Sampling and Analysis Plan and Site-Specific Quality Assurance Project Plan for Supplemental Sediment and Surface Water Sampling Lincoln Lace & Braid Ponagansett Street Providence, Rhode Island

Prepared for

Providence Redevelopment Agency
400 Westminster Street
Providence, Rhode Island 02903

Prepared by

EA Engineering, Science, and Technology, Inc.
Airport Professional Park
2350 Post Road
Warwick, Rhode Island 02886

FINAL
August 2009
EA Project No. 61891.05

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Alan Peterson — Date
US Environmental Protection Agency

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LIST OF ACRONYMS

EA	EA Engineering, Science, and Technology, Inc.
QAPP	Quality Assurance Project Plan
RIDEM	Rhode Island Department of Environmental Management
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SVOC	Semi-volatile organic compound
VOC	Volatile organic compound

1. INTRODUCTION

EA Engineering, Science, and Technology, Inc. (EA), on behalf of the City of Providence Parks Department, is pleased to submit this Sampling and Analysis Plan (SAP) and Site-Specific Quality Assurance Project Plan (QAPP) for supplemental sampling of sediments and surface water to sufficiently characterize the sluiceway at the Lincoln Lace & Braid site located on Ponagansett Avenue in Providence, Rhode Island. Please refer to Figure 1 for a Site Location Map and Figure 2 for an Existing Conditions Plan. Previous site investigation reports have indicated sediments within the sluiceway are not impacted by contaminants above the Rhode Island Department of Environmental Management (RIDEM) applicable standards. However, previously unknown investigation reports found during a recent file review at RIDEM, conducted by EA on behalf of the City, document the collection and analysis of six sediment samples collected from within the sluiceway. During a meeting at RIDEM on 23 July 2009 between the City, EA, and RIDEM personnel, findings of the file review, potential remedial approaches, and further characterization were discussed.

2. HISTORICAL ANALYTICAL DATA

Analytical results indicate the presence of lead, arsenic, and petroleum hydrocarbons above RIDEM Residential and/or Industrial/Commercial Direct Exposure Criteria within sediments sampled from the sluiceway. Please find a table of the analytical results presented below.

Table 1 - Sediment Sampling Analytical Data - 26 May 1999**

Sample Designation	SS-44	SS-45	SS-46	SS-47	SS-48	SS-49	SS-50	RIDEM RDEC	RIDEM I/CDEC
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab	Composite		
TPH	**661**	**625**	**1120**	**600**	**736**	181	NA	500	2,500
Arsenic	**21.2**	**10.9**	10.5	7.46	24.6	11.1	NA	7.0	7.0
Lead	373	427	**537**	436	91.4	86.1	NA	150	500
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	0.00604	0.9	7.8
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	0.00571	0.4	0.8
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	0.00814	0.9	7.8
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	0.00235	0.8	10,000
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	0.00278	0.9	78
Chrysene	NA	NA	NA	NA	NA	NA	0.00609	0.4	780
Indeno (1,2,3-c,d) pyrene	NA	NA	NA	NA	NA	NA	0.00267	0.9	7.8
Pyrene	NA	NA	NA	NA	NA	NA	0.01360	13	10,000

* The sediment sampling results were compared to the RDEC and I/CDEC for comparison purposes only. No sediment criteria exist at this time.
**Data obtained from *Pre-Design Investigation Report, Former Lincoln Lace and Braid Company Site, Providence, RI, August 2000, RIDEM OWM*
Notes:
1. RDEC: Residential Direct Exposure Criteria
2. I/CDEC: Industrial/Commercial Direct Exposure Criteria
3. All concentrations presented in milligrams per kilogram (mg/kg, part per million)
4. NA: Not analyzed
5. **Bold**: Concentration exceeds RIDEM RDEC
6. Shaded: Concentration exceeds RIDEM I/CDEC

3. PROPOSED SURFACE WATER SAMPLING

EA proposes to collect three grab surface water samples during a relatively low flow period. However, the overall project schedule may impact the sampling schedule. EA will utilize EA Standard Operating Procedures (SOP) for surface water sampling (Appendix A). EA proposes three distinct sampling locations, as depicted on Figure 1, attached:

- Collect one sample set within the Woonasquatucket River 20 ft upstream from the sluiceway outlet.
- Collect one sample set within the Woonasquatucket River 20 ft downstream from the sluiceway outlet.
- Collect one sample set within the sluiceway 20 ft upstream from the sluiceway outlet. This sample set will also be analyzed for volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC).

The samples will be collected, placed in a cooler with ice, and delivered to a Rhode Island Certified Laboratory per accepted industry standard chain-of-custody protocols (Appendix B) for analysis of the following:

Analysis	Number of Samples	EPA Analysis Method	Preservative	Holding Time
Total Arsenic	6	200.7	HNO_3	6 months
Dissolved Arsenic	6	200.7	None	24 hours*
Total Lead	6	200.7	HNO_3	6 months
Dissolved Lead	6	200.7	None	24 hours*
Total Iron	6	200.7	HNO_3	6 months
Dissolved Iron	6	200.7	None	24 hours*
VOC	1	8260	HCl	14 days
SVOC	1	8270	None	14 days
* Samples must be filtered within 24 hours of sample collection. Once sampled, hold time is 6 months.				

4. PROPOSED SEDIMENT SAMPLING

EA proposes to collect eight grab sediment samples during a relatively low flow period. However, the overall project schedule may impact the sampling schedule. EA will utilize EA SOP for sediment sampling (Appendix C). EA proposes to collect the samples at 20-ft intervals directly upstream of the riprap dam (Figure 3). The samples will be collected using a hand auger in accessible areas. Iron floc will be removed from the sample prior to containerizing. The aim of removing iron floc from the samples is to isolate sediment for analysis. EA hypothesizes that floc was included within historical sediment samples collected. The floc may be a primary source of contamination. Therefore, isolation of the sediment from the iron floc will allow EA to develop a comprehensive remedial action plan for the sluiceway.

The sediment samples will be collected and placed in a cooler with ice and delivered to a Rhode Island Certified Laboratory per accepted industry standard chain-of-custody protocols for analysis of the following:

Analysis	Number of Samples	EPA Analysis Method	Preservative	Holding Time
Total Arsenic	8	6010	None	6 months
Total Lead	8	6010	None	6 months
Total Iron	8	6010	None	6 months
Total Petroleum Hydrocarbons	8	8100	None	14 days

5. IRON FLOC SAMPLING

EA proposes to collect two samples of iron floc. These sampling locations will be determined in the field by identifying areas of significant iron floc accumulation. The floc samples will be collected using a hand auger in accessible areas. Discussions with ESS Laboratory of Cranston, Rhode Island indicated that they should be able to adjust interference settings to reduce interference of iron with the analysis of lead and arsenic. This methodology will differentiate both matrices (floc and sediment), thereby determining the primarily impacted media.

The iron floc samples will be collected and placed in a cooler with ice and delivered to ESS Laboratory per accepted industry standard chain-of-custody protocols for analysis of the following:

Analysis	Number of Samples	EPA Analysis Method	Preservative	Holding Time
Total Arsenic	8	6010	None	6 months
Total Lead	8	6010	None	6 months

6. QUALITY ASSURANCE/QUALITY CONTROL

6.1 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

ESS Laboratory will be performing analytical services for this contract. Please refer to the ESS Laboratory SOP for each matrix, provided as Appendix D. ESS will provide a laboratory data package deliverable that will indicate the quality control results from the laboratory analysis.

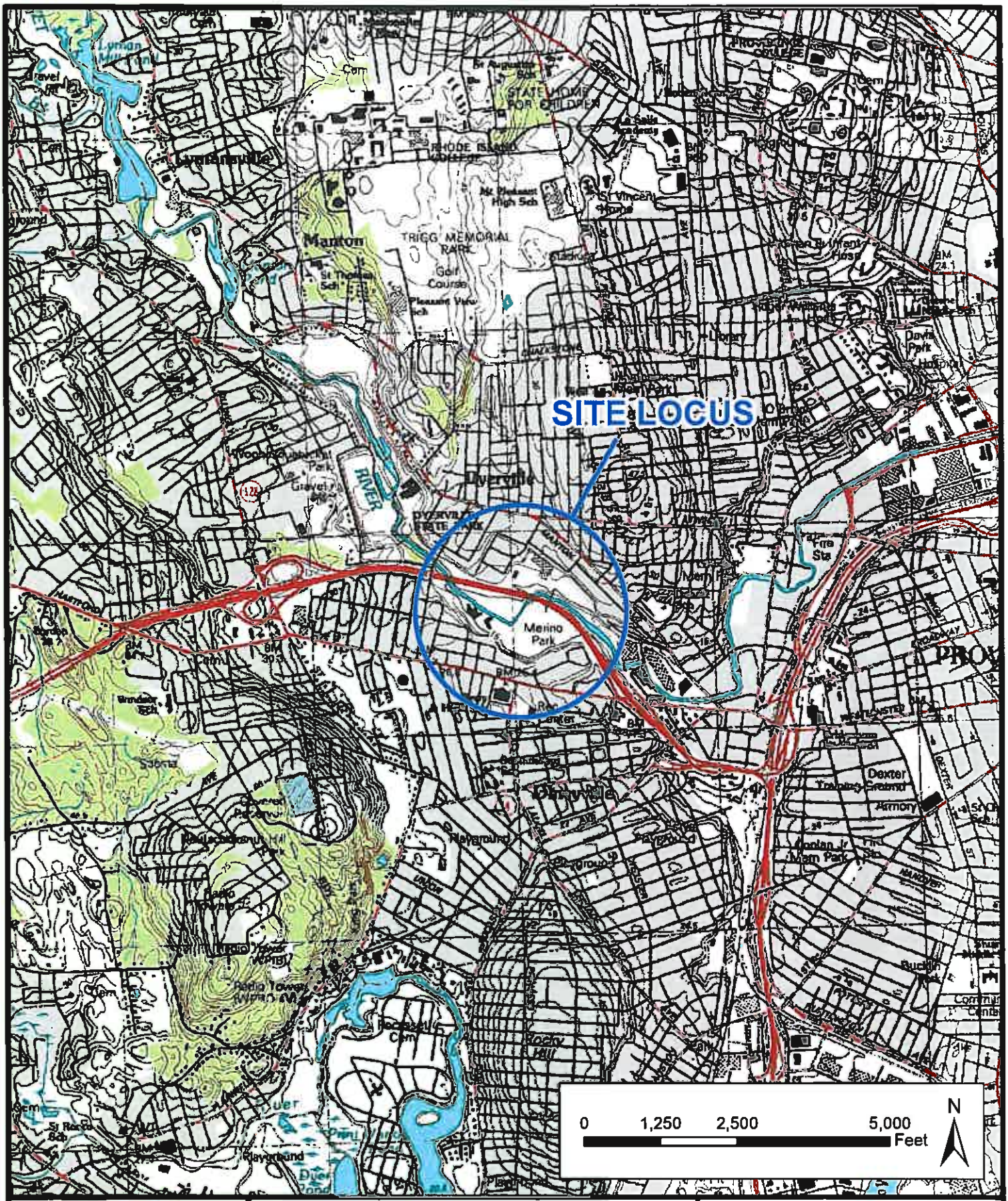
6.2 VERIFICATION AND VALIDATION PROCEDURES

The EA project Manager will be responsible for the overall validation and final approval of the data in accordance with the project purpose and use of the data. The field data will be reviewed and verified throughout the field program. The laboratory data verification will be applied to all of the laboratory data.

The Project Manager will review the data packages provided by the laboratory and manually check the sampling documents (chain-of-custody), the presence of all analyses and analytes, the use of required sample preparation and analysis procedures, and the correctness of concentration units. The method detection and reporting limits will be evaluated against the project requirements. Results of the data review will be included in the summary letter report.

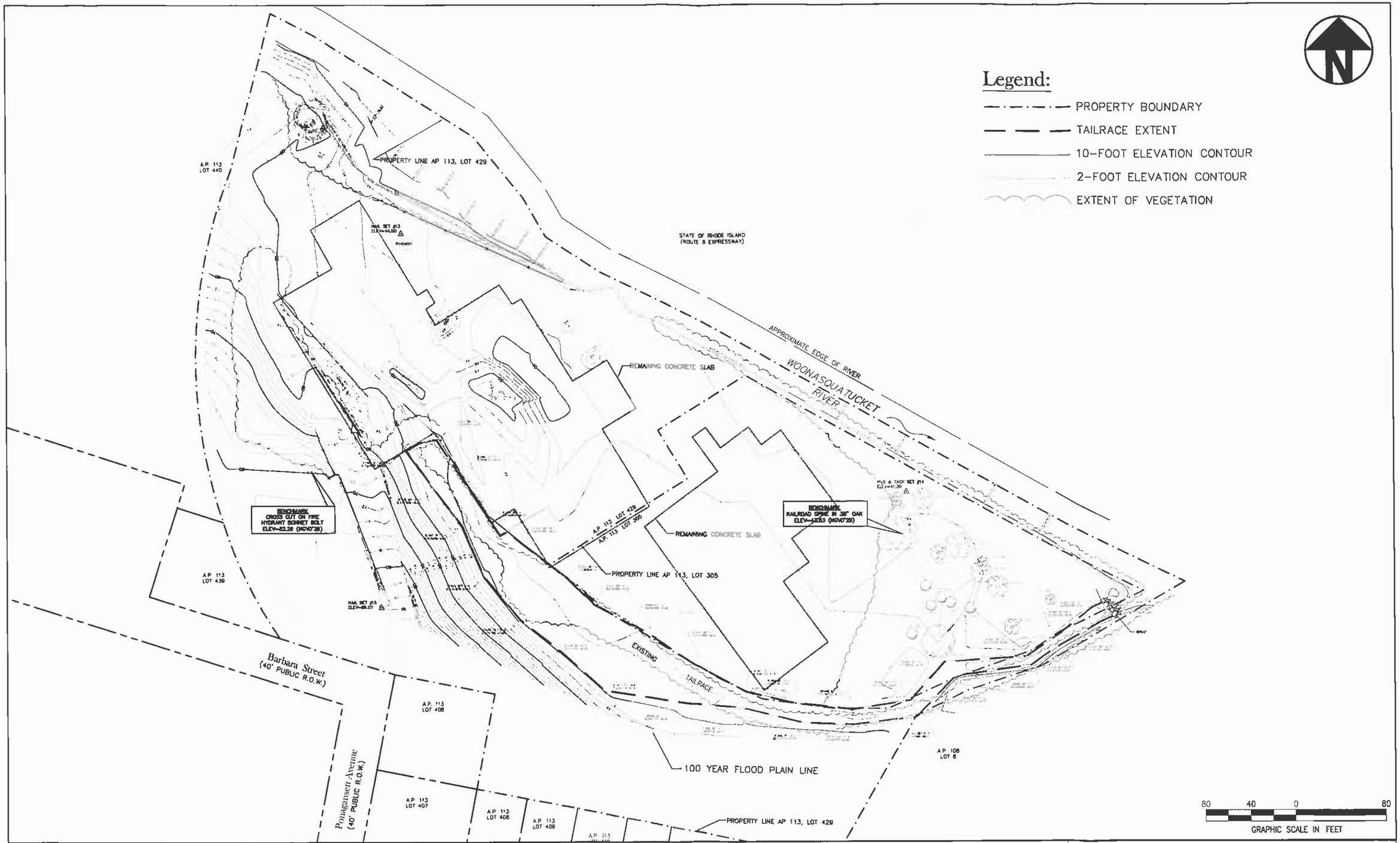
6.3 REPORTS AND DATA PRESENTATION

The summary letter report will present the data collected in a tabular format and provide figures with sample locations. The letter report will include a summary of field and laboratory procedures, the results of the sample analyses, a brief assessment of the data quality, and findings and recommendations. The report will be forwarded to RIDEM for review and approval, as well as USEPA Region I and the City of Providence.



EA	LINCOLN LACE & BRAID 55 PONAGANSETT STREET PROVIDENCE, RI	FIGURE 1 SITE LOCUS

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
MKS	RM	PT	MKS	AS SHOWN	AUGUST 2009	61891.05	LLB_LOCUS.MXD

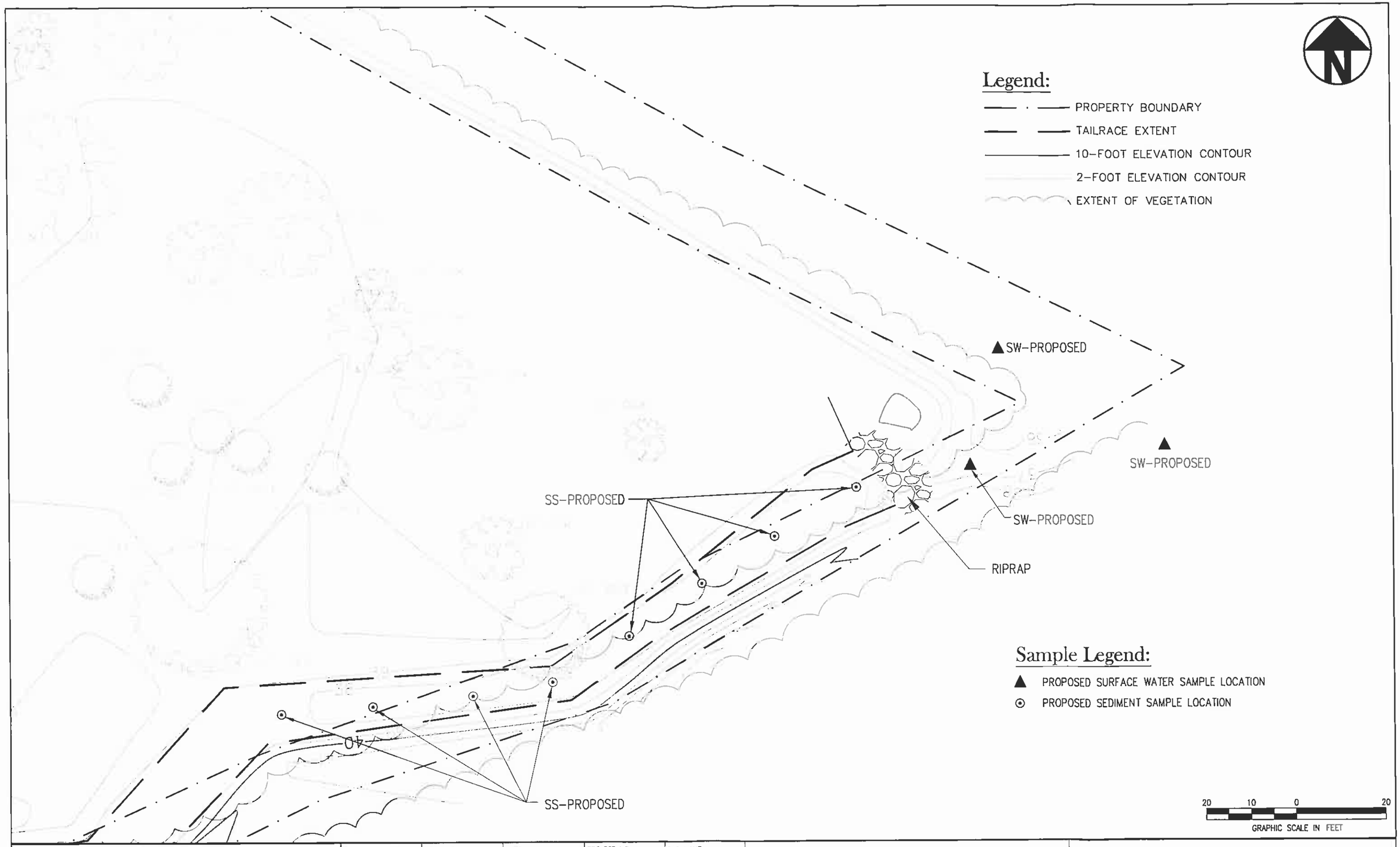


EA ENGINEERING, SCIENCE, AND TECHNOLOGY

DESIGNED BY	DRAWN BY	DATE	PROJECT NO	FILE NAME
RGM	DPA	8-19-2009	61891.05	-
CHECKED BY	PROJECT MGR	SCALE	DRAWING NO.	FIGURE
MKS	MKS	1" = 80'	-	2

LINCOLN LACE AND BRAID REMEDIATION PROJECT
PROVIDENCE, RHODE ISLAND

EXISTING CONDITIONS PLAN
FIGURE 2



EA ENGINEERING, SCIENCE, AND TECHNOLOGY

DESIGNED BY	DRAWN BY	DATE	PROJECT NO.	FILE NAME
RGM	DPA	7-23-2009	61891.05	-
CHECKED BY	PROJECT MGR.	SCALE	DRAWING NO.	FIGURE
MKS	MKS	1" = 20'	-	3

LINCOLN LACE AND BRAID REMEDIATION PROJECT
PROVIDENCE, RHODE ISLAND

PROPOSED SAMPLING PLAN
FIGURE 3

APPENDIX A

EA SOP 021
Sediment Sampling

Standard Operating Procedure No. 021
for
Sediment Sampling

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
Hunt Valley, Maryland 21031

Revision 0
August 2007

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1. SCOPE AND APPLICATION

This Standard Operating Procedure delineates protocols for sampling sediments from streams, rivers, ditches, lakes, ponds, and lagoons.

EA recognizes that other protocols have been developed that meet the criteria of quality and reproductivity. Clients may have their own sediment sampling protocols which may contain methodologies and procedures that address unique or unusual site-specific conditions or may be in response to local regulatory agency requirements. In such cases, EA will compare its and the client's protocols. The goal is to provide the client with the most quality; therefore, if the client's protocols provide as much or more quality assurance than EA's protocols for the particular site or project, EA will adopt those particular protocols and this Standard Operating Procedure will be superseded in those respects. If EA is required to implement the client's protocols in lieu of EA's protocols, EA will make the client formally aware of any concerns regarding differences in protocols that might affect data quality and will document such concerns in the project file.

2. PROCEDURES

The water content of sediment varies. Sediments range from soft to dense and fine to rocky. A variety of equipment may be necessary to obtain representative samples, even at a single site. Factors to consider in selecting the appropriate sample equipment include sample location (edge or middle of the waterbody), depth of water and sediment, grain size, water velocity, and analytes of interest.

3. GENERAL PROCEDURES

1. Surface water and sediment samples are to be collected at the same location.

2. Collect the surface water sample first. Sediment sampling usually results in disturbance of the sediments, which may influence the analytical results of the surface water samples.

3. Wear gloves when collecting samples. Consult the Health and Safety Plan for proper personal protective equipment.

4. If sampling from a boat or near waterbodies with depths of 4 ft or more, the sampling team will wear life jackets.

5. Wading into a waterbody disturbs the sediment. Move slowly and cautiously, approach the sample location from downstream. If flow is not strong enough to move entrained particles away from the sample location, wait for the sediment to resettle before sampling.

6. Collect samples first from areas suspected of being the least contaminated, thus minimizing the risk of cross-contamination.

7. Collecting samples directly into sample containers is not recommended. Sediment samples should be placed in Teflon®, stainless steel, or glass trays, pans, or bowls for sample preparation.

8. Use the proper equipment and material construction for the analytes of interest. For example, for volatile organic compound analysis, the sampling material in direct contact with the sediment or surface water must consist of Teflon, polyethylene, or stainless steel.

9. Use proper decontamination methods before and after sampling and between samples.

10. Collect samples for volatile organic compound analysis first. Do not mix such samples before placing them in the sample containers. For composite volatile organic compound samples, place equal aliquots of each subsample in the sample container.

11. Sediment that will be analyzed for other than volatile organic compounds should be prepared as follows:

    - Place the sediment in a mixing container.
    - Divide the sediment into quarters.
    - Mix each quarter separately and thoroughly.
    - Combine the quarters and mix thoroughly.
    - For composite samples, mix each subsample as described above. Place equal aliquots of each subsample in a mixing container and follow the procedure described above.

12. Mark the sampling location on a site map. Photograph (optional, recommended) and describe each location, and place a numbered stake above the visible high water mark on the bank closest to the sampling location. The photographs and description must be adequate to allow the sampling station to be relocated at a future date.

13. Dispose of investigation-derived wastes according to applicable rules and regulations.

4. CORERS

A corer provides a vertical profile of the sediment, which may be useful in tracing historical contaminant trends. Because displacement is minimal, a corer is particularly useful when sampling for trace metals and organics. Corers can be constructed out of a variety of materials.

For example, a 2-in. diameter polyvinyl chloride pipe with a Teflon or polyethylene liner can be lowered into the sediment; a 2-in. diameter well cap can be used to form an airtight seal and negative pressure as the pipe is withdrawn.

- Ensure that the corer and (optional) liner are properly cleaned.
- Stand downstream of the sample location.
- Force the corer into the sediment with a smooth continuous motion. Rotate (not rock) the corer if necessary to penetrate the sediment.
- Twist the corer to detach the sample; then withdraw the corer in a single smooth motion. If the corer does not have a nosepiece, place a cap on the bottom to keep the sediment in place.
- Remove the top of the corer and decant the water (into appropriate sample containers for surface water analysis, if required).
- Remove the nosepiece or cap and deposit the sample into a stainless steel, Teflon, or glass tray.
- Transfer the sample into sample containers using a stainless steel spoon (or equivalent device).

5. SCOOPS AND SPOONS

When sampling at the margins of a waterbody or in shallow water, scoops and spoons may be the most appropriate sampling equipment. For collecting samples several feet from shore or in deeper water, the scoop or spoon may be attached to a pole or conduit.

- Stand downstream of the sample location.
- Collect the sample slowly and gradually to minimize disturbing the fine particles.
- Decant the water slowly to minimize loss of fine particles.
- Transfer the sediment to sample containers or mixing trays, as appropriate.

6. DREDGES

Three types of dredges are most frequently used: Peterson, Ponar, and Eckman. Many other dredge types are available; their applicability will depend on site-specific factors.

6.1 PETERSON AND PONAR DREDGES

- These dredges are suitable for hard, rocky substrates, deep waterbodies, and streams with fast currents. Ponars have top screens and side plates to prevent sample loss during retrieval.
- Open the jaws and place the cross bar into the proper notch.
- Lower the dredge to the bottom, making sure it settles flat.
- When tension is removed from the line, the cross bar will drop, enabling the dredge to close as the line is pulled upward during retrieval.
- Pull the dredge to the surface. Make sure the jaws are closed and that no sample was lost during retrieval.
- Open the jaws and transfer the sediment to sample containers or to a mixing tray.

6.2 ECKMAN DREDGE

- The Eckman dredge works best in soft substrates in waterbodies with slow or no flow.
- Open the spring-loaded jaws and attach the chains to the pegs at the top of the sampler.
- Lower the dredge to the bottom, making sure it settles flat.
- Holding the line taut, send down the message to close the jaws.
- Pull the dredge to the surface. Make sure the jaws are closed and that no sample was lost during retrieval.
- Open the jaws and transfer the sediment to sample containers or to a mixing tray.

APPENDIX B

EA SOP 007
Chain of Custody Protocols

Standard Operating Procedure No. 002
for
Chain-of-Custody Form

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
Hunt Valley, Maryland 21031

Revision 0
August 2007

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1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to delineate protocols for use of the chain-of-custody form. An example is provided as Figure SOP002-1. Other formats with similar levels of detail are acceptable.

2. MATERIALS

The following materials may be required: chain-of-custody form and indelible ink pen.

3. PROCEDURE

- Give the site name and project name/number.
- Enter the sample identification code.
- Indicate the sampling dates for all samples.
- List the sampling times (military format) for all samples.
- Indicate "grab" or "composite" sample with an "X."
- Specify the sample location.
- Enter the total number of containers per cooler.
- List the analyses/container volume.
- Obtain the signature of sample team leader.
- State the carrier service and airbill number, analytical laboratory, and custody seal numbers.
- Sign, date, and time the "relinquished by" section.
- Upon completion of the form, retain the shipper copy, and affix the other copies to the inside of the sample cooler, in a zip-seal bag to protect from moisture, to be sent to the designated laboratory.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

None.

6. REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80.

U.S. EPA. 1990. Sampler's Guide to the Contract Laboratory Program. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C. December.

U.S. EPA. 1991. User's Guide to the Contract Laboratory Program. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response. January.

EA Engineering, Science, and Technology, Inc.

Company Name:	Project Manager or Contact: Phone:
Project No. Dept.: Task:	Project Name:
Sample Storage Location:	ATO Number:
Page of	**Report #:**

Parameters/Method Numbers for Analysis

Chain of Custody Record

EA Laboratories
19 Loveton Circle
Sparks, MD 21152
Telephone: (410) 771-4950
Fax: (410) 771-4077

Report Deliverables:
1 2 3 4 D E

EDD: Yes/No

DUE TO CLIENT: _____

Date	Time	Water	Soil	Sample Identification 19 Characters	No. of Containers	EA Labs Accession Number	Remarks
							LPM:

Samples by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Date/Time	Received by Laboratory: (Signature)	Date/Time	Airbill Number:	Sample Shipped by: (Circle) Fed Ex. Puro. UPS Hand Carried Other:
Cooler Temp. _____C pH: ___Yes ___No Comments:				**Custody Seals Intact ___Yes ___No**	
NOTE: Please indicate method number for analyses requested. This will help clarify any questions with laboratory techniques.					

APPENDIX C

EA SOP 002
Surface Water Sampling

Standard Operating Procedure No. 007
for
Surface Water Sampling Procedures

Prepared by

EA Engineering, Science, and Technology, Inc.
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Hunt Valley, Maryland 21031

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1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to delineate protocols for sampling surface water. This procedure can be applied to the collection of surface water samples from streams, rivers, ditches, lakes, ponds, and lagoons. Surface water samples provide an indication of the amount of contaminant in the surface water. It is, therefore, important to collect a representative sample.

2. MATERIALS

The following materials may be required:

0.45-µ disposable filters	Sample bottles
Cooler with ice	Short-handled dip sampler (PTFE) or stainless steel)
Long-handled dip sampler (polytetrafluoroethelyne [PTFE] or stainless steel)	Stainless steel or PTFE-lined bucket
Peristaltic pump with 0.45-µM filters and disposable tygon tubing	

3. PROCEDURE

For all surface water samples, mark the sampling locations on a site map. Photograph (if cameras are allowed onsite) and describe each location, and place a numbered stake above the visible high water mark on the bank closest to the sampling location, and/or mark adjacent trees with surveyor's flagging. The photographs and descriptions must be adequate to allow the sampling station to be relocated at some future date by someone other than the original sampling crew. Use the long handled dip sampler where access is poor or non-contact with water is suggested in the Health and Safety Plan.

Sampling should performed deliberately and methodically to minimize disturbance of bottom sediments, yet as quickly as possible to ensure a representative sample. To prevent contamination of the exterior of the sample container, and/or potential contamination of the surface water sample by laboratory contaminants on the exterior of the bottle, the sample container should never be dipped into the water, rather a decontaminated, long-handled or measuring cup-type PTFE or stainless steel sampler, or a sampling bucket should be used to collect unfiltered samples.

Sampling with the PTFE or stainless steel sampler (long-handled or measuring cup-type):

- Remove the cap from the sample bottle.
- Dip a sample of surface water using the sampler.

- Tilt sample bottle and gently pour sample from sampler into the bottle. Allow the sample to trickle down the side of the bottle. Avoid aerating the sample.

- Add preservative as required by SOP No. 039. Replace cap, and place in cooler immediately.

Sampling with stainless steel or PTFE-lined bucket:

- Remove cap from sample bottle.

- Gently dip collection bucket in the water. Fill bucket and carefully lift from water body.

- Tilt sample bottle and gently pour sample from sampler into the bottle. Allow the sample to trickle down the side of the bottle. Avoid aerating the sample.

- Add preservative as required by SOP No. 039. Replace cap, and place in cooler immediately.

– OR –

- Use smaller sampling cup to transfer sample from bucket to sample bottle as described above.

Both filtered and unfiltered samples will be taken for metals analyses. Bulk samples for filtration will be collected using the stainless steel or PTFE-lined bucket method described above. Sample filtration must be performed immediately upon retrieval of the bulk sample as follows.

Filtration will be performed immediately after collecting sample. Set up filtration equipment prior to collecting sample. Filtration may be accomplished by gravity, or if necessary, due to slow filtering, a peristaltic pump will be used to pressure filter the sample. Vacuum filtration will not be used due to the possibility of analyte volatilization.

Gravity filtration will be accomplished as follows:

- Using decontaminated forceps, place a 0.45-µM membrane in a decontaminated filter funnel.

- Slowly pour sample into the funnel and collect filtrate directly into appropriate sample container(s).

- Add preservative(s) as required by SOP No. 039. Immediately cap container and place in cooler.

- Dispose of filter membrane.

Pressure filtration will be accomplished as follows:

- Using previously assembled disposable tubing, 45-µ in-line filter, and peristaltic pump, filter sample from collection bucket into appropriate container.
- Adjust pump rate to avoid aeration of sample.
- Fill container, preserve as indicated in SOP No. 039, immediately cap container and place in cooler.
- Dispose of filter and tubing.

Refer to SOP Nos. 001, 002, 004, 005, 016, and 039.

4. MAINTENANCE

Refer to manufacturer's specifications for maintenance procedures on generators and pumps.

5. PRECAUTIONS

Avoid disturbing bottom sediments.

Consult the Health and Safety Plan prior to collecting any samples for personal protective equipment such as dermal and respiratory protection and personal flotation devices when sampling in or near deep water or from boats.

Always decontaminate the sampling and filtration equipment, and change gloves between sampling locations to minimize the risk of cross-contamination.

Always set up generators downwind of working area. Never service generators onsite.

6. REFERENCES

None.