May 10, 2013

Mr. Keith Gronwald
NYS Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York 12233-7014

RE: Addendum Remedial Investigation Work Scope for Sediments
RG&E Former East Station MGP Site
Voluntary Cleanup Agreement (VCA) Index # B8-0535-98-07; Site # V00538-8

Dear Mr. Gronwald:

Attached is a work scope prepared by Haley & Aldrich of NY (H&A) to investigate sediments as a component of the ongoing site Remedial Investigation (RI) and is consistent with the requirement noted in Section 3.4 of the RI Work Plan dated July 10, 2010.

RG&E proposes to conduct the sediment investigation in August or September 2013, pending NYSDEC approval of this work scope and subcontractor availability. Implementation of the work is estimated to take two to three weeks to complete and will be performed in conjunction with the continuation of the Phase 2 Genesee River Sediment Assessment planed for August/September.

If you have any questions, please contact me at (585) 771-4556 or at steve_mullin@rge.com or contact Doug Allen (H&A project manager) at (603) 391-3320, or via email at DAllen@HaleyAldrich.com.

Sincerely,

Steven R. Mullin

Steven Mullin
Lead Analyst, Environmental Remediation
RG&E Electric Capital Delivery

ec: David Crosby, P.E. – NYSDEC (w/o attachment)
Deborah McNaughton - NYSDOH
David Fingado – Manager RG&E Environmental Remediation (w/o attachment)

ADDENDUM REMEDIAL INVESTIGATION WORK SCOPE FOR SEDIMENT
RG&E EAST STATION FORMER MGP SITE
ROCHESTER, NEW YORK
SITE NO. V00358-8

by

Haley & Aldrich of New York
Rochester, New York

for

Rochester Gas & Electric Corporation
Rochester, New York

File No. 36492-031
10 May 2013

HALEY&
ALDRICH

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Rochester, NY 14623

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HaleyAldrich.com

10 May 2013
File No. 36492-031

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau C, 11th Floor
625 Broadway
Albany, New York 12233-7014

Attention: Keith Gronwald

Subject: Addendum Remedial Investigation Work Scope for Sediment
RG&E East Station Former Manufactured Gas Plant Site
Rochester, New York
Site No. V00358-8

Dear Mr. Gronwald:

Rochester Gas & Electric Corporation (RG&E) retained Haley & Aldrich of New York (Haley & Aldrich) to prepare an Addendum Remedial Investigation Work Scope for Sediment (work scope) to investigate Manufactured Gas Plant (MGP)-related impacts to Genesee River sediment. This work scope is a component of the ongoing RG&E East Station Former MGP Site Remedial Investigation (RI) and is consistent with the requirement noted in Section 3.4 of the RI Work Plan dated 19 July 2010. The overall investigation area includes sediments adjacent to the Former MGP Site and the Bausch & Lomb (B&L) Property which is downstream from the Former MGP Site and abuts the Former MGP Site to the north. The work scope has been prepared in accordance with the requirements of the Voluntary Cleanup Agreement (Index #B-0535-98-07, 10 April 2003) between RG&E and the New York State Department of Environmental Conservation (NYSDEC).

This work scope has been developed to further investigate sediment conditions described in the Phase 2 Data Summary Package - Assessment of MGP-Related NAPL Residuals in Sediments in the Genesee River Project Area by GEI Consultants, Inc. dated 31 March 2010. The Phase 2 Data Summary Package reported the following findings regarding sediment conditions adjacent to the MGP Site and B&L Property, based on 2008 and 2009 field observations and analytical results:

- Sediments form a narrow wedge along the shoreline, thinning and disappearing toward the center of the channel;
- Sediment containing NAPL was found immediately along the shoreline at the southern portion of the Former MGP Site;
- Downstream of the NAPL locations, trace to moderate sheens were found at two sediment probe locations, and trace sheen in several more locations; and,
- An area of trace sheen was observed in sediment adjacent to the B&L Property.

Based on these findings, the Phase 2 Data Summary Package provided the following recommendations regarding the sediments adjacent to the Former MGP Site and the B&L Property:

- Integrate the 2008 and 2009 data into the RI being completed for the Former MGP Site (note that the RI will include B&L Property) and identify data gaps by comparing upland and sediment observations; and,

- Delineate MGP-related residuals to background concentrations.

Key figures from the Phase 2 Data Summary Package that illustrate sediment conditions adjacent to the Former MGP Site and B&L Property observed in 2008 and 2009 are included in Appendix A.

SEDIMENT INVESTIGATION OBJECTIVES

With consideration towards the observations and recommendations presented in the Phase 2 Data Summary Package, along with comparison of the 2008 and 2009 sediment observations with upland soil conditions documented during the on-site RI, Haley & Aldrich has developed the following objectives for the sediment investigation:

- Delineate sediments adjacent to the Former MGP Site and B&L property with visual (NAPL or sheen) or olfactory (strong coal tar-like odor) indications of MGP-related impacts.

- Develop a conceptual site model for the distribution of MGP-related impacts for purposes of identifying a remediation strategy.

SEDIMENT INVESTIGATION APPROACH

The approach proposed for implementing the sediment investigation is structured to be adaptive, wherein probing and sampling locations can and will be adjusted based on field observations, including upland observations from the B&L Property Supplemental Remedial Investigation (SRI), should that pending work be completed prior to the initiation of the sediment work. The overall approach is described below.

Sediment investigation activities will focus on areas of NAPL and sheen identified during the 2008 and 2009 sediment investigation by GEI. The focus areas are shown on Figure 1, along with previous sediment and upland observations, and include the following:

- An area of NAPL and sheen observed near the Former MGP southern property boundary (Area 1). Soil borings and Tar-specific Green Optical Screening Tool (TarGOST®) probe locations completed during the RI identified the presence of coal tar in upland soils adjacent to the Genesee River;

- An area of sheen and NAPL observed midway along the Genesee River (Area 2). This area is downstream of Area 1 and is adjacent to upland TarGOST® probe locations and confirmatory soil borings that indicated the presence of coal tar in overburden soils adjacent to the River;

- An area of sheen observed along the northern portion of the Former MGP Site (Area 3). This area begins just before the Genesee River makes an easterly bend, and is also adjacent to an upland soil boring that indicated the presence of sheen and coal tar in overburden soils adjacent to the River; and,

- An area of slight sheen (Area 4), interpreted as MGP-related, located adjacent to the southern portion of the B&L Property.

In addition to the four focus areas described above, sediment probe locations will also be completed in the following areas:

- Areas where 2008 and 2009 probe locations were widely spaced to evaluate the potential presence of additional MGP-related NAPL or sheen in sediment;

- Areas where B&L Property SRI soil borings, scheduled to begin in late spring or early summer 2013, identify the presence of MGP-related NAPL in overburden soils adjacent to the Genesee River; and,

- Areas where preferential pathways for MGP-related residuals (for example, a pipe or surface drainage feature) are observed during SRI or sediment investigation field activities.

Proposed sediment probe locations are shown on Figure 2. Note that actual locations will vary depending on field observations and safe accessibility during the field survey.

Sediment Probing and Core Sampling Plan

The following sediment probing and core sampling plan has been developed to further investigate the potential presence of MGP-related NAPL and sheen in the Genesee River sediment, and to evaluate the compositional characteristics, concentrations, and source nature of polycyclic aromatic hydrocarbons (PAHs) in sediment:

- Evaluate the presence of NAPL or sheen at the approximate locations shown in Figure 2 using a hand-held and/or mechanically driven sediment probe deployed from a barge or other vessel. The surface water depth and sediment thickness will be recorded to document the sediment morphology, along with other relevant observations such as sediment type (soft, cobbly, etc.) and adjacent riverbank features (pipes, drainage ditches, etc.).

- If sheens or coal tar blebs are observed during sediment thickness probing, investigate the lateral extent of sheens/blebs with additional probing outward (upstream, downstream, and adjacent) from the area of observed sheens or blebs.

- Collect manual or mechanically-driven core samples to refusal at the following locations:
  - Within the four NAPL or sheen areas described above to verify the presence of NAPL and sheen and evaluate the depth of MGP-related impacts within sediment deposits, and to collect representative samples for laboratory analysis.
  - Upstream, downstream, and adjacent to the three areas described above (if sediment are present and continuous), outside of the limits of NAPL or sheen determined during probing, to verify the absence of NAPL or sheen, and to collect a surface sediment sample for laboratory analysis.
  - Additional core samples will also be spatially distributed in areas where no NAPL or sheen is present, to verify the apparent absence of MGP-related PAH residuals, and to collect representative samples for laboratory analysis.
  - Additional sediment samples may be collected if potential point-source features unrelated to the Former MGP Site (unmarked discharge pipe, area of erosion, etc.) are observed during the field survey.
- Core samples will be logged and described in accordance with Haley & Aldrich Operating Procedure OP3004, "Sediment and Wetland Sediment/Soil Sampling" included as Appendix B.
- Surface sediment samples (zero to 6 inch interval) or samples from intervals with visible staining or MGP-like odor will be collected in laboratory-supplied glassware and analyzed for New York STARS list volatile organic compounds (VOCs), semi-volatile PAHs, which will include at a minimum the 34 target PAHs that have been used for bioavailability evaluation at many NYSDEC-supervised sites, total organic carbon (TOC), and grain size distribution. Quality assurance/quality control samples will be analyzed at a frequency indicated in the Quality Assurance Project Plan included in the RI Work Plan by Haley & Aldrich dated 19 July 2010.

Health and Safety

A Health & Safety Plan (HASP) will be prepared as a stand-alone document to address worker safety. The HASP will be submitted to NYSDEC and New York State Department of Health (NYSDOH) prior to the commencement of field work. Haley & Aldrich will require subcontractors to prepare and implement their own HASPs.

Community Air Monitoring and Odor Management

Due to the limited sediment disturbance anticipated for the sediment investigation and water-saturated nature of the sediment core samples, no Community Air Monitoring or Odor Management activities are anticipated.

DATA EVALAUTION AND REPORTING

Field observations and analytical results from the sediment investigation will be presented in a brief Data Summary Package following the conclusion of the sediment field investigations and data evaluation. The Data Summary Package will include a brief description of the updated conceptual site model for sediment and upland soils along the Genesee River bank. Results will also be included in the Former MGP Site Remedial Investigation Report (RIR).

RG&E proposes to begin the sediment investigation in August or September 2013, pending NYSDEC approval of this work scope and subcontractor availability. Approximately two to three weeks is anticipated to complete the field work. After NYSDEC approves the work scope, the schedule will be updated and refined. If you have any questions or require additional information, please call Steve Mullin (RG&E) at 585-771-4556 or myself at 603-391-3320, or via email at DAllen@HaleyAldrich.com.

Sincerely yours,
HALEY & ALDRICH OF NEW YORK

Douglas C. Allen, P.G.
Senior Hydrogeologist

Helder J. Costa
Sediment Practice Leader

Enclosures:

References
Figure 1 - 2008 and 2009 Sediment Investigation Observations with Upland Observations
Figure 2 - Proposed Sediment Probe Locations
Appendix A - Figures from 2010 Phase 2 Data Summary Package
Appendix B - OP3004 – Sediment and Wetland Sediment/Soil Sampling

c: Steve Mullin, Rochester Gas & Electric Corporation

G:\36492_East_Station\031 Sediment WP\2013-0510-HANY-Sediment Investigation Work Scope-F2.docx

REFERENCES

1. Phase 2 Data Summary Package – Assessment of MGP-Related NAPL Residuals in Sediments in the Genesee River Project Area, GEI Consultants, Inc., March 2010.

2. Remedial Investigation Work Plan, RG&E East Station Former Manufactured Gas Plant Site, Haley & Aldrich of New York, July 2010.

3. Status Update Memorandum, RG&E East Station Former Manufactured Gas Plant Site, Haley & Aldrich of New York, March 2011.

4. Data Summary Package, RG&E East Station Former Manufactured Gas Plant Site, Haley & Aldrich of New York, December 2011.

5. Off-Site Supplemental Remedial Investigation Work Plan, RG&E East Station Former Manufactured Gas Plant Site, Haley & Aldrich of New York, June 2012.

6. On-Site Supplemental Remedial Investigation Data Summary Package, RG&E East Station Former Manufactured Gas Plant Site, Haley & Aldrich of New York, March 2013.

G:\36492_EAST_STATION\GLOBAL\GIS\2013-0510 SEDIMENT OBSERVATIONS.MXD

SEDIMENT OBSERVATIOINS (GEI CONSULTANTS)

- NAPL
- MODERATE TO HEAVY SHEEN
- TRACE SHEEN
- NO SHEEN
- BEDROCK BOTTOM

SOIL BORING OBSERVATIONS

- MINOR MGP IMPACTS OBSERVED
- SHEEN OBSERVED
- MINOR TLM/OLM OBSERVED
- TLM/OLM OBSERVED

MAXIMUM TarGOST RESPONSE

- BACKGROUND (LESS THAN 20%)
- 20% TO 50%
- 50% TO 100%
- GREATER THAN 100%

TarGOST CONFIRMATORY BORING OBSERVATIONS

- MINOR MGP IMPACTS OBSERVED
- SHEEN OBSERVED
- MINOR TLM/OLM OBSERVED
- TLM/OLM OBSERVED

NOTE:
1. SEDIMENT OBSERVATIONS WERE COMPLETED IN 2008 AND 2009 BY GEI CONSULTANTS.
2. UPLAND OBSERVATIONS WERE COMPLETED IN 2010, 2011 AND 2012 BY HALEY & ALDRICH OF NEW YORK AND ARE BASED ON FIELD OBSERVATIONS ONLY.
3. NAPL AND/OR SHEEN IN SEDIMENT YELLOW BOXES ARE FOR ILLUSTRATIVE PURPOSES ONLY AND ARE NOT INTENDED TO DEMONSTRATE THE EXTENT OF IMPACTS.
4. AERIAL PHOTO DATED APRIL 2009 OBTAINED FROM THE NEW YORK STATE GIS CLEARINGHOUSE.

N W E S

0 75 150 300

SCALE IN FEET

HALEY & ALDRICH

RG&E EAST STATION FORMER MGP SITE
ROCHESTER, NEW YORK

2008 AND 2009 SEDIMENT INVESTIGATION OBSERVATIONS WITH UPLAND OBSERVATIONS

SCALE: AS SHOWN
MAY 2013

FIGURE 1

G:\36492_EAST_STATION\GLOBAL\GIS\2013-0510-HAI-SEDIMENT WITH PROPOSED LOCATIONS-F.MXD

NOTE:
1. SEDIMENT OBSERVATIONS WERE COMPLETED 2008 AND 2009 BY GEI CONSULTANTS.
2. PROPOSED SAMPLING LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON FIELD OBSERVATIONS AND EQUIPMENT ACCESS LIMITATIONS.
3. AERIAL PHOTO DATED APRIL 2009 OBTAINED FROM THE NEW YORK STATE GIS CLEARINGHOUSE.

N W E S

0 75 150 300

SCALE IN FEET

HALEY & ALDRICH

RG&E EAST STATION FORMER MGP SITE
ROCHESTER, NEW YORK

PROPOSED SEDIMENT PROBE LOCATIONS

SCALE: AS SHOWN
MAY 2013

FIGURE 2

APPENDIX A

Figures from 2010 Phase 2 Data Summary Package

SEE INSET MAP FOR CONDITIONS ADJACENT TO B&L PROPERTY

V2

V1

FORMER BAUSCH AND LOMB MANUFACTURING FACILITY

RG&E EAST STATION MGP SITE

BAUSCH STREET BRIDGE

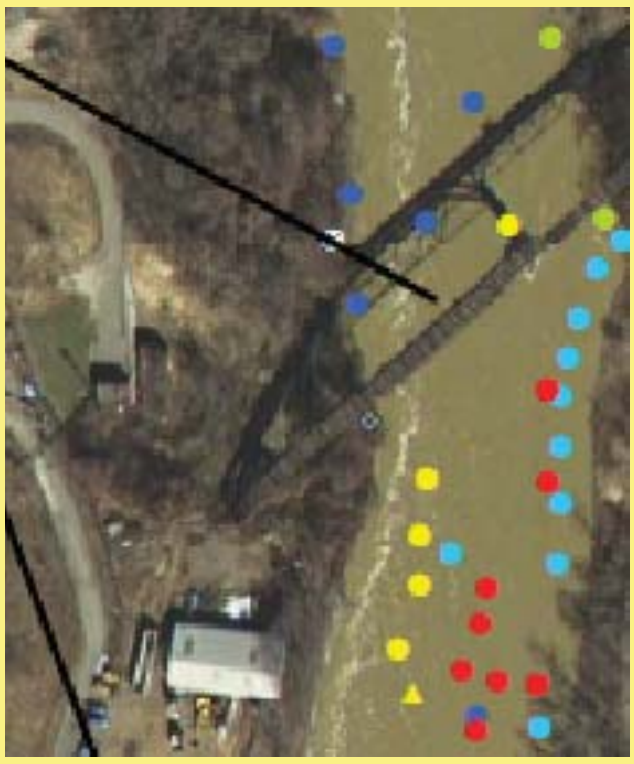
ROCHESTER METAL ETCHING COMPANY INACTIVE HAZ WASTE DISPOSAL SITE

FORMER CITY OF ROCHESTER INCINERATOR FACILITY

RG&E WEST STATION MGP SITE

PLATT STREET BRIDGE

N



BAUSCH & LOMB PROPERTY

INSET MAP: RIVER CONDITIONS ADJACENT TO B&L PROPERTY

LEGEND

- MUNICIPAL SEWER - ACTIVE
- MUNICIPAL SEWER- ABANDONED OR HISTORIC
- OTHER OUTFALL - ACTIVE OR OBSERVED
- OTHER OUTFALL - ABANDONED OR HISTORIC
- MONROE COUNTY COMBINED SEWER OVERFLOW ABATEMENT PROGRAM TUNNELS
- RG&E Remediated Sites
- RG&E MGP Sites

BOTTOM TYPE

- BEDROCK BOTTOM
- COBBLEY BOTTOM
- SAND AND GRAVEL
- SANDY BOTTOM
- SILTY BOTTOM

- 2008 VIBRACORE
- DRILLED PROBE
- CORE
- PROBE

SOURCE:
1. ORTHOPHOTO OBTAINED FROM NEW YORK STATE INTERACTIVE MAPPING GATEWAY (http://www1.nysgis.state.ny.us/MainMap.cfm), IMAGE DATE: APRIL 2005.

0 100 200 400

SCALE, FEET

PHASE 2 ASSESSMENT
GENESEE RIVER
ROCHESTER, NEW YORK

ROCHESTER GAS & ELECTRIC COMPANY
ROCHESTER, NEW YORK

GEI Consultants

Project 091980

RIVER BOTTOM SEDIMENT TYPE 2008 & 2009 RESULTS AREA A

March 2010 Figure 4-3b

J:\Projects\RG&E_GeneseeR\2009_BT_Probes_A_4-3b.mxd

SEE INSET MAP FOR CONDITIONS ADJACENT TO B&L PROPERTY

V2

V1

FORMER BAUSCH AND LOMB MANUFACTURING FACILITY

RG&E EAST STATION MGP SITE

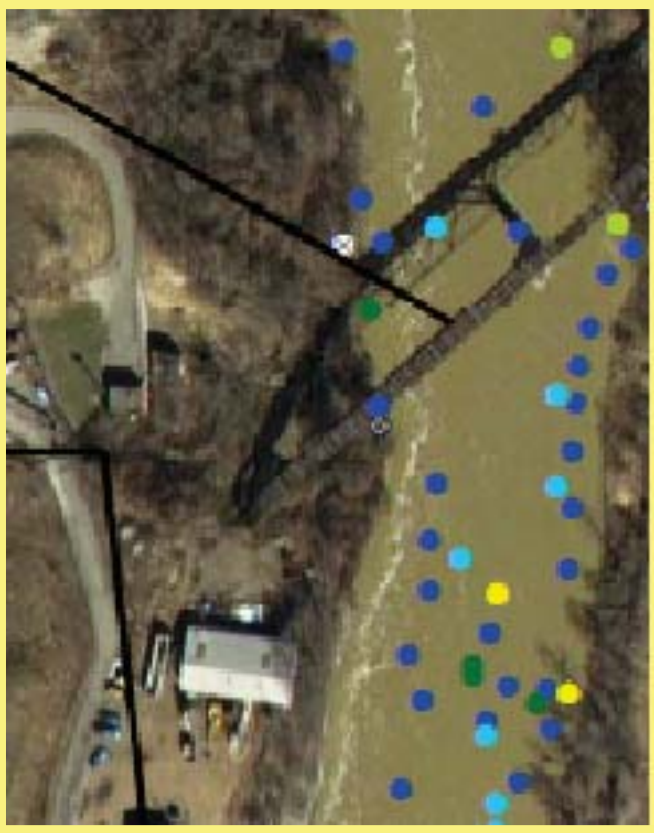
BAUSCH STREET BRIDGE

ROCHESTER METAL ETCHING COMPANY INACTIVE HAZ WASTE DISPOSAL SITE

FORMER CITY OF ROCHESTER INCINERATOR FACILITY

PLATT STREET BRIDGE

RG&E WEST STATION PARK AREA MGP SITE (REMEDIATED)



BAUSCH & LOMB PROPERTY

INSET MAP: RIVER CONDITIONS ADJACENT TO B&L PROPERTY

LEGEND

- MUNICIPAL SEWER - ACTIVE
- MUNICIPAL SEWER- ABANDONED OR HISTORIC
- OTHER OUTFALL - ACTIVE OR OBSERVED
- OTHER OUTFALL - ABANDONED OR HISTORIC
- MONROE COUNTY COMBINED SEWER OVERFLOW ABATEMENT PROGRAM TUNNELS
- RG&E Remediated Sites
- RG&E MGP Sites

PROBING DEPTH (FT)

- 0.0 - 0.5
- 0.6 - 2.0
- 2.1 - 4.0
- 4.1 - 6.0
- 6.1 - 8.0
- 8.1 - 10.0
- 10.1 - 15.0
- 15.1 - 20.0

- 2008 VIBRACORE
- DRILLED PROBE
- CORE
- PROBE

SOURCE:
1. ORTHOPHOTO OBTAINED FROM NEW YORK STATE INTERACTIVE MAPPING GATEWAY (http://www1.nysgis.state.ny.us/MainMap.cfm), IMAGE DATE: APRIL 2005.

0 100 200 400

SCALE, FEET

PHASE 2 ASSESSMENT
GENESEE RIVER
ROCHESTER, NEW YORK

ROCHESTER GAS & ELECTRIC COMPANY
ROCHESTER, NEW YORK

GEI Consultants

Project 091980

THICKNESS OF SEDIMENT PENETRATED BY PROBING 2008 & 2009 RESULTS AREA A

March 2010 Figure 4-4b

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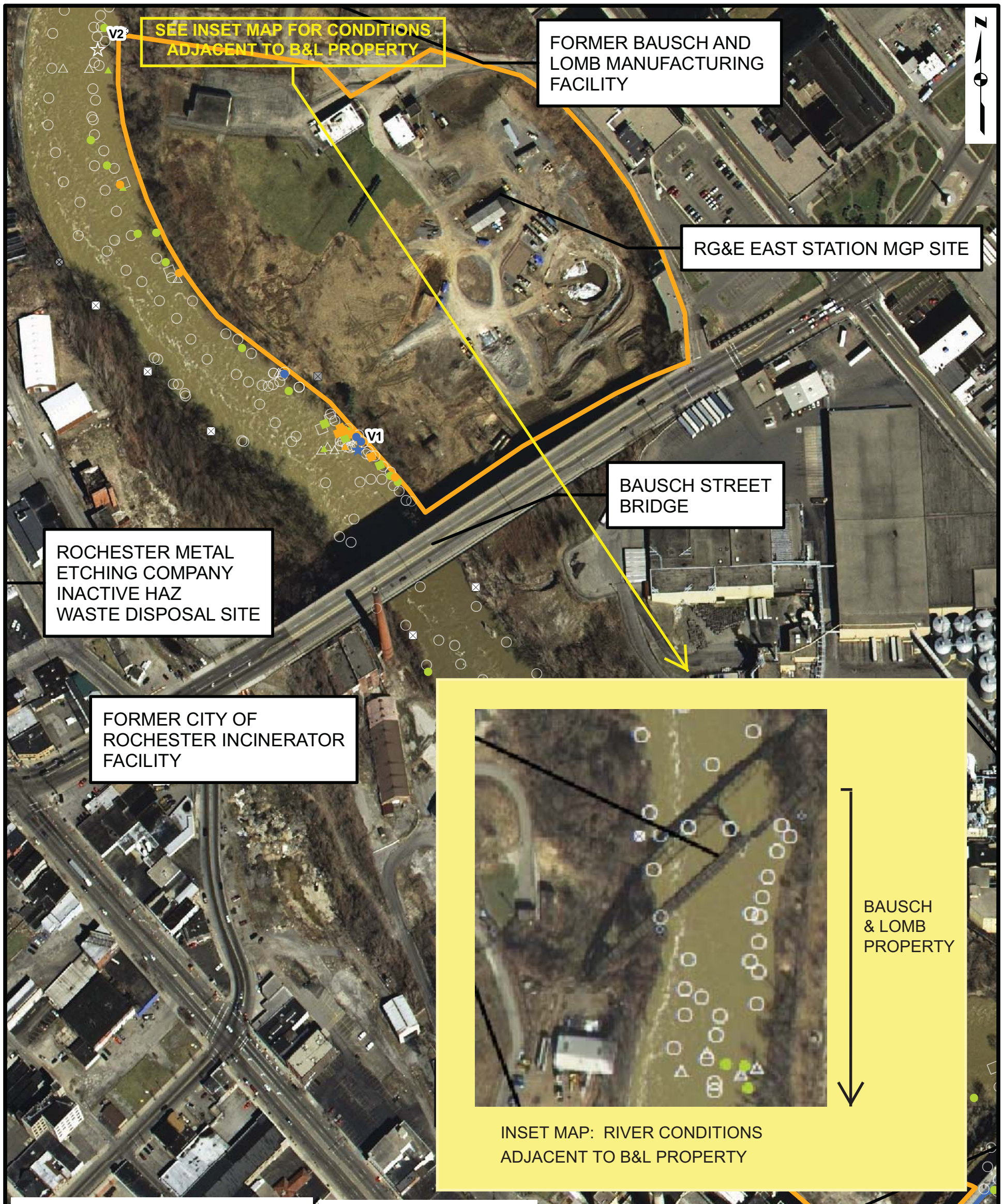

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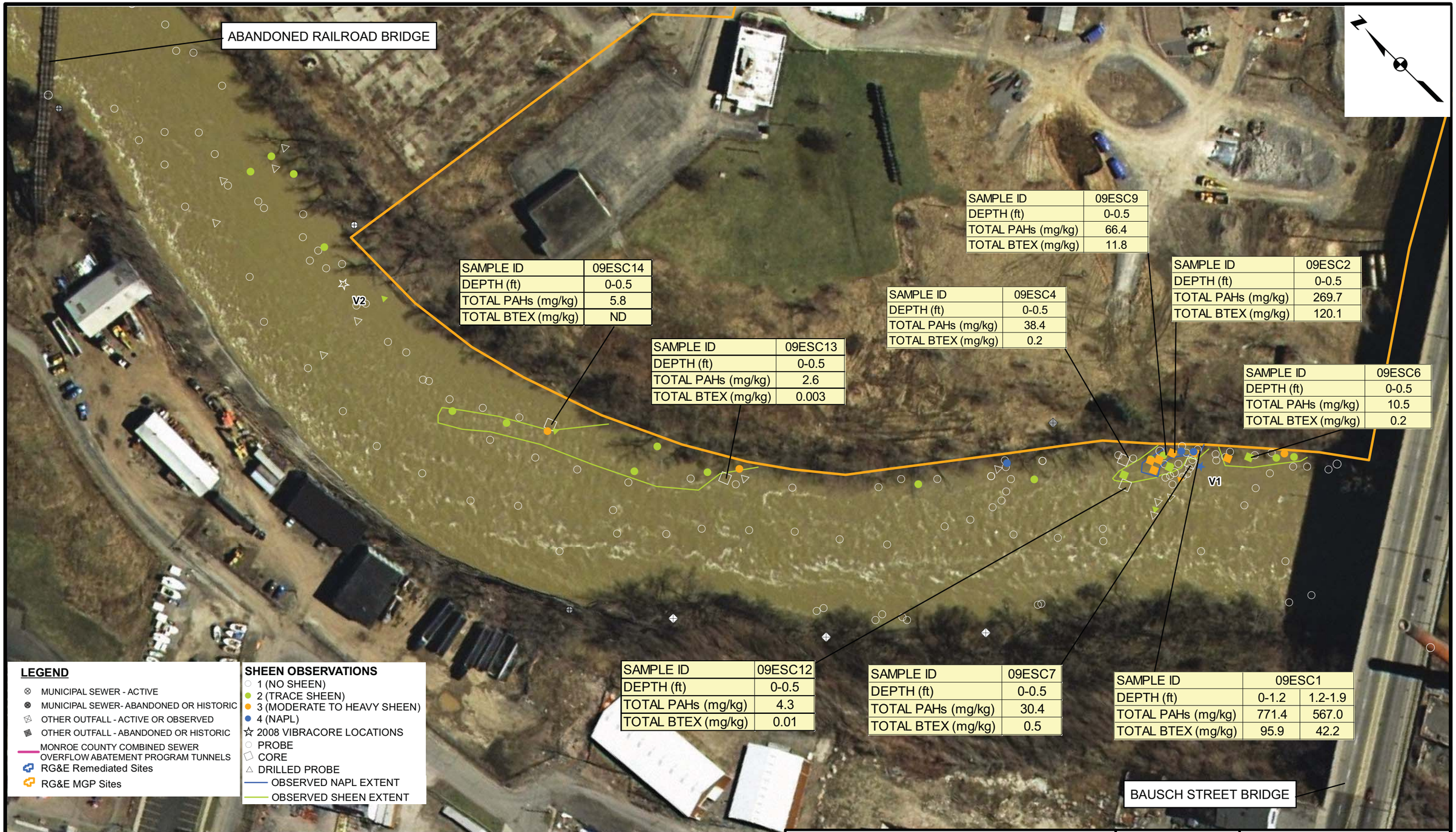

SOURCE:
1. ORTHOPHOTO OBTAINED FROM NEW YORK STATE INTERACTIVE MAPPING GATEWAY (http://www1.nysgis.state.ny.us/MainMap.cfm), IMAGE DATE: APRIL 2005.

0 50 100 200
SCALE, FEET

PHASE 2 ASSESSMENT
GENESEE RIVER
ROCHESTER, NEW YORK

ROCHESTER GAS & ELECTRIC COMPANY
ROCHESTER, NEW YORK

GEI Consultants

2008 & 2009 SEDIMENT SHEEN OBSERVATIONS AND ANALYTICAL RESULTS EAST STATION AREA

Project 091980 | March 2010 | Figure 4-10

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APPENDIX B

OP3004 – Sediment and Wetland Sediment/Soil Sampling

OPERATING PROCEDURE: OP3004

SEDIMENT AND WETLAND SEDIMENT/SOIL SAMPLING

LEVEL II (Interim)

PREPARATION AND APPROVALS

VERSION	AUTHORED / DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
Ver. 0.1	ABD: 3/04/04	RVE: 8/09/04			
Ver. 0.2	RWS: 04/09/2008	HJC 06/04/2008			

Total Pages: 30

Haley & Aldrich categorizes Operating Procedures by Levels, to facilitate their preparation and use. The Levels are defined as follows:

Level III - miscellaneous procedure from a variety of sources; not sanctioned as appropriate for any particular use by the company but provided on the Intranet as a potential resource when current company operating procedure is not available; (e.g., project-specific procedure submitted by staff member, old procedures, ASTM procedures, etc.)

Level II - in-progress or draft procedure, typically written in the standard format; in various stages of review; has not yet been sanctioned an official operating procedure but could be suitable for project-specific application upon verification by project staff

Level I - company sanctioned operating procedure suitable for use on projects

The company encourages and welcomes feedback regarding its Operating Procedures. If staff members have recommendations related to the use or improvement of any procedures, or suggestions for developing new procedures, please contact the Boston Office Field Services Manager or a Service Delivery Leader.

TABLE OF CONTENTS

LIST OF FIGURES

OPERATING PROCEDURE OP3004

SEDIMENT AND WETLAND SEDIMENT/SOIL SAMPLING

1. PURPOSE

The purpose of this Operating Procedure (OP) is to describe the procedures for the collection of representative stream sediment and wetland soils samples. Sediment and wetland sediment/soil as referenced herein mean deposited sediment or soil-like material below both flowing and standing surface water. Wetlands are lands transitional between terrestrial and aquatic systems where the water table is typically at or near the surface, or the land is covered by shallow water. Wetland sediment/soils exhibit features characteristic of the wetland conditions of saturation, flooding, or ponding, which must occur long enough during the growing season to develop anaerobic and reducing conditions in the upper horizons of the soils. Hydric soil indicators are currently termed "redoximorphic" features of the soils, a term used to replace descriptions of "soil mottling" due to wetness. Wetland sediment/soils include organic and mineral soils ranging from poorly drained to well drained.

Stream sediment and wetland sediment/soil samples may contain contaminants that are insoluble in water, persistent in the environment, relatively immobile in the soil, and/or exhibit low volatility. Accordingly, the procedures are intended specifically to minimize the alteration of samples.

Refer to OP3000 for General Environmental Field Procedures and Protocol, including procedures for decontamination of sampling equipment and containers. Refer to OP3001 for Operating Procedures on Preservation and Shipment of Environmental Samples.

Refer to OP3003 for Operating Procedures on Surficial Soil Sampling, and OP3007 for Operating Procedures on Surface Water Sampling.

Haley & Aldrich (H&A) personnel are to use the techniques in OP3004 to collect stream sediment and wetland sediment/soil samples. These operating procedures may be varied or changed as required, depending upon site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

2. EQUIPMENT & SUPPLIES

Required:

1. Site map(s)/plan(s), including Work Plan (WP), Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), or other applicable project planning document

2. Safety equipment, as specified in the site-specific Health & Safety Plan (HASP)
3. Field book and/or field data sheets (H&A Sampling Record Form #3004)
4. Tape measure (100 ft)
5. Global Positioning System (GPS) unit to document station locations
6. Stainless steel, plastic, or other appropriate composition bucket, bowl or pan
7. Appropriate environmental sample containers (4 oz., 8 oz., or wide mouth glass jars, with Teflon lined lids)
8. Plastic zip-lock bags
9. Sample labels
10. Chain-of custody records and custody seals
11. Cooler(s)
12. Ice
13. Decontamination supplies/equipment

Sampling equipment may include one or more of the following:

1. Stainless steel spade or shovel
2. Stainless steel trowel(s) or scoop(s)
3. Bucket auger with thin-wall tube attachment (stainless steel)
4. Bit auger with thin-wall tube attachment (stainless steel)
5. Thin-wall tube sampler
6. Split-spoon sampler
7. Gravity corer
8. Ponar grab sampler
9. Ekman dredge
10. Lexan® tubes
11. Peristaltic pump
12. Russian peat corer
13. Piston corer

Optional:

1. Camera and film
2. Survey equipment or global positioning system (GPS) to locate sampling points
3. Survey stakes, flags or buoys and anchors
4. Nylon rope
5. Plastic sheeting or cover

3. PROCEDURE

Decontaminate equipment as described in Haley & Aldrich Operating Procedure OP3027 Decontamination Procedure.

Disposed of drill cuttings as described in Haley & Aldrich Operating Procedure OP3028 Investigation Derived Wastes.

Please refer to Haley & Aldrich Operating Procedure OP3001 Preservation and Shipment of Environmental Samples, for naming, labeling, handling, and shipping information.

3.1 Preparation

- Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies required.
- Obtain the necessary sampling and monitoring equipment.
- Obtain the necessary personal protection equipment (PPE) in accordance with the site-specific HASP.
- Decontaminate or pre-clean equipment, and ensure that it is in working order.
- Prepare schedules and coordinate staff, client and regulatory agencies, if appropriate.
- Perform a general site survey prior to site entry in accordance with the site-specific HASP.
- Use stakes, flagging, or buoys to identify and mark all sampling locations within wetlands. Verify and/or document locations using calibrated GPS unit. Use GPS to locate sediment stations and deploy anchor(s) alongside or downstream of intended sampling locations. Occupy river stations in an upstream sequence whenever possible. All wetland staked locations and in-water sampling areas should be utility-cleared by the property owner or the On-Scene-Coordinator prior to sampling. Utility clearance should always be confirmed prior to beginning work.

3.2 Pre-sampling Observations, Notes and Required Entries

Field measurements and observations should be recorded in the field at the time of sampling. A Sampling Record Form is included as Appendix C. Typically required information is listed below and will be recorded in a project Field Log Book or Sampling Record Form, whichever is more appropriate:

- Sample location number
- Date collected
- Time collected
- Samplers (names of individuals who actually collected the sample)
- Sample destination (Analytical laboratory) to receive samples

- Description of sample location with sketch or map (i.e. sludge lagoon, stream, wetland, etc.)
- GPS coordinates of sampled locations
- Sample depth (i.e. distance in feet from ground surface)
- Depth of water above sample (distance in feet from top of water surface to top of sediment)
- Indicate photograph number and roll used (if applicable)
- Observable physical characteristics
  - Odor
  - Color
  - Texture
  - Layering
  - Other
- Samples collected (enter all sample numbers colleted at this location)

3.3 Sampling Procedures

- After all entries are completed, label and number required sample bottles. Fill our label in indelible ink and carefully and clearly address all categories and parameters.
- Sampling instructions have been provided for various optional sampling devices which may be used to collect sediment and wetland sediment/soil samples. Select the prescribed sampling device, or an appropriate alternative to meet project objectives. Any change in sampling device should be cleared first with an authorized project team member.
- Decontaminate sampling device and/or container immediately prior to and following its use according to Operation Procedure OP#3000 – General Environmental Field Procedures and Protocol.
- Sub-sampled sediment samples must be homogenized or when called for, composited and homogenized, before placing in containers. Homogenization is appropriate for most chemical analytical parameters, including but not limited to: metals, pesticides/PCBs, herbicides, semi-volatile organic compounds (SVOCs). However, samples for volatile organic compounds (VOCs) should not be homogenized prior to adding to VOC sample containers.
- Because sediment samples may be stored frozen to extend holding time, sample containers should be filled approximately two-thirds to three-quarters of their capacity, depending on their water content. For high-moisture sediments, jars should be filled no more than two-thirds full. Specific instructions will be should be provided by the analytical laboratory for VOC samples. Refer to a project WP, FSP, or QAPP for required sample volumes and appropriate containers for given analyses. Only VOC

sample containers should contain any laboratory-provided preservatives. An additional, unpreserved VOC sample is required for moisture content of the unhomogenized sediment. All container caps will include an inner Teflon septa or lining and must be tightly secured. Refer to OP#3001 for operating procedures on sample handling and preservation.

- Check for appropriate liner in cap and secure cap tightly. Store the samples with ice in a cooler, following these sealing and packing instructions:
  - Ice will be placed in plastic zip-lock bags to contain ice and water. Sample containers will be adequately layered in bubble wrap to prevent breakage. Samples will be positioned upright in the cooler to prevent breakage, and samples will be stored and shipped at 4ºC.
  - All VOC vials will be sealed in a thick or heavy duty plastic zip-lock bag, bubble wrap, or foam VOC vial holders provided by the laboratory.
  - Check to make sure all appropriate information is in the Field Log Book or the Sampling Record Form and Chain-of-Custody document using indelible ink.
  - If samples are to be shipped to a laboratory for analysis, a Chain-of-Custody record, custody seals, "Fragile" markers, and reinforced nylon tape will all be properly affixed to or on the sample cooler. If samples are to be delivered to the lab by courier, only the Chain-of-Custody record is required.
    - Chain-of-Custody Record – enclose in a large zip-lock bag and tape to inside of top of cooler lid.
    - Custody Seals – place custody seal over cooler gasket separating cooler lid from the cooler bottom at all sides except the hinged location.
    - Nylon Tape – tape completely around cooler at two locations. Tape reinforcement will prevent cooler from opening if the lid locking mechanism fails.
    - Fragile Markers – fragile markers and upright stickers will be affixed to each side of the cooler.

3.4 Sampling Device Instructions

The sampling devices presented below may be used to collect sediment and wetland sediment/soil samples within several feet of the ground surface. The specific procedures and equipment for sediment and wetland sediment/soil sampling may be specified in the project WP, FSP, QAPP or related document. The most appropriate device for a specific sampling program may be based on the depth of water at a sampling location, the physical characteristics of the sediment to be sampled, and/or site conditions (accessibility, type of soil or sediment, desired depth of samples, etc.).

3.4.1 Trowels, Hand Scoops, Spades & Shovels

This method is probably the simplest, most expeditious, direct method for sampling accessible sediment. These devices are easy to operate, decontaminate, and work well for sampling low-mositure, exposed (e.g., intertidal or wetland surface) locations. Stainless steel or rigid non-contaminating plastic are the preferred material for these tools.

Surface material is sampled to the specified depth using a stainless steel or plastic scoop, trowel, spade or shovel. In wetlands, vegetation may or may not be considered part of the sediment/soil sample; any such distinction must be discussed and cleared with an authorized project team leader, unless addressed in the project WP, FSP, or QAPP. For the purpose of this method, surface sediment or wetland sediment/soil is considered to range from 0 to 6 inches in depth and a shallow aqueous layer is considered to range from 0 to 12 inches in depth. Scoops or trowels can be disruptive to the liquid/sediment interface and may cause substantial alteration of the sample. Thus, these methods are limited in application to bulk surface "grab" sampling.

Procedures for Use

1. Carefully remove the top layer of sediment or wetland sediment/soil to the desired sample depth with a cleaned, stainless steel spade, shovel, trowel or scoop. In the case of sludges exposed to air, it may be desirable to remove the first 1-2 centimeters of material prior to collecting the sample.

2. Using a cleaned, stainless steel scoop or trowel, collect the desired quantity of sediment.

3. If compositing a series of grab samples, use a stainless steel mixing bowl or Teflon tray for mixing.

4. Surface water should be decanted from the sample or the composition mixing bowl prior to sealing or transfer to the sample container. Care should be taken to retain the fine sediment fraction during this procedure.

5. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a laboratory-supplied cut-off syringe or Encore® sampler. Place the remainder of the sample into a stainless steel, plastic, or other appropriate compositing container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, place the sample into the appropriate labeled containers.

6. Check that a Teflon liner is present in cap if required. Secure cap tightly.

7. The chemical preservation of solids is generally not recommended, except in the case of VOC samples. Refrigeration is usually the best approach for solid samples supplemented by minimal holding time. Sediment samples may be stored frozen to extend holding times up to one year for most analyses.

3.4.2 Bucket and Bit Augers with Thin-Wall Tube Attachment

This method should only be attempted on very consolidated sediment absent overlying surface water, such as within an intertidal zone during low tide, or for wetland sediment/soil. Collection of a sub-surface sediment or wetland sediment/soil sample can be accomplished with a system consisting of a bucket or bit auger, a series of extensions, a "T" handle, and a thin wall tube attachment (Figure 1). The use of additional extensions in conjunction with a bucket auger can increase the sampling depth from which sediment can be collected.

A cleaned bucket or bit auger is used to bore a hole to the desired sample depth and then is withdrawn. When using a bucket auger, the soil sample must be removed from the bucket with a cleaned, stainless steel spoon or trowel. The bucket auger can collect a large sediment sample (up to 24 ounces) but is limited in penetrating depth to approximately two feet under ideal conditions. The bit auger has a greater penetrating depth (up to six feet) but collects a lesser volume of sediment. The bit auger tip is removed from the auger when the desired sampling depth is reached and replaced with the thin wall tube attachment. The system is then lowered back into the cored hole and driven into the sediment at the completion depth. The corer is then withdrawn and the sample collected from the thin wall tube sampler. The various depths represented by the core are homogenized for the appropriate depth. This equipment can be used in a wide variety of sediment and wetland sediment/soil conditions. This equipment is inexpensive, easy to operate, and generally works well to sample most sediments.

Procedures for Use

1. Attach the cleaned auger head to the required length of extensions, then attach the "T" handle to the upper extension.

2. Clear the area to be sampled of any surface debris (twigs, rocks, litter). It may be advisable or necessary to remove the first 8 to 15 cm of surface sediment for an area approximately 15 cm in radius around the sampling location.

3. Insert the bucket auger or bit auger into the sediment at a 0^{o} to 20^{o} angle from vertical. This orientation minimizes spillage of the sampler upon extraction from the sediment.

4. Begin drilling by rotation of the "T" handle, to cut a core of sediment. If desired sample location is at a depth, periodically remove accumulated sediment in the auger and place on a plastic sheet spread near the hole. This prevents accidentally brushing loose material back down the borehole when removing the auger or adding extensions. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

5. After reaching the desired depth, slowly and carefully remove auger from boring.

6. If a bucket auger is being used, remove soil sample with cleaned, stainless steel spoon or trowel.

7. If a bit auger is being used, remove auger tip from the extension rods and replace with cleaned thin wall tube sampler. Install proper cutting tip.

8. Carefully lower the tube sampler down the borehole. Gradually press the tube sampler into the sediment. Take care to avoid scraping the borehole side. Avoid hammering the drill rods to facilitate coring, as the vibrations may cause the boring walls to collapse.

9. Remove the tube sampler and the unscrew drill rods.

10. Remove the cutting tip and remove the core from the device.

11. Discard the tope of the core (approximately 1 inch), as this represents material collected before penetration of the layer of concern. Transfer the remaining sample or a specified aliquot of sample into an appropriate sample container.

12. If VOC analysis is to be performed, transfer the sample into an appropriate methanol preserved, labeled container with a stainless steel spoon, wooden tongue depressor or equivalent, and secure the cap tightly.

13. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and repeat previous steps, making sure to decontaminate the auger and tube sampler between samples.

14. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed sediment or wetland soil material.

3.4.3 Hand Held Corer

This device consists of a "T" handle and cylindrical core tube (Figure 2). The device is equipped with a check valve at the top to prevent washout during retrieval through overlying water, if applicable, and a nosepiece at the bottom to help contain the sample. This device can be used in a wide variety of sediment conditions. Hand corers can also be fitted with brass or polycarbonate plastic liners.

Procedures of Use

1. Inspect the corer for proper pre-cleaning.

2. Press the corer in with a smooth, continuous motion.

3. Twist the corer, and then withdraw the corer in a single smooth motion.

4. Remove the nosepiece and withdraw the sample into a stainless steel, plastic or other appropriate homogenization container.

5. Transfer the sample into an appropriate sample container with a stainless steel spoon, wooden tongue depressor or equivalent.

6. Check that a Teflon liner is present in the cap, if required. Secure the cap tightly.

3.4.4 Gravity Corer (with Stabilizing Fins)

This method consists of a cylindrical metal tube with a detachable tapered nosepiece on the bottom and a ball or check valve located on the top. The device may have stabilizing fins to maintain vertical positioning as the device is moving through a liquid. The tapered nosepiece facilitates cutting and reduces core disturbances during penetration. Gravity corers are capable of collecting benthic sediment samples ranging from 15 to 30 inches depending upon the density of the sampled material and weight of the device. This device works well to collect sediment samples in a marine environment or from a low velocity stream, pond or river. Some gravity corers have attachable weights and may accept plastic or brass liners.

Procedures for Use

1. Attach a pre-cleaned corer to the required length of a sample line. Solid braided 5-millimeter (3/16 inch) nylon line is sufficient; 20-millimeter (3/4 inch) nylon, however, is easier to grasp during hand hoisting.

2. Secure the free end of the line to a fixed support to prevent accidental loss of the corer.

3. Lower the corer through the water column to the top of sediment; push the corer manually through the sediment to the desired depth, or refusal.

4. Retrieve the corer slowly using a smooth, continuous lifting motion. Do not bump the corer as this may result in some sample loss.

5. Remove the nosepiece from the corer and slide the sample out of the corer into a stainless steel, plastic or other appropriate homogenization container. For vertical sub-sampling, the core tube may be cut along its entire length and opened to facilitate observation of lithology.

6. When subsampling for homogenization and chemical analysis, scrape the outer layer of sediment in contact with the core tube prior to homogenizing. This outer layer may be used for grain size analysis, which is not compromised by cross-contamination.

7. Transfer the homogenized sample into an appropriate sample jar with a stainless steel spoon, wooden tongue depressor or equivalent.

8. Check that a Teflon liner is present in the cap, if required. Secure the cap tightly.

3.4.5 Ponar Grab Sampler

Collection of surface sediment can be accomplished with a system consisting of a remotely activated device (Ponar Grab or Ponar Dredge) and a deployment system. The Ponar Grab is a weighted, clamshell-type grab sampling device with jaws that are lever- or spring-activated. This technique consists of manually opening the sampler and latching it in place, then slowly lowering the Ponar Grab sampler to the surface of the sediment by use of nylon rope, cable, or extended handle. When the tension in the drop line is released and a lifting action is applied to the lowering line, the level system snaps the clamshell device closed. The mechanism is activated, and the device entraps sediment in spring loaded or lever operated jaws.

This device is used to collect consolidated fine- to coarse-textured sediment. The sampler is only capable of collecting a shallow surface sediment sample (from 1 to 4 inches), depending on the dimensions of the sampler.

Procedures for Use

1. Attach a sturdy nylon rope or steel cable to the ring provided on top of the pre-cleaned Ponar Grab sampler. Solid braided 5-millimeter (3/16 inch) nylon line is sufficient; 20-millimeter (3/4 inch) nylon, however, is easier to grasp during hand hoisting.

2. Measure and mark the distance to the sediment surface on the sample line. A secondary mark, slightly shallower will indicate proximity, so that the lowering rate can be reduced, this preventing unnecessary bottom disturbance.

3. Tie the free end of the sample line to a fixed point to prevent accidental loss of sampler.

4. Arrange the Ponar sampler with the jaws latched in the open position, setting the trip bar so the sampler remains open when lifted from the top. If the sampler is so equipped, place the spring loaded pin into the aligned holes in the trip bar. From this point on, support sampler by its lift line or the sampler will be tripped and the jaws will close.

5. Begin lowering the sampler until the proximity mark is reached, or to a point approximately 2 inches above the sediment.

6. Drop the sampler to the sediment. Slack on the line (several centimeters) will release the trip bar or spring loaded pin. In strong currents more slack may be necessary to release mechanism. Pull up sharply on the line closing the sampler.

7. Slowly raise the sampler to the surface and slowly decant any free liquid through the screens on the top of the sampler. Care should be taken to retain the fine sediment fraction during this operation.

8. Open the sampler and transfer the sediment to a stainless steel, plastic or other appropriate composition container. Ensure that non-dedicated containers have been adequately decontaminated. If necessary, continue to collect additional sediment samples until sufficient material has been secured to fulfill laboratory requirements. Thoroughly homogenize and then transfer the sediment to sample containers appropriate for the analysis requested. Samples for VOCs must be collected directly from the bucket before homogenization to minimize volatilization of contaminants.

Check for a Teflon liner in the cap, if required, and secure cap tightly

3.4.6 Thin-Tube Hand-Held Sampling Trier

The system consists of a trier, a long hollow cylindrical tube with a slot extending almost its entire vertical length, and a "T" handle (Figure 3). The trier is driven into the sediment or wetland sediment/soil to be sampled and used to extract a core sample from the appropriate depth. The tip and edges of the tube are sharp to allow the trier to cut a core by rotation of the "T" handle once it is completely pushed-down or manually driven to the depth of collection. Triers range from approximately 20 to 60 inches in length and from approximately 0.5 to 1 inch in diameter.

Procedures for Use

1. Insert the cleaned trier into the sediment or wetland soil at a 0 to 45° angle from horizontal. This orientation minimizes spillage of sample from the sampler. Extraction of sample might require tilting of the containers.

2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure the slot is facing upward.

4. Transfer the sample into an appropriate labeled container with a stainless steel scoop, wooden tongue depressor or equivalent and secure caps tightly.

3.4.7 Telescopic Mechanical Sampling Arm

The device consists of an aluminum pole approximately 1 to 2 inches in diameter divided into three 4-foot sections. Attached to the end of the pole is a stainless steel sampling beaker (usually with an 18-ounce capacity). The pole is capable of telescoping from 4 to 12 feet. This mechanical sampling arm is used to collect sediment or wetland sediment/soil samples from excavations, or water bodies with high banks. It allows a sample to be collected from a location that would otherwise be difficult to access.

Procedures of Use

1. Attach the cleaned, stainless steel beaker to the end of the pole either by tightening a clamp or wing nuts.

2. Make sure your feet are safely and securely positioned.

3. Telescope the pole to the required length.

4. Lower the pole end into the excavation or otherwise difficult to reach sediment or wetland soils.

5. Collect the sample.

Remove the sample from the beaker with a cleaned, stainless steel scoop, trowel or new wooden tongue depressor.

3.4.8 Sediment Sampling with Lexan® Coring Tube

This method consists of a coring tube that samples soft sediments to depths of approximately 1-2 meters. Sampling with a Lexan® coring tube extracts an undisturbed sediment sample which allows the study of the sediment-water interface. Using a vacuum pump allows the tube to be capped without disturbing the sample. The process described below can be facilitated if necessary by creating a sharp edge on the coring tube prior to advancing the tube into the sediment. The sharp edge will help advance the coring tube.

Procedures for Use

1. If using a boat to access the sampling location, anchor the boat if necessary to remain within a radius of approximately 1-5 meters from the originally identified sample location.

2. Identify the proposed sample location in the field notebook along with other appropriate information collected during sediment sampling activities.

3. Measure the total depth of water with a weighted tape.

4. At each sample location, lower a section of Lexan® tube until it reaches the top of the sediment.

5. Push the Lexan® tube into the sediment by hand, or using a core driver block, to the desired depth, or until refusal. If the procedure is being performed to determine sediment depth (probing), a calibrated rod may be used in place of the Lexan® tube. If the procedure is being performed to collect samples for laboratory analysis, continue with Step 5.

6. Drive the tube several more inches using a core driver block and measure the distance. This procedure is performed to obtain a “plug” at the bottom of the core and prevent the loose sediment from escaping.

7. Place a vacuum pump on top of the Lexan® tube, or even a plastic core tube cap to create suction, which should prevent the sediments/plug from escaping.

8. Slowly pull the tube from the sediment, twisting it slightly as it is removed (if necessary).

9. Before the tube is fully removed from the water, place a cap on the bottom end of the tube while it is still submerged.

10. Keeping the tube upright, wipe the bottom end dry and seal the cap with duct tape and label. Measure the length of sediment recovered and evaluate the integrity of the core. If the core is not suitably intact, repeat coring procedure within 5 to 10 feet of the first location attempted.

11. While still keeping the core upright, use a hacksaw to make a horizontal cut in the tube approximately one inch above the sediment.

12. Re-cap the cut end of the tube, seal the cap with duct tape, and mark this end as "top".

13. Wipe the tube dry.

14. Slice tube open or push sediment from tube onto pre-cleaned aluminum foil; scrape the outer surface of the sediment core that was in contact with the coreing tube wall to prevent vertical smearing.

15. Sediment samples to be analyzed for volatile organic compounds (VOCs) will be transferred directly from the sample collection device to the sample containers.

16. All other surface sediment samples will be transferred to a stainless-steel mixing bowl for homogenization. Additional samples may be required to collect the volume of sediment specified in the study design. The mixing bowl should be covered with aluminum foil while additional samples are being collected to prevent sample contamination (e.g., from precipitation, splashing water). After a sufficient volume of sediment is transferred to the mixing bowl, homogenize the contents of the bowl using stainless-steel spoons until the texture and color of the sediment appears to be uniform.

17. After the sample is homogenized, distribute sub-samples to the various containers and preserve the samples.

18. Place filled sample containers on ice in a cooler.

3.4.9 Piston Corer

The method of using a piston corer utilizes the general procedure as described above for using a Lexan® tube. The piston inserted into the core tube aids in maintaining suction to minimize loss of

unconsolidated material from the bottom of the tube. Piston corers are typically used when undisturbed sediment samples at significant penetration depths are required.

Procedures for Use

1. If using a boat to access the sampling location, anchor the boat if necessary to remain within a radius of approximately 1-5 meters from the originally identified sample location.

2. As provided in the WP, FSP, or QAPP, determine how deep of a penetration is needed at the specific sampling location. Prepare the appropriate length of tubing to be able to achieve the desired penetration depth plus an additional couple of feet.

3. Run the line through the tubing and connect to the piston stopper. Insert the piston stopper approximately 0.5 inches from the end of the tube.

4. Attach the tubing to the piston core with provided clamps and/or other mechanism.

5. Slowly lower the tube/piston unit through the water column until it reaches the top of sediment. When the tube has reached the sediment, try to minimize movement of the tube therefore minimizing sediment disturbance. Tie off the line attached to the stopper to a permanent anchor on the vessel.

6. Drive the tubing into the sediment to the penetration depth required.

7. Remove the line and attach to the piston corer. Bring up tube and core and position horizontally on the boat or ground.

8. Immediately cap the open end of the tube. Remove piston corer from the tube and cap the other end.

9. After both ends are capped and properly secured, the core should be stored vertically to allow for the sediment to settle. Once settled, cut Lexan® tube where necessary to accommodate the size of the extracted core.

10. If the required depth was not reached and or there was not the acceptable retrieval. Redeploy the piston corer prior to capping the ends. There may be debris in the way of the tube and/or other hard objects that impede penetration. In the event that the desired penetration depth is not achieved, slightly change the sample location (within the 1-5 m radius of the original sample location). If the area continues to be problematic, contact an authorized project team leader.

11. Once an acceptable core is extracted, capped and left to settle. Cut tube open and describe and sample from the core as described in Section 3.3.

3.4.10 Sediment Sampling in Wetlands with Russian Peat Corer

The Russian peat corer is a chamber-type instrument that collects an unconsolidated sediment/soil sample in wetlands. The side-filling corer is inserted into the sediment in the closed position to the desired depth. Once at the desired depth, the corer is rotated and the sample stored within the core. The following steps outline the procedure for using the Russian peat corer:

Procedures for Use

1. Manually insert the bottom point of the Russian Peat Corer with the blunt edge of the core tube turned against the cover plate to prevent sediment/soil from entering the tube during advancement. If the sediment is highly consolidated or otherwise hard to penetrate, a slide hammer can be used to aid in driving the sampler.

2. When the Russian Peat Corer is driven to the required depth, turn the core tube clockwise 180 degrees allowing to tube to rotate and allowing the sharp edge to cut through the sediment longitudinally.

3. Pull up the corer and retrieve the sample by turning the core tube counterclockwise. The sample will be exposed on the core cover plate.

4. Describe physical characteristics of the sediment/soil in accordance with H&A OP2001 – Identification and Description of Soils in the Field and Using Visual-Manual Methods.

5. Sub-sample and/or homogenize the sample for chemical analyses as decribed previously.

3.4.11 Sediment Sampling with Peristaltic Pump

The method of sediment sampling with a peristaltic pump consists of lowering tubing to a desired sampling location and using the peristaltic pump to extract the sediment from the bottom of the water body. This method of sediment sampling may be efficient for the collection of flocculent, unconsolidated sediments with very high water content.

Procedures for Use

1. If using a boat to access the sampling location, anchor the boat if necessary to remain within a radius of approximately 1-5 meters from the originally identified sample location.

2. Identify the proposed sample location ID in the field notebook along with other appropriate information collected during sediment sampling activities.

3. Measure the total depth of water using a weighted tape.

4. Lower a new piece of Waterra tubing of sufficient length (potentially with weight added) to a depth 1-2 feet above measurement from step 3.

5. Initiate pump and purge 3 tube volumes. Deactivate pump, but do not allow backflow.

6. Lower tubing to a depth 6 inches above measurement from step 3.

7. Initiate pump, wait until flocculate 'floc' comes to end of line, then collect floc in a beaker. When sufficient volume is available, fill sample container.

8. Label each sample container with the following: date, time, sample location, and depth of sample.

9. Place samples in a cooler on ice.

10. After the sampling at a sample location is completed and the appropriate sample jars filled, decontaminate re-useable sampling equipment in accordance with the section entitled Decontamination. Discard Waterra tubing.

3.4.12 Sediment Sampling with Ekman Dredge

The method of sediment sampling with the Ekman dredge consists of slowly lowering the grab sampler, in the open position, through the water column to the sediment surface with a cable or nylon rope. Once the sampler has reached the top of sediment, the dredge buckets are released, collecting a surface grab sample (depth depending on the dimensions of the dredge bucket). The Ekman dredge can be used in water of various depths and can be released from a boat, or off-water from a pier or bridge. This type of sediment sampler is most efficient in waters with little to no current. reached the sediment dredge method is best employed on consolidated, fine textured sediments as well as soft sediments, such as silt, muck and sludge in water.

Procedures for Use

1. Once at the predetermined sample location, anchor the boat if necessary to remain within a radius of approximately 1-5 meters from the originally identified sample location.

2. Identify the proposed sample location ID in the field notebook along with other appropriate information collected during sediment sampling activities.

3. Measure the total depth of water using a weighted tape.

4. Thread a study nylon cable through the top bracket of the sampler.

5. Arrange the Ekman dredge sampler so that the jaws are in the open position and trip cables are positioned over the release studs. Take extra precaution to ensure that there is nothing in the

way of the jaws during this step in the event of accidental deployment of the spring loaded jaw.

6. Slowly lower the sampler over the side of the boat to a point just above the sediment surface. When the sampler hits the surface of the sediment, the field person should be able to feel the impact.

7. Raise the dredge 6 inches above sediment surface.

8. Trigger the jaw release mechanism by lowering a messenger down the line.

9. Raise the sampler back up through the water column keeping the sampler upright.

10. Open the flaps of the sampler to get access to the collected sediment. Estimate the sample volume and percent water by volume. Record on sampling sheet.

11. Label each sample container with the following: date, time, sample location, and depth of sample.

12. Place samples in a cooler on ice.

3.5 Chain-of-Custody Forms

All samples submitted to the contract analytical laboratory for analyses, will be accompanied by a Chain-of-Custody form. Appropriate Chain-of-Custody procedures will be followed at all times during a sampling event and subsequent transport to the contract analytical laboratory. Refer to OP3026 for operation procedures on completing a Chain-of-Custody form and Chain-of-Custody procedures.

3.6 Decontamination

Sediment and wetlands soil sampling equipment brought into actual contact with a laboratory sample, other than sample containers, will be cleaned prior to and between each use according to Operating Procedure OP3000 – General Environmental Field Procedures and Protocol. After decontamination, the equipment will be wrapped in aluminum foil and placed on clean racks off the ground until it is used.

3.7 Quality Assurance/Quality Control

To assure quality of field sampling procedures, the following procedures must be followed:

- All data must be documented on field data sheets or within site logbooks.

- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in a Site work plan or related document. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be

documented.

Additional, project-specific collection of field quality control samples (e.g., field duplicates, equipment blanks, trip blanks, etc.) should be specified in the project WP, FSP, or QAPP. Project-specific QA/QC requirements supersede procedures described herein for that particular project.

Figure 1:
Sampling Augers

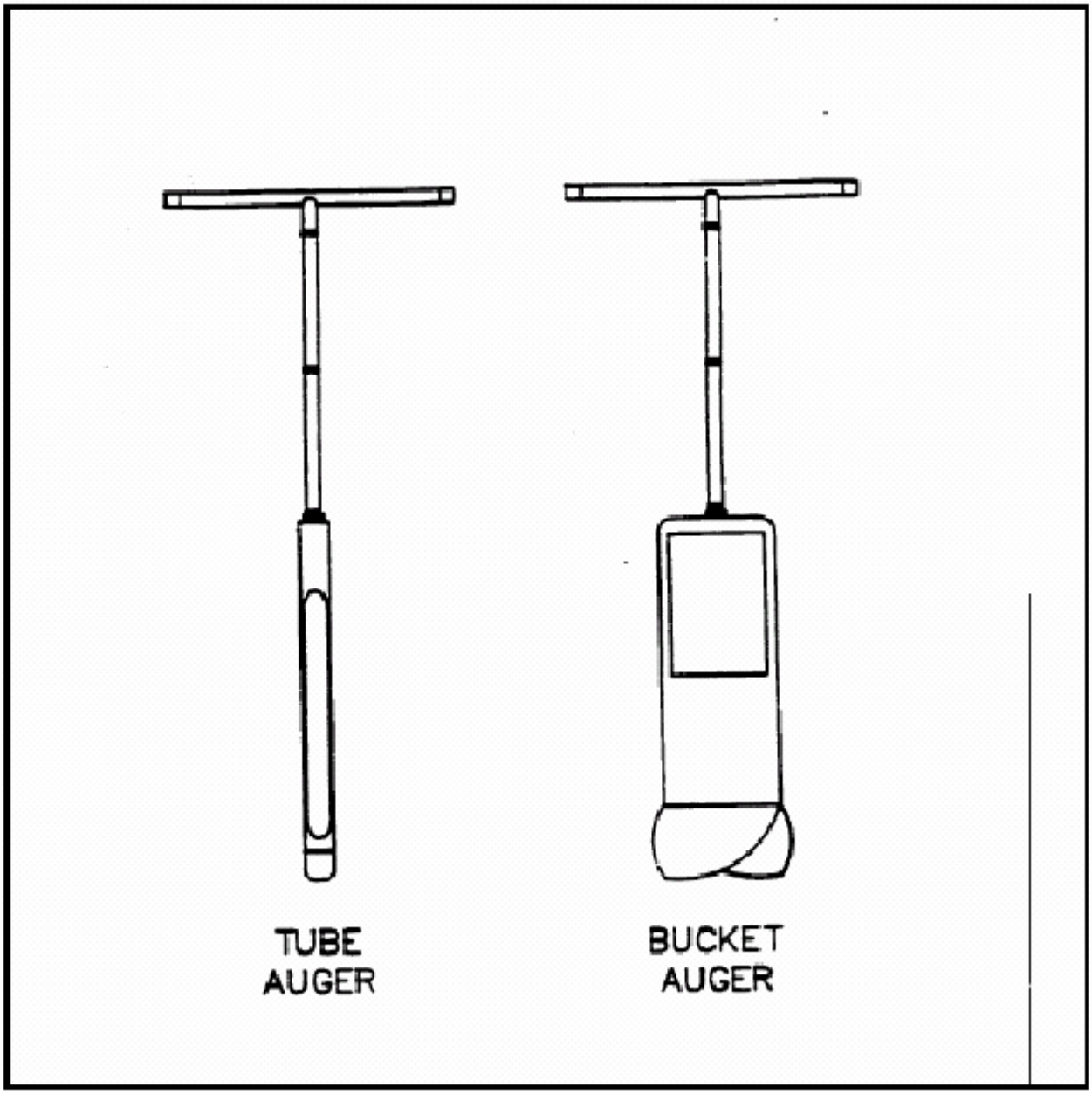


Figure 2:
Sample Coring Device

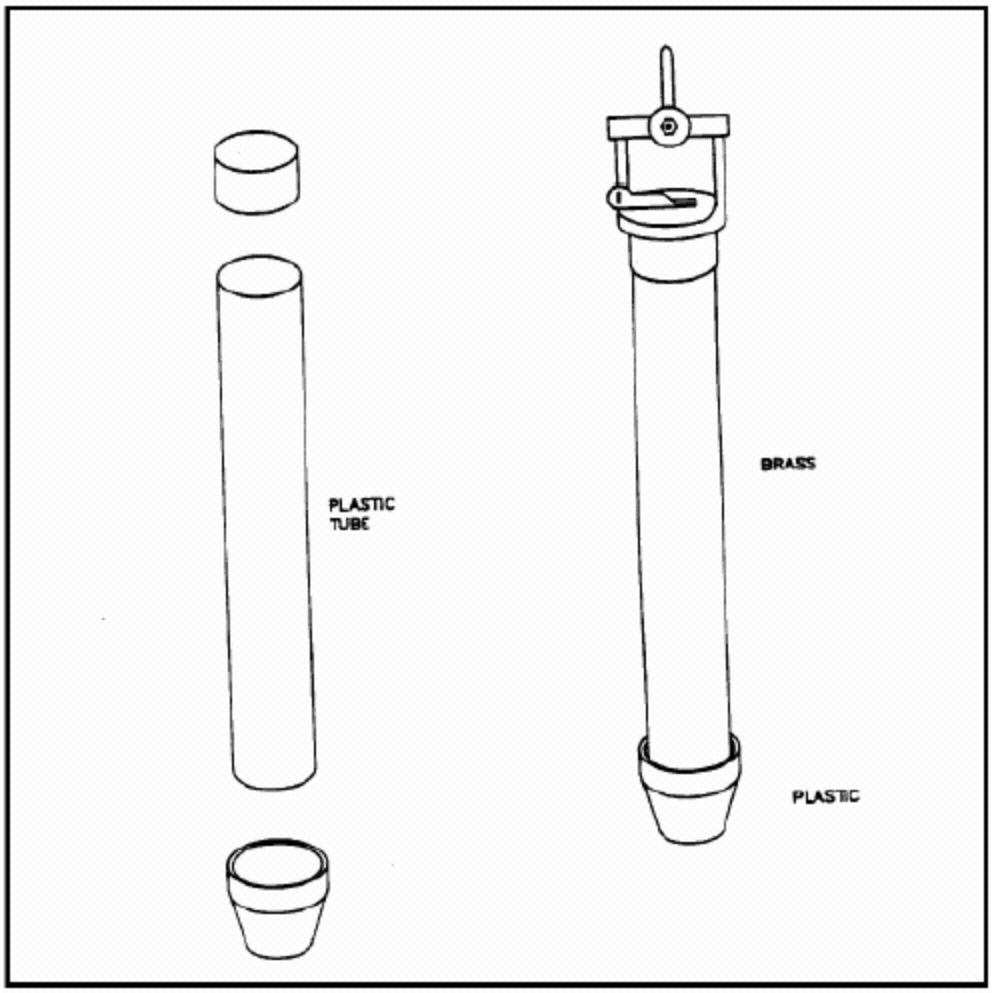
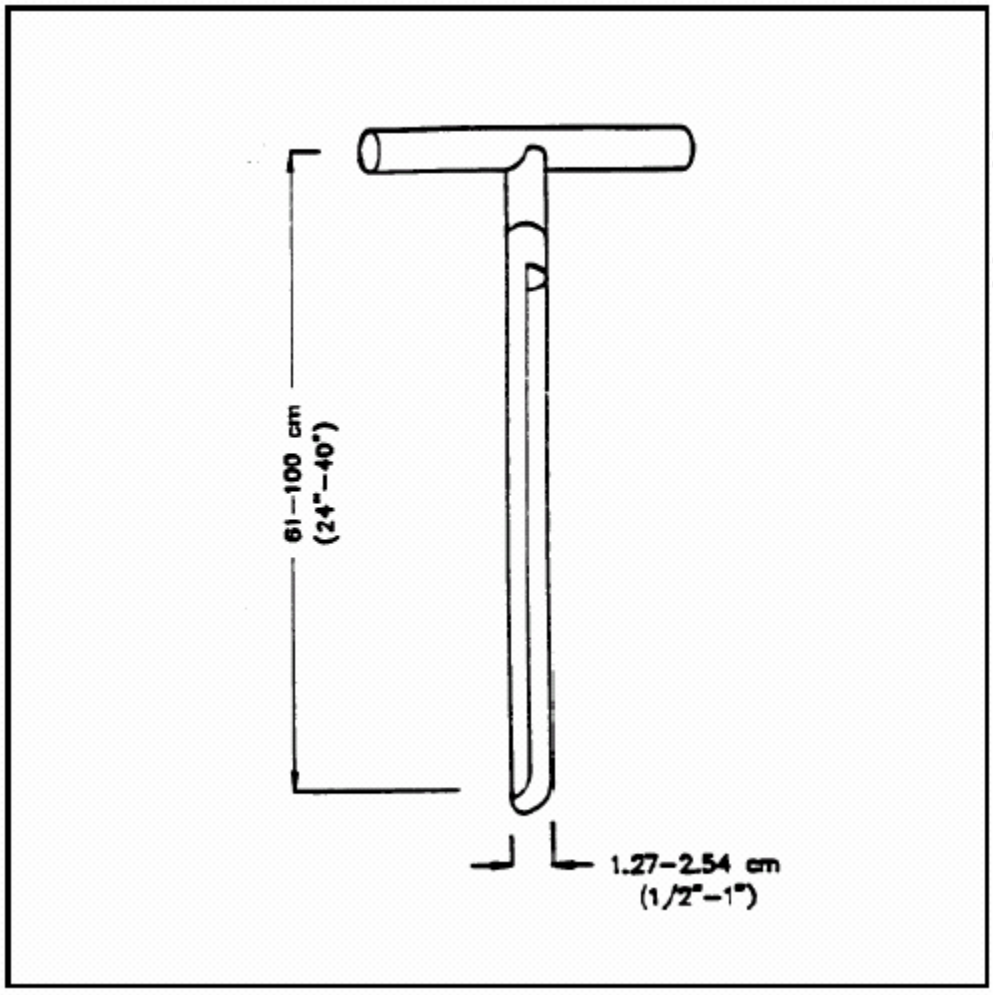


Figure 3:
Sampling Trier



APPENDIX A
REFERENCES

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APPENDIX B
RELATED HALEY & ALDRICH PROCEDURES

- OP2001 Identification and Description of Soils in the Field Using Visual-Manual Methods
- OP2005 Test Borings, Sampling, Standard Penetration Testing and Borehole Abandonment
- OP2026 Exploratory Test Pits
- OP3000 General Environmental Field Procedures and Protocol
- OP3001 Preservation and Shipment of Environmental Samples
- OP3003 Surficial Soil Sampling
- OP3006 Procedures for Subsurface Soil Sampling for Chemical Analysis
- OP3026 Chain of Custody

APPENDIX C
FORMS

All Haley & Aldrich field forms are maintained on the server at K:\techproc\sop\Forms. The following forms are attached:

- Form 3001 Sampling Labels (Environmental)
- Form 3002 Chain of Custody (Electronic)
- Form 3003 Chain of Custody (Field)
- Form 3004 Sampling Record

HALEY & ALDRICH

Sediment Sampling Data Sheet

Project		**Report No.**	
Location		**Date**	
Client		**File No.**	
Contractor		**Field Rep.**	
Weather		**Outdoor Temp**	

Sample Location ____________ **Sample ID** ____________ **Time** ____________

Pond Depth ____________

Sampling Device ____________ **Decon** ____________

Easting ____________ **Northing** ____________

Remarks: (ie: field filtrations, persons communicated with at site, etc.)

LOCATION ID:

Sample Location ____________ **Sample ID** ____________ **Time** ____________

Pond Depth ____________

Sampling Device ____________ **Decon** ____________

Easting ____________ **Northing** ____________

Remarks: (ie: field filtrations, persons communicated with at site, etc.)

LOCATION ID:

Sample Location ____________ **Sample ID** ____________ **Time** ____________

Pond Depth ____________

Sampling Device ____________ **Decon** ____________

Easting ____________ **Northing** ____________

Remarks: (ie: field filtrations, persons communicated with at site, etc.)

LOCATION ID:

Designation: D 4544 – 86 (Reapproved 2002)

Standard Practice for Estimating Peat Deposit Thickness[1]

This standard is issued under the fixed designation D 4544; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice uses a technique of probing to estimate the thickness of surficial peat deposits overlying mineral soil or bedrock. These estimates may be needed for energy, horticultural, or geotechnical purposes.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.3 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 *NRC Canada Document:*
Peat Testing Manual [2]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *peat*—a naturally occurring organic substance derived primarily from plant materials.

4. Summary of Practice

4.1 The resistance to penetration of a pushed or driven rod will increase sharply at the boundary of a peat layer with underlying mineral soil or bedrock. When this abrupt change is measured in a series of probings with an appropriate spacing, the thickness and areal extent of peat can be defined and the volume of peat may be calculated.

4.2 Sampling of the peat may be required to determine the peat characteristics.

5. Significance and Use

5.1 This practice allows the determination of the depth at which the resistance to penetration of a pushed or driven rod increases sharply. When the overlying material is peat and the underlying one is mineral soil or bedrock, the depth of change may be interpreted as the thickness of peat. Successive areal determinations of this depth, in combination with surface measurements of the lateral extent of peat will allow calculation of the volume of peat in the deposit.

6. Interferences

6.1 Sampling of the zone of contact of peat with underlying material is usually necessary to verify the interpretations of material change from the rod penetration resistances.

6.2 Where the peat – mineral transition zone is of significant thickness, or where the peat is underlain by soft clays or marls, further sampling and testing will be required (see 7.2).

6.3 The frequency of sampling is highly dependent upon the physical details of the deposit.

6.4 Penetration of the rod may be prevented by wood pieces in the peat deposit. Data should be examined and rechecked if this occurrence is suspected.

6.5 The thin and flexible nature of the rod strings will limit the depths of penetrating and sampling.

7. Apparatus

7.1 *Graduated Steel Rods*—Penetration is achieved with graduated steel rods of 9.5 ± 1.0-mm diameter and 1.0 or 1.2-m length,[3] which can be threaded together to penetrate a range of thickness. The rods are ringed at 200-mm intervals for easy estimation of depth. A ring with a short threaded end is

[1] This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.22 on Soil as a Medium for Plant Growth.

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[2] Available from the National Research Council of Canada, Publications Section, Building R-88, Ottawa, Ontario, Canada K1A OR6.

[3] For further information, see Jeglum, J. K., "Method for Measurement of Peat Thickness," *Peat Testing Manual*, Technical Memorandum No. 125, NRC Canada, May 1979, pp. 33–34.

screwed into the last section and another rod or stick inserted horizontally to facilitate pulling out the rod.

7.2 *Piston-Type Sampler*—Sampling is achieved, as necessary, with a piston-type or similar exploratory type sampler, the head of which is threaded into the bottom rod.[4]

8. Procedure

8.1 Align the rod vertically.

8.2 Penetrate the peat with the rod by pushing or driving. Add sections of rod as required.

8.3 Measure the thickness of peat when the resistance to penetration of the rod increases sharply owing to the resistance of the material underlying the peat. It may be possible to hear the scraping of the rod in the underlying soil, especially when it is sand.

8.4 Pull up the rod and seek verification of the resistance change by the presence of mineral material in the threads of the bottom rod.

8.5 Record the lateral position of the sounding.

8.6 Repeat steps 8.1-8.5 as necessary to define the thickness of the peat and its lateral extent.

8.7 At selected locations, attach the sampler and obtain peat and peat – mineral soil contact zone samples. When a piston-type sampler is attached to the bottom rod, the head is pushed down until resistance is met, the rod is pulled up until the central core catches at the end of the outer cylinder, and the open cylinder is then pushed a little further to obtain mineral material.

9. Report

9.1 The report shall include the following specific information:

9.1.1 Name and location of project; names of field party,

9.1.2 A map of the positions penetrated or sampled. Show surface elevations and water levels, where available,

9.1.3 A table of peat depths showing areal locations and noting whether depth was determined by penetration or sampling,

9.1.4 Descriptions of samples taken, along with locations,

9.1.5 Any test data run on samples taken, and

9.1.6 Appropriate description and classification of the peat in the deposit.

10. Keywords

10.1 deposit thickness; peat; probing

[4] This piston-type sampler and its use is described in *Muskeg Engineering Handbook*, I. C. MacFarlane, ed. Muskeg Subcommittee of the NRC Canada, 1969, pp. 144–145.