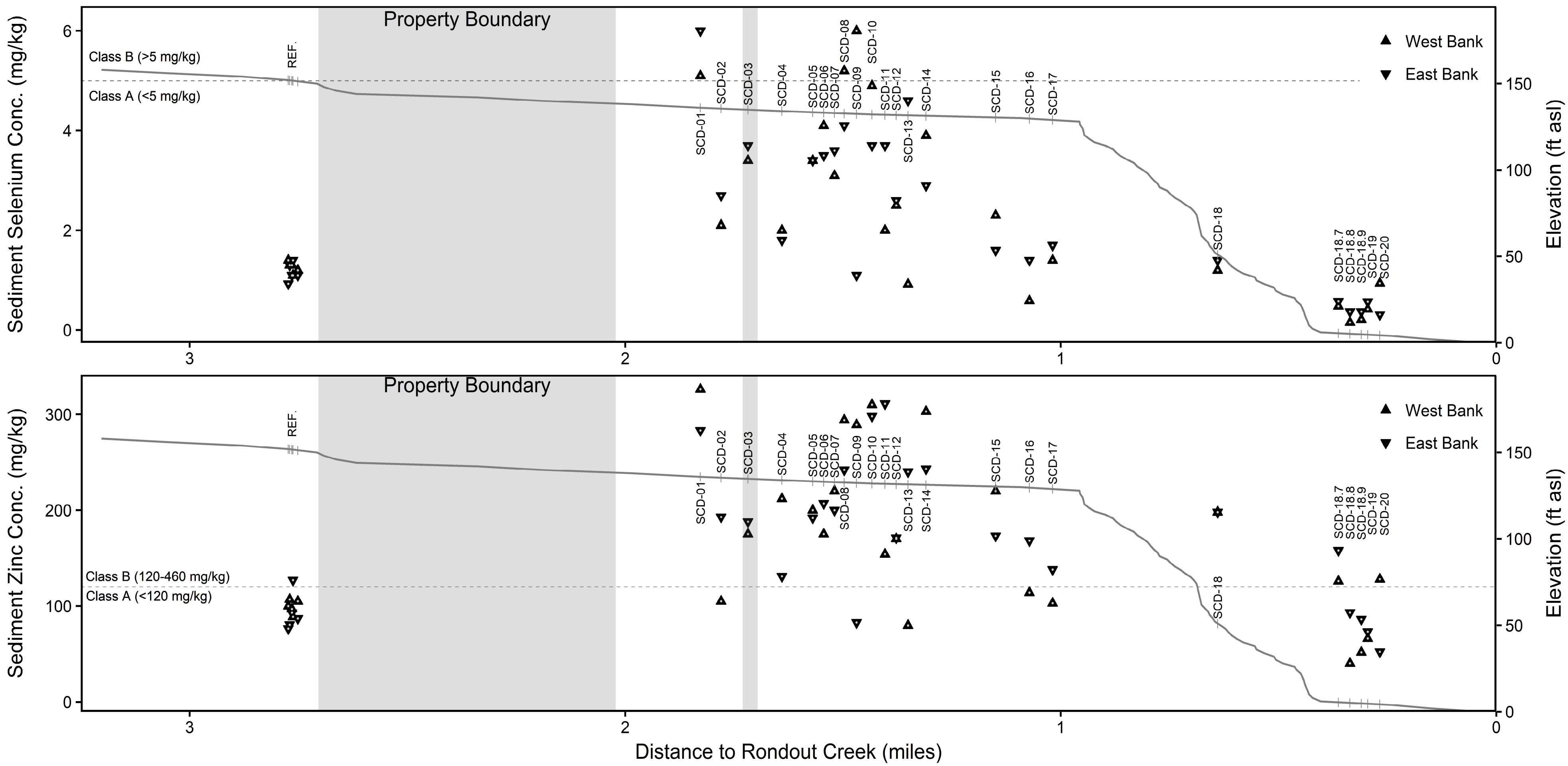
EHS Support	Downstream Sediment Investigation Dyno Nobel Port Ewen Site Port Ewen, New York	Plantasie Creek Floodplain Sampling Off-Site Features Map	FIGURE 2



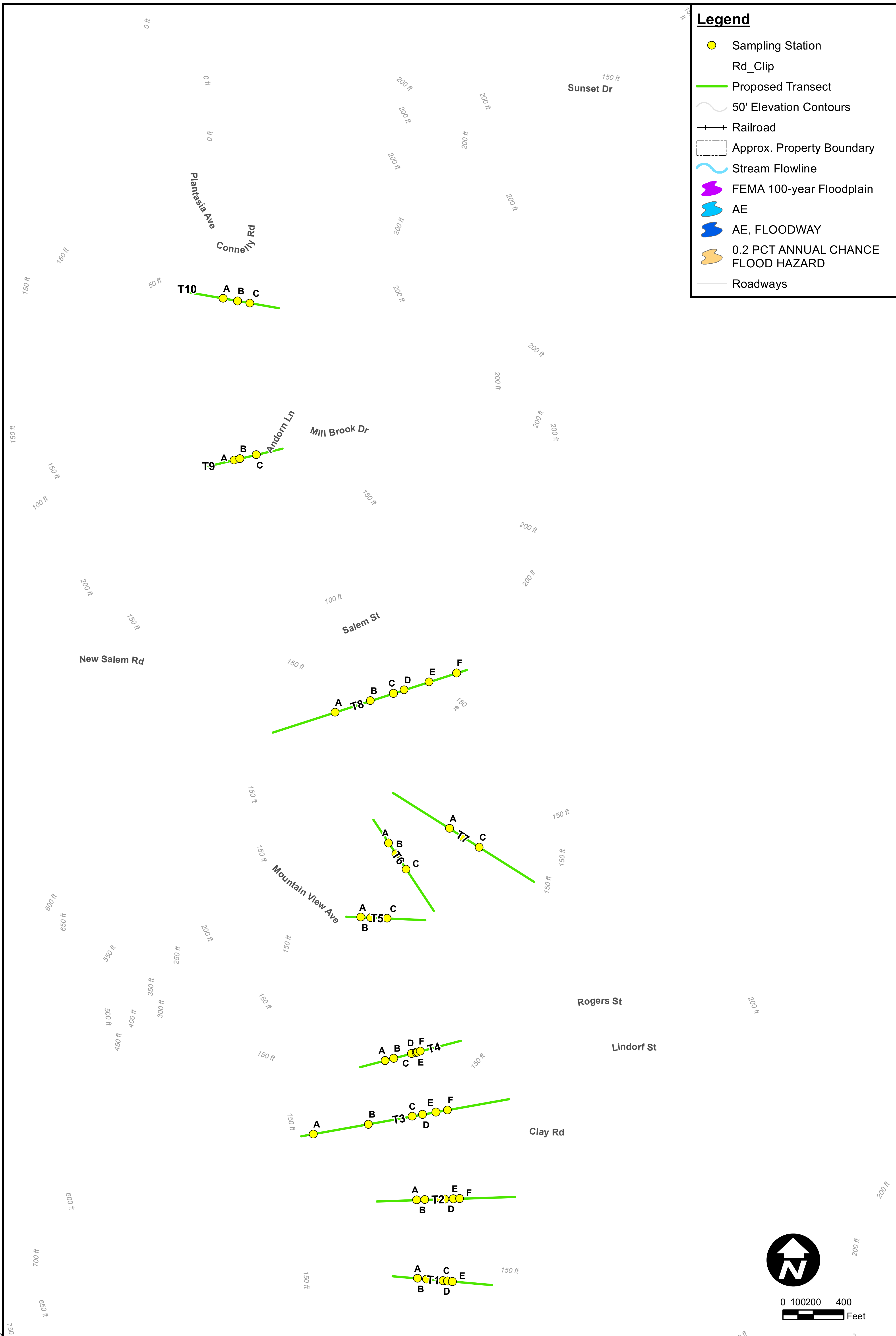
EHS Support	Downstream Sediment Investigation Dyno Nobel Port Ewen Site Port Ewen, New York	**Plantasie Creek Longitudinal Profile**	**FIGURE 3**



EHS Support	Downstream Sediment Investigation Dyno Nobel Port Ewen Site Port Ewen, New York	Longitudinal Profiles – Surface Copper and Mercury Sediment Concentrations and SGV Classes	FIGURE 4A



EHS Support	Downstream Sediment Investigation Dyno Nobel Port Ewen Site Port Ewen, New York	**Longitudinal Profiles – Surface Selenium and Zinc Sediment Concentrations and SGV Classes**	**FIGURE 4B**



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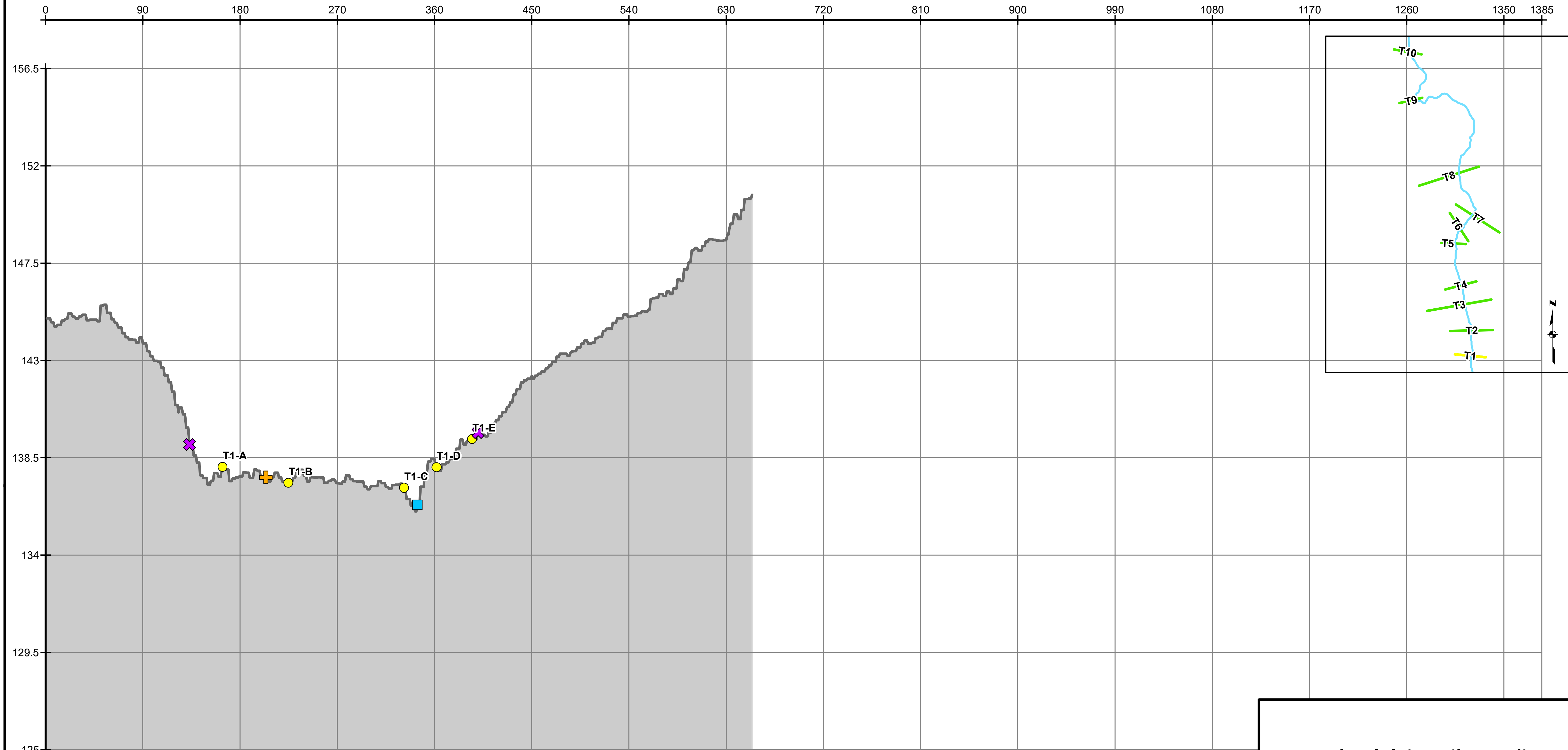
Downstream Sediment Investigation Dyno Nobel Port Ewen Site Port Ewen, New York	Floodplain Soil Sampling Transect Overview	FIGURE 5



Legend

- Sampling Station
- 100y Floodplain Edge
- Parcel Boundary
- Stream Center
- Proposed Transect Elevation

Horizontal Scale
1 inch = 90 feet

Vertical Scale
1 inch = 4.5 feet

Floodplain Soil Sampling
Cross Section - Transect T1

Downstream Sediment Investigation
Dyno Nobel Port Ewen Site
Port Ewen, New York

FIGURE 5A

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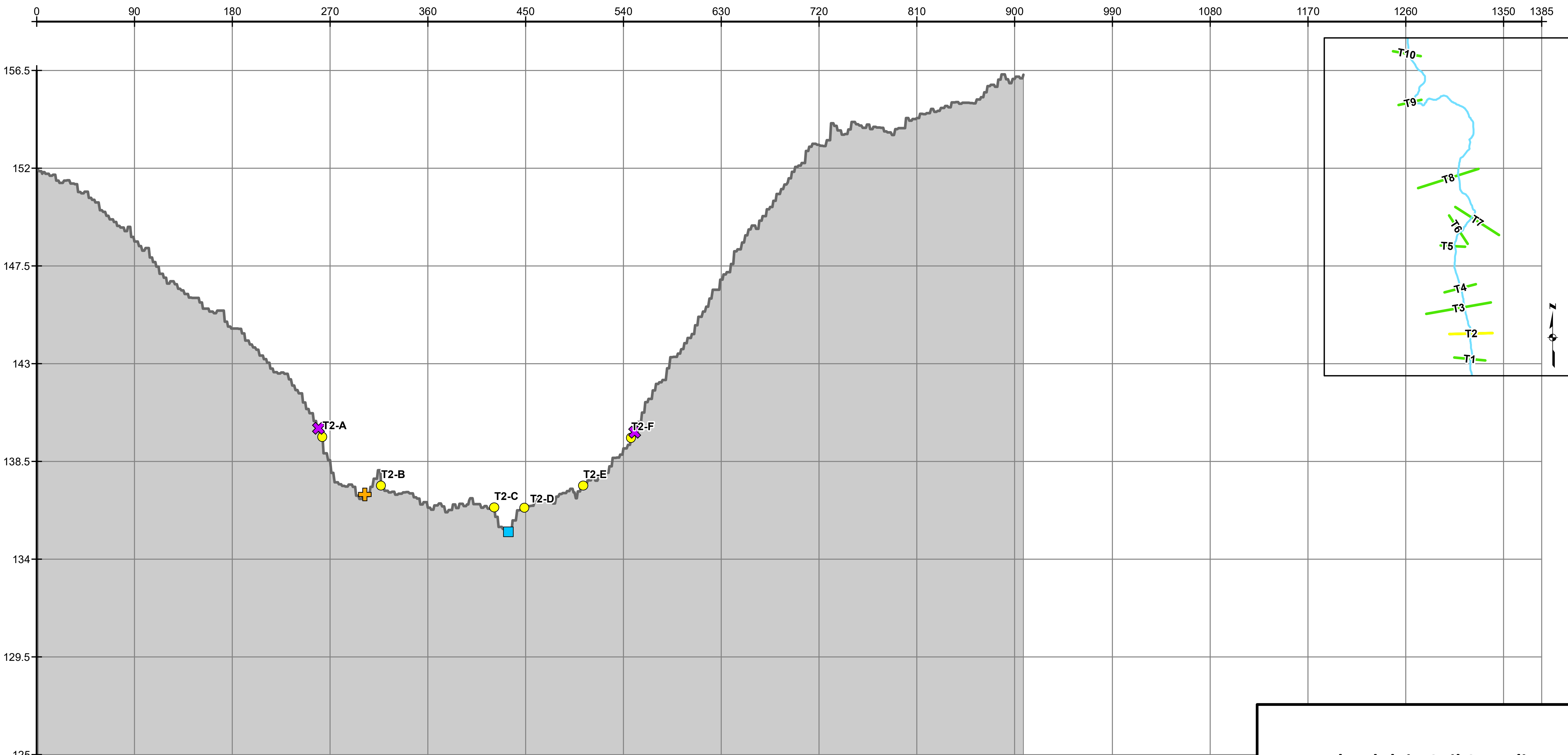

Legend

- Sampling Station
- 100y Floodplain Edge
- Parcel Boundary
- Stream Center
- Proposed Transect Elevation

Horizontal Scale
1 inch = 90 feet

Vertical Scale
1 inch = 4.5 feet

Floodplain Soil Sampling
Cross Section - Transect T2

Downstream Sediment Investigation
Dyno Nobel Port Ewen Site
Port Ewen, New York

FIGURE 5B

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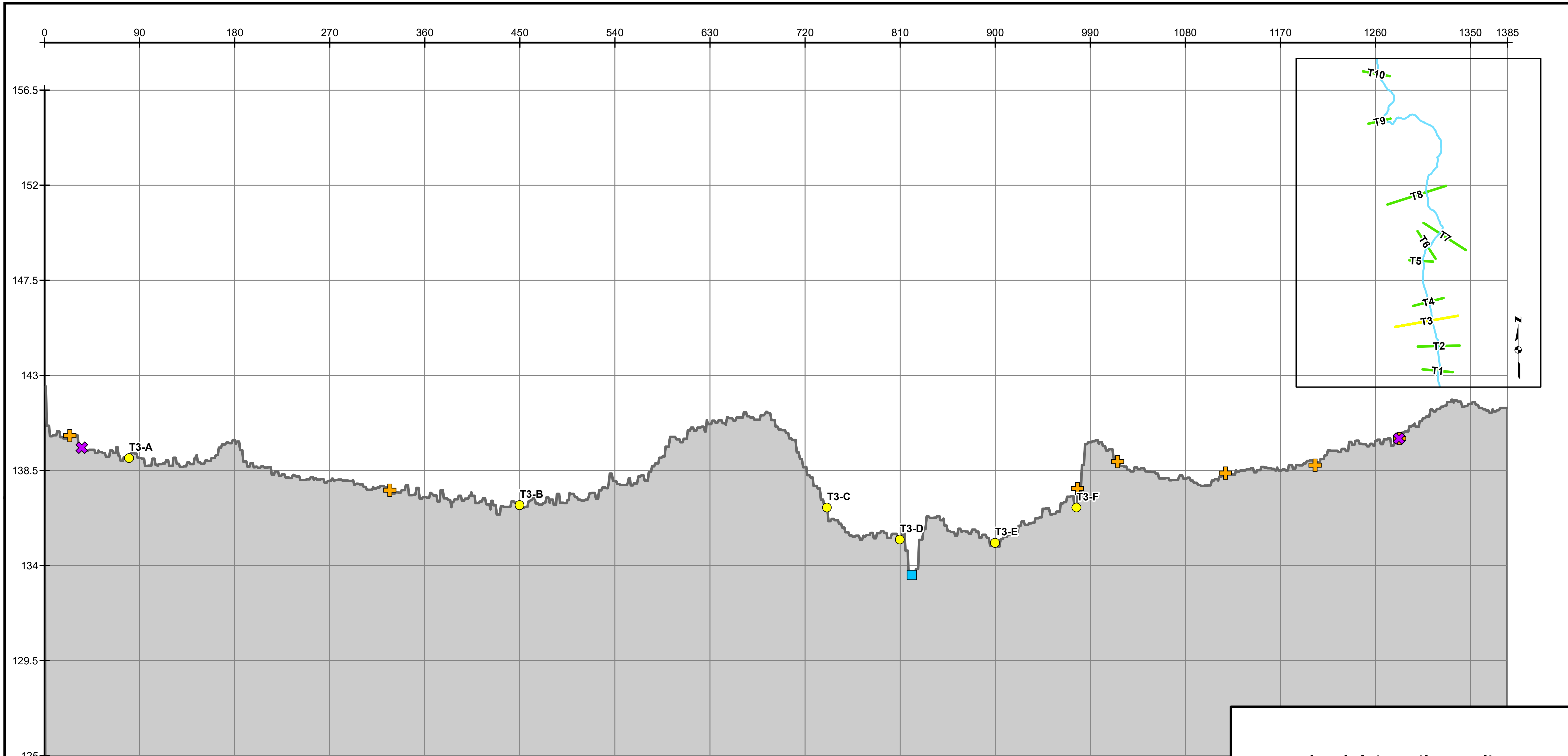

Legend

- Sampling Station
- 100y Floodplain Edge
- Parcel Boundary
- Stream Center
- Proposed Transect Elevation

Horizontal Scale
1 inch = 90 feet

Vertical Scale
1 inch = 4.5 feet

Floodplain Soil Sampling
Cross Section - Transect T3

Downstream Sediment Investigation
Dyno Nobel Port Ewen Site
Port Ewen, New York

FIGURE 5C

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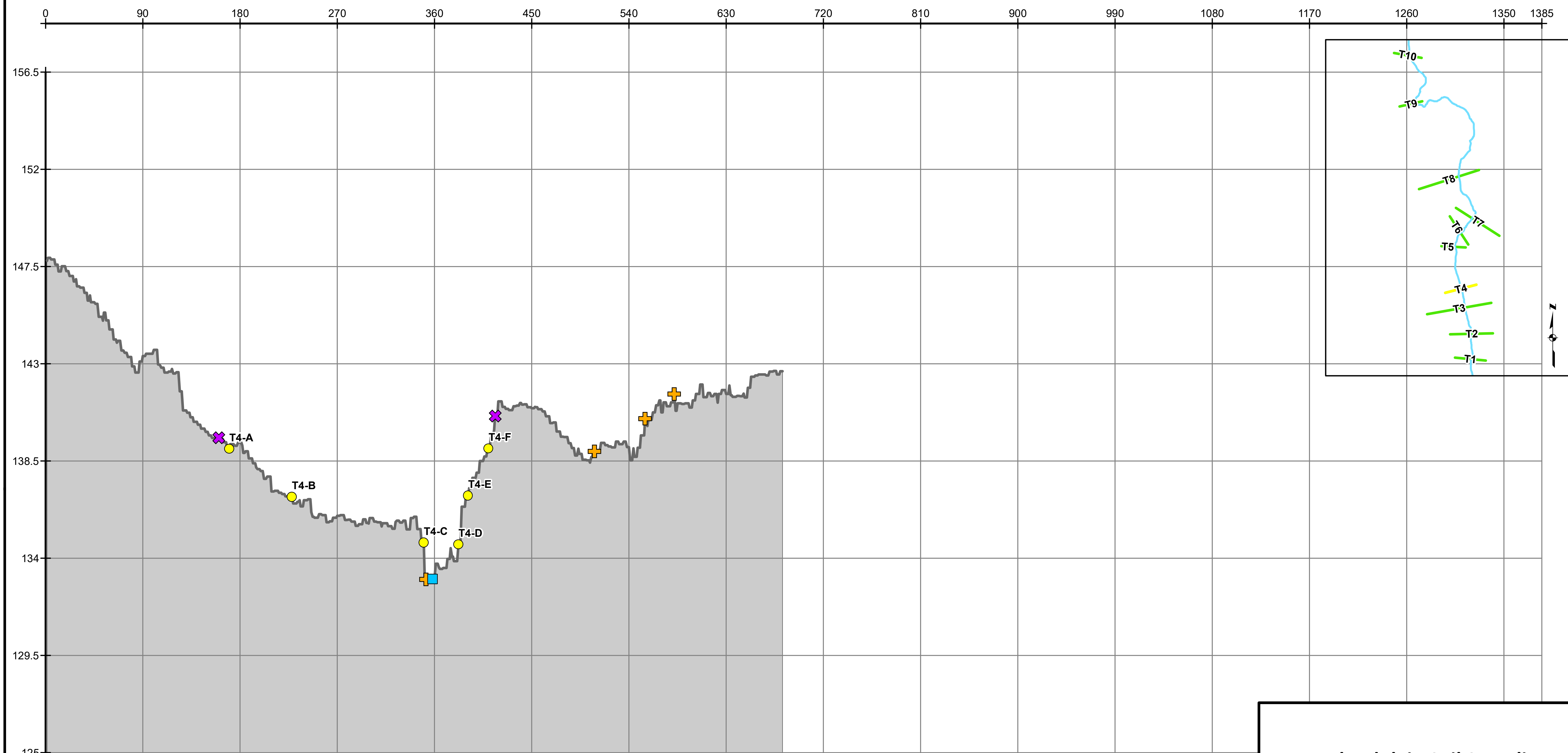

Legend

- Sampling Station
- 100y Floodplain Edge
- Parcel Boundary
- Stream Center
- Proposed Transect Elevation

Horizontal Scale
1 inch = 90 feet

Vertical Scale
1 inch = 4.5 feet

Floodplain Soil Sampling
Cross Section - Transect T4

Downstream Sediment Investigation
Dyno Nobel Port Ewen Site
Port Ewen, New York

FIGURE 5D

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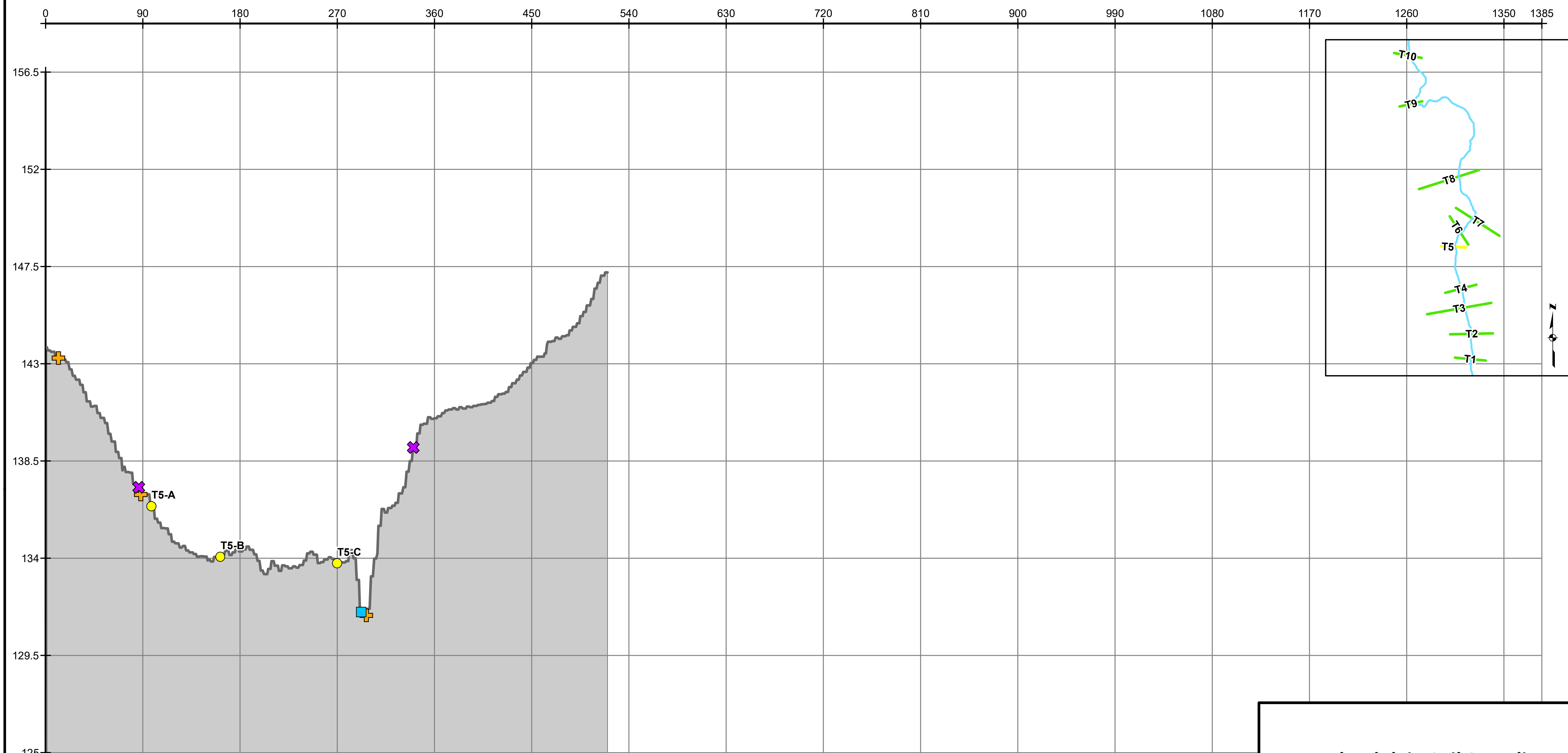

Floodplain Soil Sampling
Cross Section - Transect T5

Downstream Sediment Investigation
Dyno Nobel Port Ewen Site
Port Ewen, New York

FIGURE 5E

Legend

- Sampling Station
- 100y Floodplain Edge
- Parcel Boundary
- Stream Center
- Proposed Transect Elevation

Horizontal Scale
1 inch = 90 feet

Vertical Scale
1 inch = 4.5 feet

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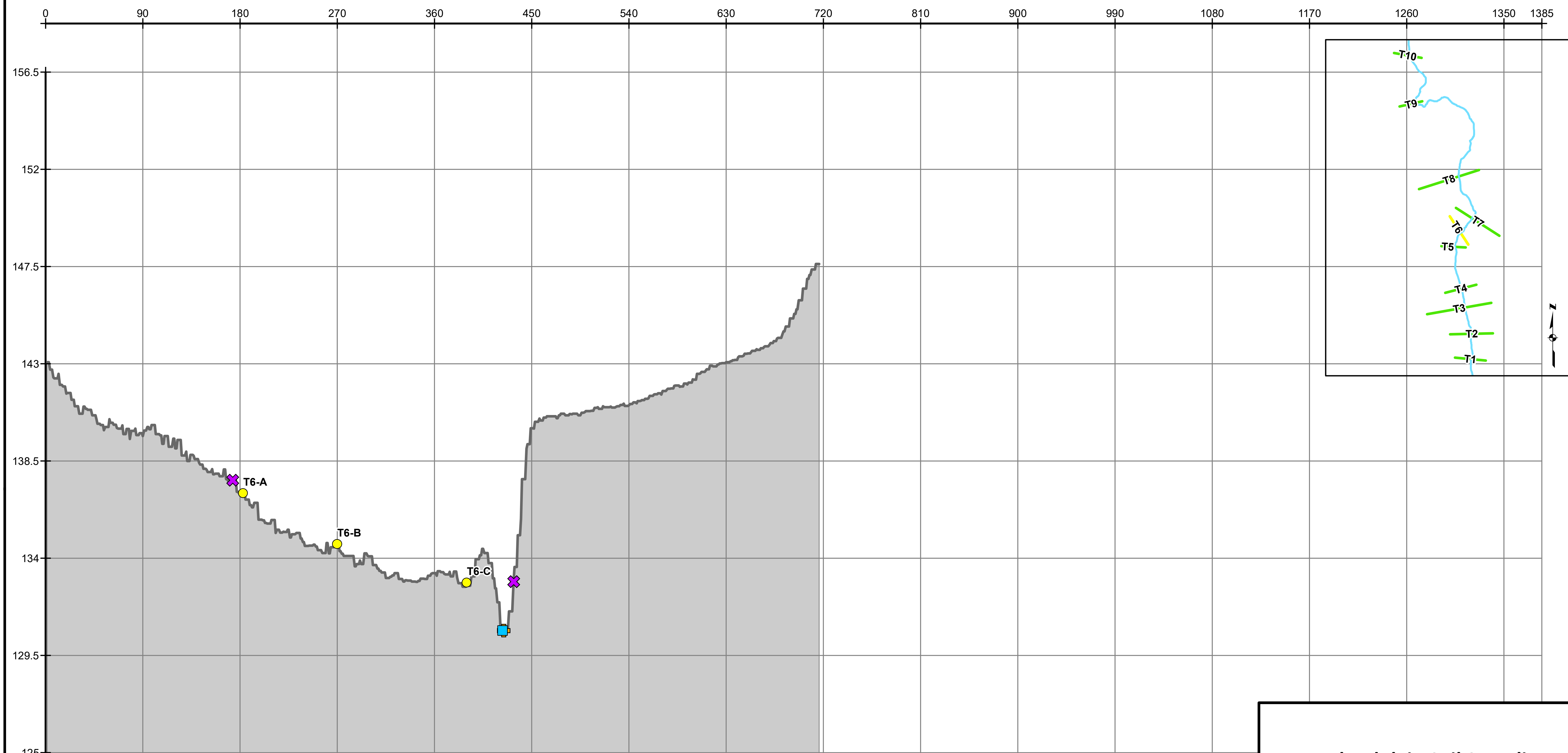


Legend

- Sampling Station
- 100y Floodplain Edge
- Parcel Boundary
- Stream Center
- Proposed Transect Elevation

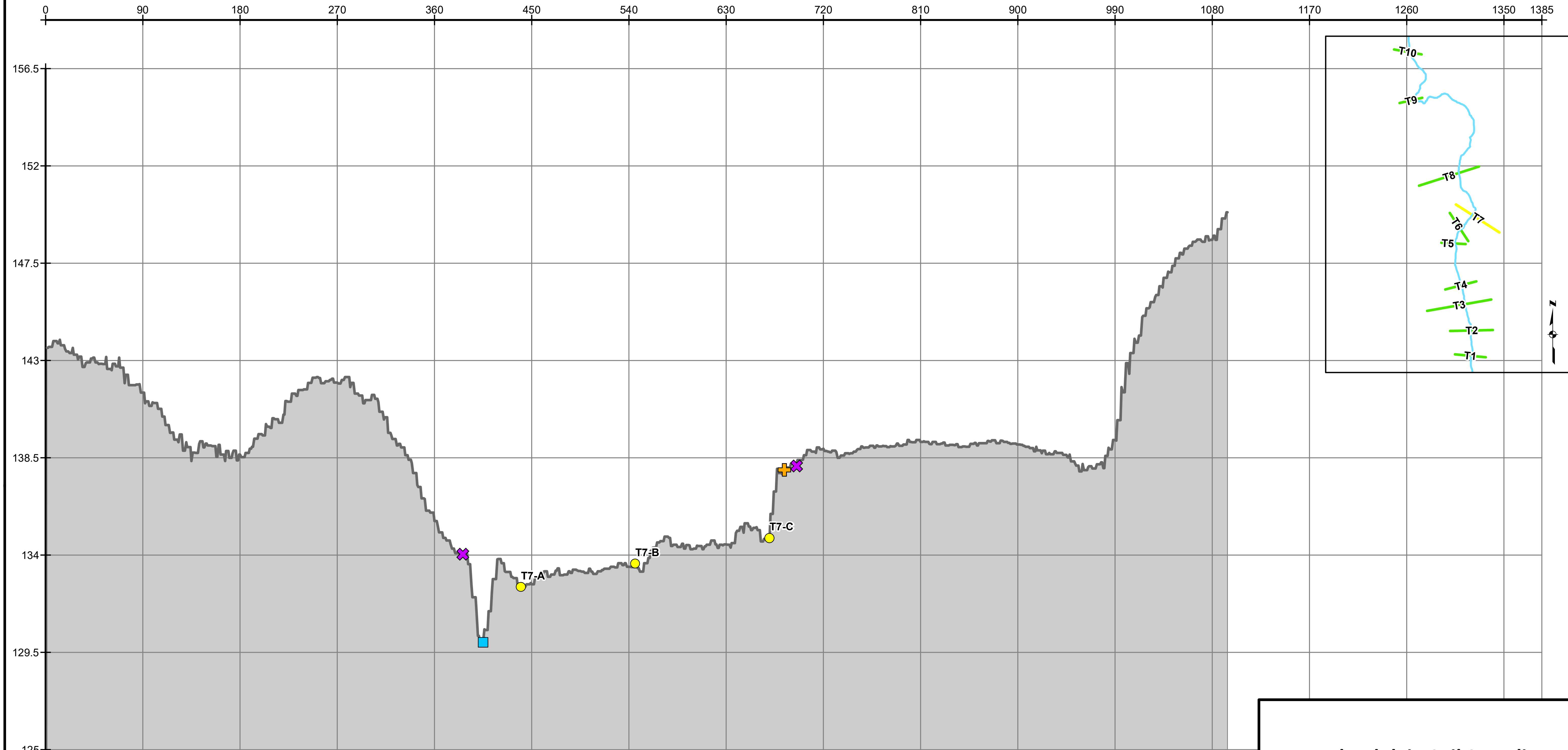
Horizontal Scale
1 inch = 90 feet

Vertical Scale
1 inch = 4.5 feet

Floodplain Soil Sampling
Cross Section - Transect T6

Downstream Sediment Investigation
Dyno Nobel Port Ewen Site
Port Ewen, New York

FIGURE 5F



Legend

- Sampling Station
- 100y Floodplain Edge
- Parcel Boundary
- Stream Center
- Proposed Transect Elevation

Horizontal Scale
1 inch = 90 feet

Vertical Scale
1 inch = 4.5 feet

Floodplain Soil Sampling
Cross Section - Transect T7

Downstream Sediment Investigation
Dyno Nobel Port Ewen Site
Port Ewen, New York

FIGURE 5G

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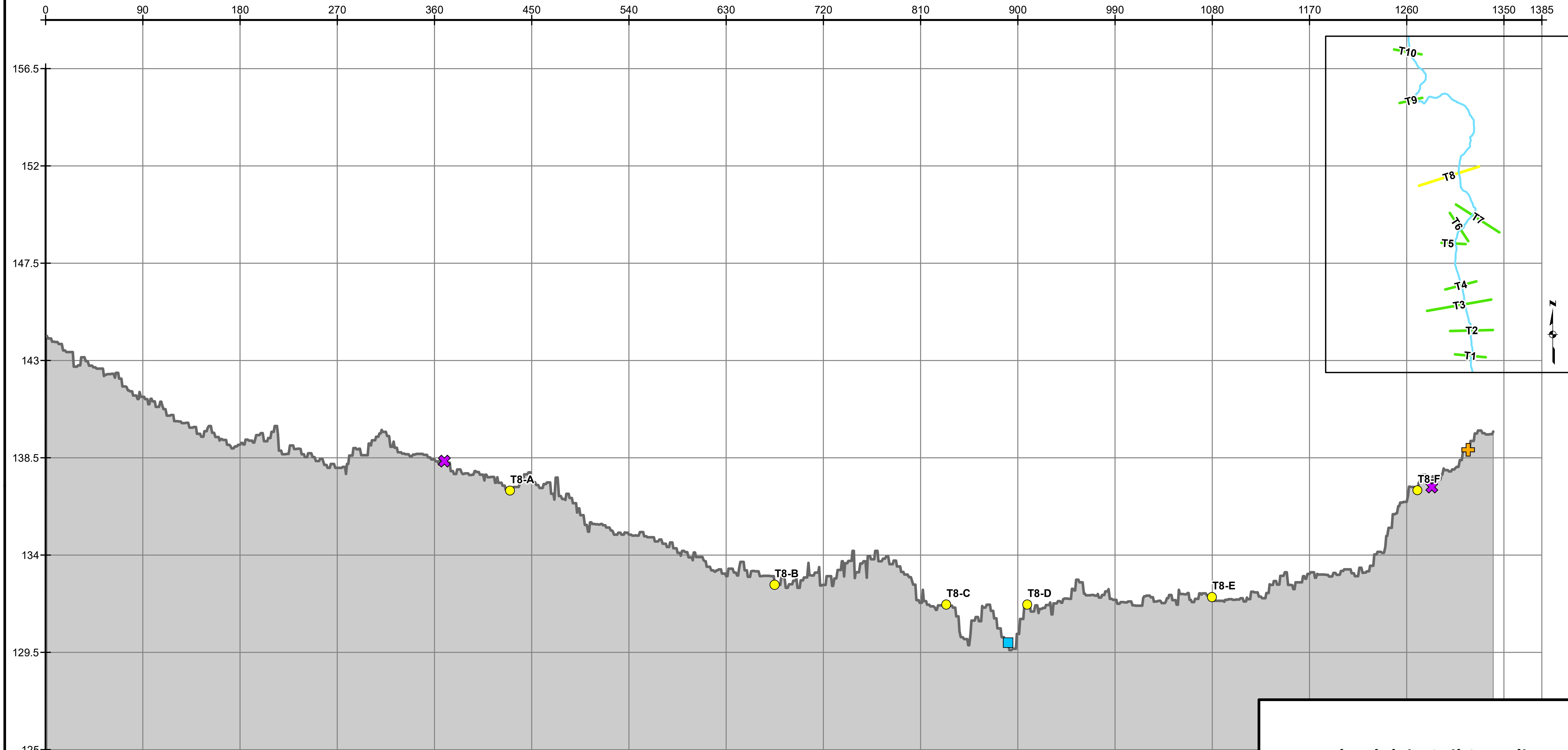

Floodplain Soil Sampling
Cross Section - Transect T8

Downstream Sediment Investigation
Dyno Nobel Port Ewen Site
Port Ewen, New York

FIGURE 5H

Legend

- Sampling Station
- 100y Floodplain Edge
- Parcel Boundary
- Stream Center
- Proposed Transect Elevation

Horizontal Scale
1 inch = 90 feet

Vertical Scale
1 inch = 4.5 feet

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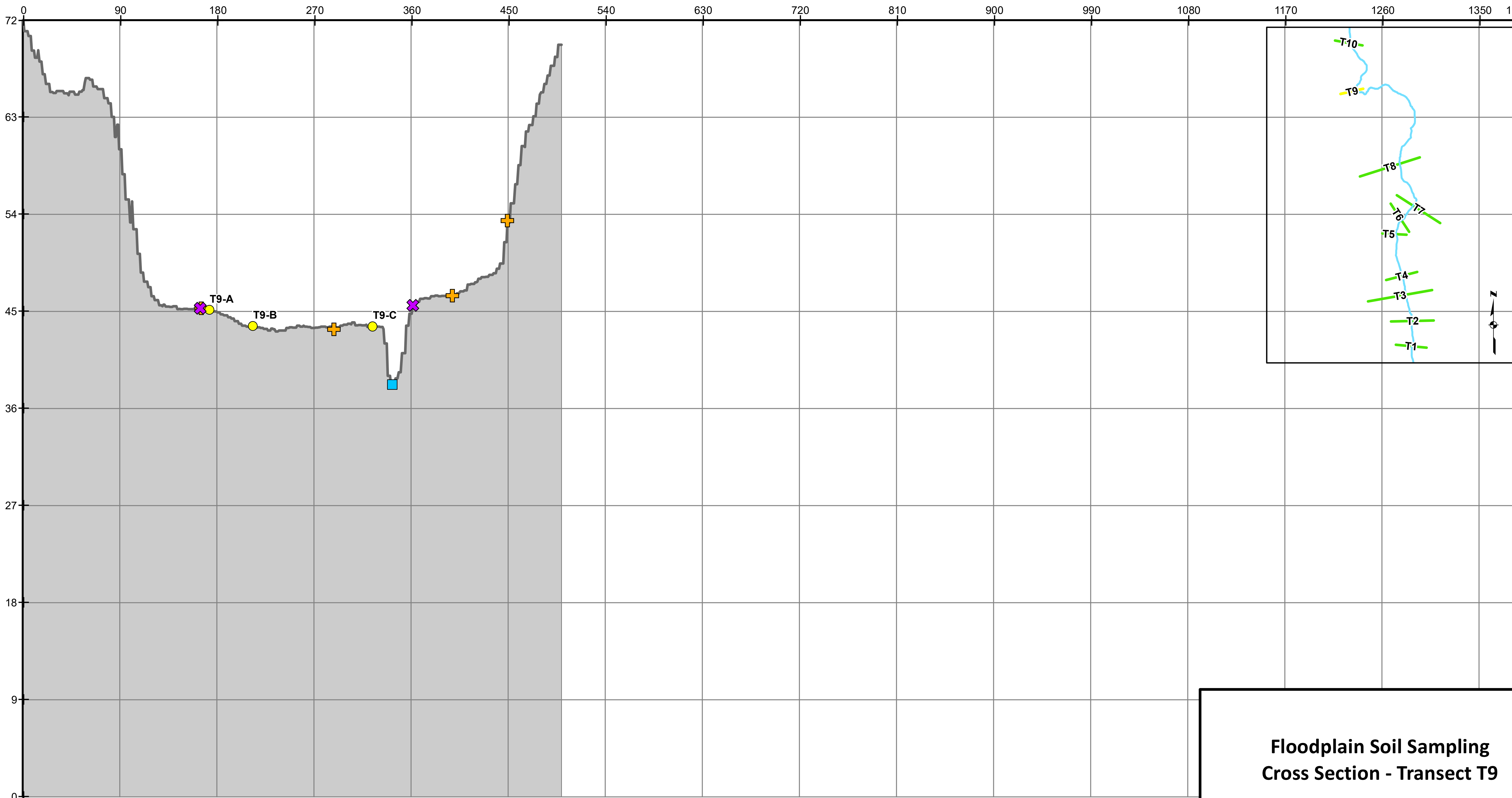


Legend

- Sampling Station
- 100y Floodplain Edge
- Parcel Boundary
- Stream Center
- Proposed Transect Elevation

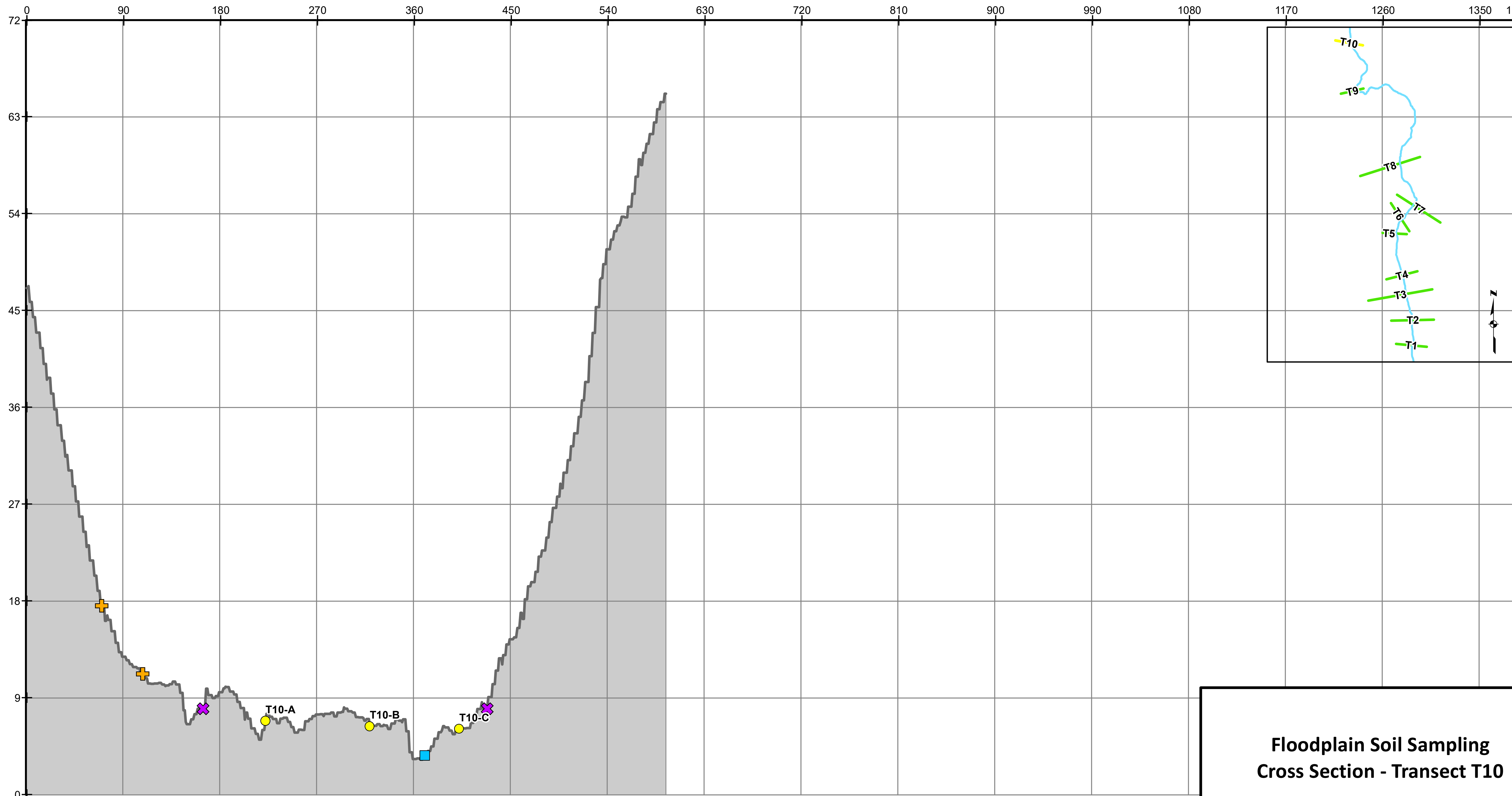
Horizontal Scale
1 inch = 90 feet

Vertical Scale
1 inch = 9 feet

Floodplain Soil Sampling
Cross Section - Transect T9

Downstream Sediment Investigation
Dyno Nobel Port Ewen Site
Port Ewen, New York

FIGURE 5I



Legend

- Sampling Station
- 100y Floodplain Edge
- Parcel Boundary
- Stream Center
- Proposed Transect Elevation

Horizontal Scale
1 inch = 90 feet

Vertical Scale
1 inch = 9 feet

Floodplain Soil Sampling
Cross Section - Transect T10

Downstream Sediment Investigation
Dyno Nobel Port Ewen Site
Port Ewen, New York

FIGURE 5J

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