Proactive by Design

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

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July 6, 2017
File No. 03.003930.08

Ms. Shauna Little
United States Environmental Protection Agency – Region 1
5 Post Office Square, Mail Code OEP06-4
Boston, Massachusetts 02109-3912

Re: Submittal of Notice of Intent
Remediation General Permit
UMASS- UCRR
100 Morrissey Blvd
Boston, Massachusetts

Dear Ms. Little:

On behalf of the University of Massachusetts (Owner) and Bond Bothers, Inc. (Construction Manager; Operator), GZA is submitting the attached Notice of Intent (NOI) form (Attachment 1) for the Remedial General Permit (RGP) for the Utility Corridor and Roadway Relocation (UCRR) Project located in Boston, Massachusetts.

BACKGROUND

The UCRR Project consists of the reconfiguration of roadways and utilities in accordance with the campus master plan. The site is located on a peninsula (Columbia Point) that extends into Dorchester Bay to the north of Savin Hill Cove. A site locus plan is included as Figure 1 (Attachment 2), and a site plan is shown on Figure 2 (Attachment 3). Historically, the site was a municipal landfill. Additionally, a manufactured gas plant (MGP) was constructed in what is today the western portion of the campus and was in operation from the late 1880s to the 1930s. The landfill was closed in 1971 and the UMASS campus was constructed in the early 1970's. The site is tracked under MassDEP Release Tracking Number (RTN) 3-31002.

The project team anticipates that construction dewatering may be required to control groundwater during excavations for utility installation, and that groundwater pumped from the construction site will be infiltrated into the ground water via infiltration pits. However, in the event that the infiltration pits do not provide adequate recharge capacity, the collected groundwater will be introduced into storm drains that discharge to either Dorchester Bay or Savin Hill Cove. There are eight possible discharge points (Outfall Numbers 1 through 8) shown on Figure 2 (Attachment 3) that may be used for this discharge, depending upon the progression of the work zone along the utility corridor.

The dewatering will be accomplished using submersible pumps and lined sump pits which will discharge to a 5,000-gallon sedimentation tank for sediment removal. If additional storage, as needed for sedimentation or for storage, is needed, a second 10,000-gallon sedimentation tank will be installed in series. In addition to the sedimentation tank(s), water will be pumped through a bag filter system and a 1,000-pound liquid phase granular activated carbon (LGAC) unit prior to discharge to the storm drains. Sample ports will be installed at the end of the treatment train to allow monitoring of water quality, and a flow meter will be installed so that the discharge quantity can be recorded. A process flow diagram is included in Figure 3 (Attachment 4).

The sedimentation tank will be cleaned out when accumulated sediments reach 1 foot in depth. The bag filters will be changed out regularly to maintain flow and acceptable head loss. Bag filters will be installed in parallel to accommodate continuous filtering while filters are being changed out. The treatment system will be accessible for maintenance, monitoring, and sampling purposes. The treatment system will be moved periodically along the utility corridor to facilitate dewatering operations; the location of the treatment system shown on Figure 2 is one of several potential locations which may be utilized during the course of the project. The discharge will enter Dorchester Bay or Savin Hill Cover via the outfall closest to the treatment system.

NOTICE OF INTENT

This NOI has included a review of literature pertaining to Areas of Critical Environmental Concern (ACEC), the Endangered Species Act (ESA), and the National Historic Preservation Act (NHPA), as documented below:

- A review of Appendix II of the Remediation General Permit, "Summary of Endangered Species Act Listings," indicated that the Northern Long-eared Bat is located state-wide. However, this species is not likely to be present at the 100 Morrissey Boulevard site due to the densely-developed nature of the Site. The Roseate Tern and Red Knot were identified as endangered/threatened species that may be present near the Site; however, it is not likely that these species will be affected by site activities. A review of the Massachusetts Geographic Information Systems (MassGIS) DEP Priority Resources Map of Boston shows that there are no ACECs and no habitats of Species of Special Concern or Threatened or Endangered Species within 500 feet of the subject site. A review of the United States Fish and Wildlife Service (USFWS) Environmental Conservation Online System (ECOS) indicates that coastal sections along Suffolk county are not listed as locations where a Roseate Tern nesting population is known or is believed to occur. A review of the Audubon field guide for the Red Knot indicates that if present, they are typically located on tidal flats or along the shoreline vegetation. Since the work area does not disturb the tidal flats or vegetated shoreline areas, it is anticipated that no effects to the Red Knot will occur. Review of the IPaC online resource of the USFWS also indicated that no critical habitats are present at the Site. Informal consultation was conducted with the USFWS and the results letter is attached in Attachment 5. Therefore, permit eligibility meets "Criterion B."

- Review of the "Essential Fish Habitat Designations" for the 10 minute x 10 minute quadrangle encompassing Boston Harbor (Attachment 5) indicated that Essential Fish Habitats for listed species under the jurisdiction of the National Marine Fisheries Service (NMFS) are not likely to be present. Based upon the assumptions presented by EPA in its Endangered Species Act (ESA) concurrence with NMFS, it is GZA's opinion that the Site discharge is in accordance with those assumptions and is unlikely to adversely affect listed species or modify critical habitats under the jurisdiction of NMFS, and is eligible to select the NMFS criterion in Section G of Attachment 1.

- A review of the Massachusetts Cultural Resource Information System on-line database, made available through the Massachusetts Historical Commission, indicated several listings for historical properties. The documentation of this review can be found in Attachment 6. As described above, the water generated during remedial activities will be treated on-Site and then pumped directly into a catch basin located on-Site; the historical properties adjacent to the Site will not be affected by the discharge, and thus permit eligibility meets "Criterion B."

- Water Quality Based Effluent Limits (WQBELs) based on the Site influent and receiving water sampling data were calculated using the spreadsheet included in Appendix V of the RGP (Attachment 7). Results applicable to this discharge are included in Section D(4) of the NOI.

- A letter was provided to the City of Boston to notify it of the proposed discharge operating in accordance with the NPDES RGP Permit. A copy of the notification is included in Attachment 8.

- Laboratory analytical results, summarized in the NOI (Attachment 1), are included as Attachment 9. Groundwater influent samples were collected from four monitoring well locations (U-701, U-702, U-703, and U-9B) on June 7, 2017. These samples were analyzed for Ammonia, Total Metals, VOCs, SVOCs, Total Suspended Solids, Chlorides, and 1,4-Dioxane. Groundwater influent data collected on October 8, 2014, from monitoring well locations U-6, U-9B and U-108, was previously submitted to EPA as part of a NOI under the 2010 RGP; this data was used to confirm that some constituents of concern were known to be absent. These substituted data collected in 2014 were analyzed using laboratory methods of sufficient sensitivity in accordance with Appendix VII, and therefore did not require reanalysis. Refer to Figure 2 (Attachment 3) for the approximate locations of Site monitoring wells. Due to the confirmed absence of fuel parameters in the influent ethanol is a parameter which is not believed to be present at the Site.

- The receiving water was sampled upstream of Outfall 1 on June 7, 2017. Physical parameters including pH, temperature, and salinity were collected using a low flow sampling apparatus fitted with instrumentation capable of accurately measuring these parameters. The physical parameter results are reported in section D(4) of the NOI.

- A dilution factor for metals was not calculated for the discharge since a dilution factor of zero is appropriate for a discharge to tidally influenced waters.

- A Best Management Practices Plan (BMPP) will be implemented upon the initiation of Site discharge.

Please do not hesitate to contact the undersigned at 781-278-3700 if you have any questions or require further information.

Very truly yours,
GZA GEOENVIRONMENTAL, INC.

Andrew Sargent, E.I.T.
Engineer I

Lawrence Feldman, LSP, Ph.D.
Senior Principal

Randy Meuse
Consultant/Reviewer, Principal

Attachments: Attachment 1: NOI Form
Attachment 2: Figure 1 – Site Locus Map
Attachment 3: Figure 2 – Site Plan and Storm Drain Outfall Locations
Attachment 4: Figure 3 – Process Flow Diagram
Attachment 5: ESA and EFH Documentation
Attachment 6: MHC Report
Attachment 7: WQBEL Calculation Spreadsheet
Attachment 8: City of Boston Notification
Attachment 9: Laboratory Analytical Reports

cc: MassDEP – Northeastern Region

ATTACHMENT 1

NOI FORM

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II. Suggested Format for the Remediation General Permit Notice of Intent (NOI)

A. General site information:

<table>
<tr><td rowspan="3">1. Name of site:
University of Massachusetts Boston</td><td colspan="3">Site address: 100 Morrissey Boulevard
Street:</td></tr>
<tr><td colspan="2">City: Boston</td><td>State: MA</td><td>Zip: 02125</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="4">2. Site owner
Commonwealth of MA - UMASS Boston

Owner is (check one): ☐ Federal ■ State/Tribal ☐ Private
☐ Other; if so, specify:</td><td colspan="3">Contact Person: Zehra Schneider Graham</td></tr>
<tr><td colspan="2">Telephone: 617-287-5444</td><td colspan="2">Email: zehra@umb.edu</td></tr>
<tr><td colspan="3">Mailing address: 225 Franklin Street, 12th Floor
Street:</td></tr>
<tr><td colspan="2">City: Boston</td><td>State: MA</td><td>Zip: 02110</td></tr>
<tr><td rowspan="4">3. Site operator, if different than owner
Bond Brothers</td><td colspan="3">Contact Person: Elio DiBiase, Project Manager</td></tr>
<tr><td colspan="2">Telephone: 617-387-3400</td><td colspan="2">Email: edibiase@bondbrothers.com</td></tr>
<tr><td colspan="3">Mailing address:
Street: 145 Spring Street</td></tr>
<tr><td colspan="2">City: Everett</td><td>State: MA</td><td>Zip: 02149</td></tr>
<tr><td>4. NPDES permit number assigned by EPA:
CGP # MAR10007F
RGP# MAG910649

NPDES permit is (check all that apply: ■ RGP ☐ DGP ■ CGP
☐ MSGP ☐ Individual NPDES permit ☐ Other; if so, specify:</td><td colspan="4">5. Other regulatory program(s) that apply to the site (check all that apply):
■ MA Chapter 21e; list RTN(s):
RTN 3-31002
☐ NH Groundwater Management Permit or Groundwater Release Detection Permit:
☐ CERCLA
☐ UIC Program
☐ POTW Pretreatment
☐ CWA Section 404</td></tr>
</table>

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B. Receiving water information:

1. Name of receiving water(s):	Waterbody identification of receiving water(s):	Classification of receiving water(s):
Dorchester Bay	MA70-03	SB

Receiving water is (check any that apply): ☐ Outstanding Resource Water ☐ Ocean Sanctuary ☐ territorial sea ☐ Wild and Scenic River

2. Has the operator attached a location map in accordance with the instructions in B, above? (check one): ■ Yes ☐ No

Are sensitive receptors present near the site? (check one): ☐ Yes ■ No
If yes, specify:

3. Indicate if the receiving water(s) is listed in the State's Integrated List of Waters (i.e., CWA Section 303(d)). Include which designated uses are impaired, and any pollutants indicated. Also, indicate if a final TMDL is available for any of the indicated pollutants. For more information, contact the appropriate State as noted in Part 4.6 of the RGP. Enterococcus, Fecal Coliform, PCB in Fish Tissue,Total Suspended Solids (TSS), Turbidity

4. Indicate the seven day-ten-year low flow (7Q10) of the receiving water determined in accordance with the instructions in Appendix V for sites located in Massachusetts and Appendix VI for sites located in New Hampshire.	N/A
5. Indicate the requested dilution factor for the calculation of water quality-based effluent limitations (WQBELs) determined in accordance with the instructions in Appendix V for sites in Massachusetts and Appendix VI for sites in New Hampshire.	N/A

6. Has the operator received confirmation from the appropriate State for the 7Q10and dilution factor indicated? (check one): ☐ Yes ☐ No
If yes, indicate date confirmation received: No dilution factor applied.

7. Has the operator attached a summary of receiving water sampling results as required in Part 4.2 of the RGP in accordance with the instruction in Appendix VIII? (check one): ■ Yes ☐ No

C. Source water information:

1. Source water(s) is (check any that apply):

■ Contaminated groundwater Has the operator attached a summary of influent sampling results as required in Part 4.2 of the RGP in accordance with the instruction in Appendix VIII? (check one): ■ Yes ☐ No	☐ Contaminated surface water Has the operator attached a summary of influent sampling results as required in Part 4.2 of the RGP in accordance with the instruction in Appendix VIII? (check one): ☐ Yes ☐ No	☐ The receiving water ☐ A surface water other than the receiving water; if so, indicate waterbody:	☐ Potable water; if so, indicate municipality or origin: ☐ Other; if so, specify:

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2. Source water contaminants: Sb, As, Cd, Cu, Pb, Fe, Ni, Zn,1,4-Dioxane, Acetone, 1,4-dichlorobenzene, TCE, Total Group I and II PAHs.	
a. For source waters that are contaminated groundwater or contaminated surface water, indicate are any contaminants present that are not included in the RGP? (check one): ☐ Yes ■ No If yes, indicate the contaminant(s) and the maximum concentration present in accordance with the instructions in Appendix VIII.	b. For a source water that is a surface water other than the receiving water, potable water or other, indicate any contaminants present at the maximum concentration in accordance with the instructions in Appendix VIII? (check one): ☐ Yes ☐ No
3. Has the source water been previously chlorinated or otherwise contains residual chlorine? (check one): ☐ Yes ■ No	

D. Discharge information

1.The discharge(s) is a(n) (check any that apply): ■ Existing discharge ☐ New discharge ☐ New source	
Outfall(s): Outfalls 1, 2,3, 4, 5, 6, 7, 8	Outfall location(s): (Latitude, Longitude) 1- 42.317322, -71.036542 2- 42.312476, -71.034190 3- 42.311929, -71.034915 4- 42.311162, -71.039164 5- 42.311872, -71.040336 6- 42.312631, -71.041646 7- 42.313379, -71.042818 8- 42.313672, -71.043281
Discharges enter the receiving water(s) via (check any that apply): ☐ Direct discharge to the receiving water ■ Indirect discharge, if so, specify: Discharges from the treatment system will enter Dorchester bay through University owned storm drains. ■ A private storm sewer system ☐ A municipal storm sewer system If the discharge enters the receiving water via a private or municipal storm sewer system: Has notification been provided to the owner of this system? (check one): ■ Yes ☐ No Has the operator has received permission from the owner to use such system for discharges? (check one): ■ Yes ☐ No, if so, explain, with an estimated timeframe for obtaining permission: University owned storm sewer system. Has the operator attached a summary of any additional requirements the owner of this system has specified? (check one): ■ Yes ☐ No	
Provide the expected start and end dates of discharge(s) (month/year): July 2017 through August 2018 Indicate if the discharge is expected to occur over a duration of: ☐ less than 12 months ■ 12 months or more ☐ is an emergency discharge	
Has the operator attached a site plan in accordance with the instructions in D, above? (check one): ■ Yes ☐ No	

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<table>
<tr><td>2. Activity Category: (check all that apply)</td><td colspan="2">3. Contamination Type Category: (check all that apply)</td></tr>
<tr><td rowspan="4">☐ I – Petroleum-Related Site Remediation
☐ II – Non-Petroleum-Related Site Remediation
■ III – Contaminated Site Dewatering
☐ IV – Dewatering of Pipelines and Tanks
☐ V – Aquifer Pump Testing
☐ VI – Well Development/Rehabilitation
☐ VII – Collection Structure Dewatering/Remediation
☐ VIII – Dredge-Related Dewatering</td><td colspan="2">a. If Activity Category I or II: (check all that apply)

☐ A. Inorganics
☐ B. Non-Halogenated Volatile Organic Compounds
☐ C. Halogenated Volatile Organic Compounds
☐ D. Non-Halogenated Semi-Volatile Organic Compounds
☐ E. Halogenated Semi-Volatile Organic Compounds
☐ F. Fuels Parameters</td></tr>
<tr><td colspan="2">b. If Activity Category III, IV, V, VI, VII or VIII: (check either G or H)</td></tr>
<tr><td>■ G. Sites with Known Contamination</td><td>☐ H. Sites with Unknown Contamination</td></tr>
<tr><td>c. If Category III-G, IV-G, V-G, VI-G, VII-G or VIII-G: (check all that apply)

■ A. Inorganics
■ B. Non-Halogenated Volatile Organic Compounds
■ C. Halogenated Volatile Organic Compounds
■ D. Non-Halogenated Semi-Volatile Organic Compounds
☐ E. Halogenated Semi-Volatile Organic Compounds
☐ F. Fuels Parameters</td><td>d. If Category III-H, IV-H, V-H, VI-H, VII-H or VIII-H Contamination Type Categories A through F apply</td></tr>
</table>

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4. Influent and Effluent Characteristics

Parameter	Known or believed absent	Known or believed present	# of samples	Test method (#)	Detection limit (µg/l)	Influent		Effluent Limitations	
						Daily maximum (µg/l)	Daily average (µg/l)	TBEL	WQBEL
A. Inorganics									
Ammonia		✔	4	350.1	100	24200	951	Report mg/L	---
Chloride		✔	4	300.0	50000	12900000	6498500	Report µg/l	---
Total Residual Chlorine	✔		3	4500ClE	10.0	<10	0	0.2 mg/L	
Total Suspended Solids			4	2540D	5000	46000	15000	30 mg/L	---
Antimony		✔	4	200.7	50.0	32.4	8.1	206 µg/L	
Arsenic		✔	4	200.7	5.0	6.7	1.68	104 µg/L	
Cadmium		✔	4	200.7	0.5	33.8	8.54	10.2 µg/L	8.9
Chromium III	✔		4	200.7	4.0	<4.0	0	323 µg/L	
Chromium VI	✔		4	7196A	10.0	<10.0	0	323 µg/L	
Copper		✔	4	200.7	4.0	16.3	7.98	242 µg/L	3.7
Iron		✔	4	200.7	200	9230	2708	5,000 µg/L	
Lead		✔	4	200.7	5.0	36.3	20.3	160 µg/L	8.5
Mercury	✔		4	245.1	0.2	<0.2	0	0.739 µg/L	
Nickel		✔	4	200.7	4.0	41.1	12.43	1,450 µg/L	8.3
Selenium	✔		4	200.7	10.0	<10.0	0	235.8 µg/L	
Silver	✔		4	200.7	5.0	<1.0	0	35.1 µg/L	
Zinc		✔	4	200.7	50.0	977	267.4	420 µg/L	86
Cyanide	✔		3	4500CN	5.0	<5.0	0	178 mg/L	
B. Non-Halogenated VOCs									
Total BTEX	✔		4	524.2	0.5	<0.5	0	100 µg/L	---
Benzene	✔		4	524.2	0.5	<0.5	0	5.0 µg/L	---
1,4 Dioxane		✔	4	8270DSIM	0.250	0.904	0.226	200 µg/L	---
Acetone		✔	4	524.2	5.0	6.7	1.68	7.97 mg/L	---
Phenol	✔		4	420.1	100	<100	0	1,080 µg/L	

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Parameter	Known or believed absent	Known or believed present	# of samples	Test method (#)	Detection limit (µg/l)	Influent		Effluent Limitations	
						Daily maximum (µg/l)	Daily average (µg/l)	TBEL	WQBEL
C. Halogenated VOCs									
Carbon Tetrachloride	✔		4	524.2	0.3	<0.3	0	4.4 µg/L	
1,2 Dichlorobenzene	✔		4	524.2	0.5	<0.5	0	600 µg/L	---
1,3 Dichlorobenzene	✔		4	524.2	0.5	<0.5	0	320 µg/L	---
1,4 Dichlorobenzene		✔	4	524.2	0.5	0.7	0.175	5.0 µg/L	---
Total dichlorobenzene								763 µg/L in NH	---
1,1 Dichloroethane	✔		4	524.2	0.5	<0.5	0	70 µg/L	---
1,2 Dichloroethane	✔		4	524.2	0.5	<0.5	0	5.0 µg/L	---
1,1 Dichloroethylene	✔		4	524.2	0.5	<0.5	0	3.2 µg/L	---
Ethylene Dibromide	✔		4	504.1	0.015	<0.015	0	0.05 µg/L	---
Methylene Chloride	✔		4	524.2	0.5	<0.5	0	4.6 µg/L	---
1,1,1 Trichloroethane	✔		4	524.2	0.5	<0.5	0	200 µg/L	---
1,1,2 Trichloroethane	✔		4	524.2	0.5	<0.5	0	5.0 µg/L	---
Trichloroethylene		✔	4	524.2	0.5	0.8	0.2	5.0 µg/L	---
Tetrachloroethylene	✔		4	524.2	0.5	<0.5	0	5.0 µg/L	
cis-1,2 Dichloroethylene	✔		4	524.2	0.5	<0.5	0	70 µg/L	---
Vinyl Chloride	✔		4	524.2	0.2	<0.2	0	2.0 µg/L	---
D. Non-Halogenated SVOCs									
Total Phthalates	✔		4	8270CSIM	2.34	<2.34	0	190 µg/L	
Diethylhexyl phthalate	✔		4	625 SIM	0.93	<0.93	0	101 µg/L	
Total Group I PAHs		✔	4	625 SIM	CALC	1.43	0.358	1.0 µg/L	---
Benzo(a)anthracene		✔	4	625 SIM	0.05	0.25	0.093	As Total PAHs	0.0038
Benzo(a)pyrene		✔	4	625 SIM	0.05	0.25	0.075		0.0038
Benzo(b)fluoranthene		✔	4	625 SIM	0.05	0.31	0.093		0.0038
Benzo(k)fluoranthene		✔	4	625 SIM	0.05	0.11	0.028		0.0038
Chrysene		✔	4	625 SIM	0.05	0.27	0.100		0.0038
Dibenzo(a,h)anthracene		✔	4	625 SIM	0.05	0.05	0.013		0.0038
Indeno(1,2,3-cd)pyrene		✔	4	625 SIM	0.05	0.19	0.048		0.0038

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Parameter	Known or believed absent	Known or believed present	# of samples	Test method (#)	Detection limit (µg/l)	Influent		Effluent Limitations	
						Daily maximum (µg/l)	Daily average (µg/l)	TBEL	WQBEL
Total Group II PAHs		✔	4	625 SIM	0.19	16.06	4.02	100 µg/L	---
Naphthalene	✔		4	8260CSIM	0.19	<0.19	0	20 µg/L	---
E. Halogenated SVOCs									
Total PCBs	✔		3	8082A	0.5	<0.5	0	0.000064 µg/L	---
Pentachlorophenol	✔		4	8270CSIM	0.84	<0.84	0	1.0 µg/L	---
F. Fuels Parameters									
Total Petroleum Hydrocarbons	✔		3	1664A	5000	<5000	0	5.0 mg/L	---
Ethanol	✔							Report mg/L	---
Methyl-tert-Butyl Ether	✔		4	8260B	1.0	<1.0	0	70 µg/L	
tert-Butyl Alcohol	✔		4	8260B	25.0	<25	0	120 µg/L in MA 40 µg/L in NH	---
tert-Amyl Methyl Ether	✔		4	8260B	1.0	<1.0	0	90 µg/L in MA 140 µg/L in NH	---
Other (i.e., pH, temperature, hardness, salinity, LC_{50}, additional pollutants present); if so, specify:									
pH		✔	4	4500-H+	6.86-11.45				
Temperature		✔	4	2550B	10.4-10.6	deg C			

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E. Treatment system information

1. Indicate the type(s) of treatment that will be applied to effluent prior to discharge: (check all that apply)

☐ Adsorption/Absorption ☐ Advanced Oxidation Processes ☐ Air Stripping ■ Granulated Activated Carbon ("GAC")/Liquid Phase Carbon Adsorption
☐ Ion Exchange ☐ Precipitation/Coagulation/Flocculation ■ Separation/Filtration ☐ Other; if so, specify:

2. Provide a written description of all treatment system(s) or processes that will be applied to the effluent prior to discharge.

Groundwater encountered during excavation activities will be pumped into a treatment system prior to discharge into University owned storm drains. The first component of the treatment system will be a frac tank where solids will settle out. The effluent will next pass through a series of bag filters to remove fines, and subsequently will pass through a 1000-lb capacity liquid phase granular activated carbon vessel. The finished effluent will then pass through a flowmeter prior to entering the storm sewer system leading to Dorchester Bay.

Identify each major treatment component (check any that apply):
■ Fractionation tanks☐ Equalization tank ☐ Oil/water separator ☐ Mechanical filter ■ Media filter
☐ Chemical feed tank ☐ Air stripping unit ■ Bag filter ☐ Other; if so, specify:

Indicate if either of the following will occur (check any that apply):
☐ Chlorination ☐ De-chlorination

3. Provide the **design flow capacity** in gallons per minute (gpm) of the most limiting component. Indicate the most limiting component: bag filters Is use of a flow meter feasible? (check one): ■ Yes ☐ No, if so, provide justification:	150
Provide the proposed maximum effluent flow in gpm.	150
Provide the average effluent flow in gpm.	50
If Activity Category IV applies, indicate the estimated total volume of water that will be discharged:	

4. Has the operator attached a schematic of flow in accordance with the instructions in E, above? (check one): ■ Yes ☐ No

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F. Chemical and additive information

1. Indicate the type(s) of chemical or additive that will be applied to effluent prior to discharge or that may otherwise be present in the discharge(s): (check all that apply)

☐ Algaecides/biocides ☐ Antifoams ☐ Coagulants ☐ Corrosion/scale inhibitors ☐ Disinfectants ☐ Flocculants ☐ Neutralizing agents ☐ Oxidants ☐ Oxygen ☐ scavengers ☐ pH conditioners ☐ Bioremedial agents, including microbes ☐ Chlorine or chemicals containing chlorine ☐ Other; if so, specify:
No additives anticipated

2. Provide the following information for each chemical/additive, using attachments, if necessary:
No Additives Anticipated
a. Product name, chemical formula, and manufacturer of the chemical/additive;
b. Purpose or use of the chemical/additive or remedial agent;
c. Material Safety Data Sheet (MSDS) and Chemical Abstracts Service (CAS) Registry number for each chemical/additive;
d. The frequency (hourly, daily, etc.), duration (hours, days), quantity (maximum and average), and method of application for the chemical/additive;
e. Any material compatibility risks for storage and/or use including the control measures used to minimize such risks; and
f. If available, the vendor's reported aquatic toxicity (NOAEL and/or LC50 in percent for aquatic organism(s)).

3. Has the operator attached an explanation which demonstrates that the addition of such chemicals/additives may be authorized under this general permit in accordance with the instructions in F, above? (check one): ☐ Yes ■ No; if no, has the operator attached data that demonstrates each of the 126 priority pollutants in CWA Section 307(a) and 40 CFR Part 423.15(j)(1) are non-detect in discharges with the addition of the proposed chemical/additive?
(check one): ☐ Yes ■ No

G. Endangered Species Act eligibility determination

1. Indicate under which criterion the discharge(s) is eligible for coverage under this general permit:

☐ **FWS Criterion A**: No endangered or threatened species or critical habitat are in proximity to the discharges or related activities or come in contact with the "action area".

■ **FWS Criterion B**: Formal or informal consultation with the FWS under section 7 of the ESA resulted in either a no jeopardy opinion (formal consultation) or a written concurrence by FWS on a finding that the discharges and related activities are "not likely to adversely affect" listed species or critical habitat (informal consultation). Has the operator completed consultation with FWS? (check one): ■ Yes ☐ No; if no, is consultation underway? (check one): ☐ Yes ☐ No

☐ **FWS Criterion C**: Using the best scientific and commercial data available, the effect of the discharges and related activities on listed species and critical habitat have been evaluated. Based on those evaluations, a determination is made by EPA, or by the operator and affirmed by EPA, that the discharges and related activities will have "no effect" on any federally threatened or endangered listed species or designated critical habitat under the jurisdiction of the FWS. This determination was made by: (check one) ☐ the operator ☐ EPA ☐ Other; if so, specify:

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■ **NMFS Criterion**: A determination made by EPA is affirmed by the operator that the discharges and related activities will have "no effect" or are "not likely to adversely affect" any federally threatened or endangered listed species or critical habitat under the jurisdiction of NMFS and will not result in any take of listed species. Has the operator previously completed consultation with NMFS? (check one): ☐ Yes ■ No

2. Has the operator attached supporting documentation of ESA eligibility in accordance with the instructions in Appendix I, and G, above? (check one): ■ Yes ☐ No

Does the supporting documentation include any written concurrence or finding provided by the Services? (check one): ☐ Yes ■ No; if yes, attach.

H. National Historic Preservation Act eligibility determination

1. Indicate under which criterion the discharge(s) is eligible for coverage under this general permit:

☐ **Criterion A**: No historic properties are present. The discharges and discharge-related activities (e.g., BMPs) do not have the potential to cause effects on historic properties.

■ **Criterion B**: Historic properties are present. Discharges and discharge related activities do not have the potential to cause effects on historic properties.

☐ **Criterion C**: Historic properties are present. The discharges and discharge-related activities have the potential to have an effect or will have an adverse effect on historic properties.

2. Has the operator attached supporting documentation of NHPA eligibility in accordance with the instructions in H, above? (check one): ■ Yes ☐ No

Does the supporting documentation include any written agreement with the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer (TPHO), or other tribal representative that outlines measures the operator will carry out to mitigate or prevent any adverse effects on historic properties? (check one): ☐ Yes ■ No

I. Supplemental information

Describe any supplemental information being provided with the NOI. Include attachments if required or otherwise necessary.

Has the operator attached data, including any laboratory case narrative and chain of custody used to support the application? (check one): ■ Yes ☐ No

Has the operator attached the certification requirement for the Best Management Practices Plan (BMPP)? (check one): ■ Yes ☐ No

J. Certification requirement

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

BMPP certification statement: A BMPP meeting the requirements of this general permit will be implemented upon initiation of discharge.	
Notification provided to the appropriate State, including a copy of this NOI, if required.	Check one: Yes ☐ No ■
Notification provided to the municipality in which the discharge is located, including a copy of this NOI, if requested.	Check one: Yes ■ No ☐
Notification provided to the owner of a private or municipal storm sewer system, if such system is used for site discharges, including a copy of this NOI, if requested.	Check one: Yes ☐ No ☐ NA ■
Permission obtained from the owner of a private or municipal storm sewer system, if such system is used for site discharges. If yes, attach additional conditions. If no, attach explanation and timeframe for obtaining permission.	Check one: Yes ☐ No ☐ NA ■
Notification provided to the owner/operator of the area associated with activities covered by an additional discharge permit(s). Additional discharge permit is (check one): ☐ RGP ☐ DGP ■ CGP ☐ MSGP ☐ Individual NPDES permit ☐ Other; if so, specify: Same operator for Site CGP and RGP	Check one: Yes ☐ No ☐ NA ■
Signature: Zehra Schneider Graham	Date: 12/01/2017
Print Name and Title: Zehra Schneider Graham, UMass Boston Deputy Director, OEHS	

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J. Certification requirement

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

BMPP certification statement: A BMPP meeting the requirements of this general permit will be implemented upon initiation of discharge.	
Notification provided to the appropriate State, including a copy of this NOI, if required.	Check one: Yes ☐ No ■
Notification provided to the municipality in which the discharge is located, including a copy of this NOI, if requested.	Check one: Yes ■ No ☐
Notification provided to the owner of a private or municipal storm sewer system, if such system is used for site discharges, including a copy of this NOI, if requested.	Check one: Yes ☐ No ☐ NA ■
Permission obtained from the owner of a private or municipal storm sewer system, if such system is used for site discharges. If yes, attach additional conditions. If no, attach explanation and timeframe for obtaining permission.	Check one: Yes ☐ No ☐ NA ■
Notification provided to the owner/operator of the area associated with activities covered by an additional discharge permit(s). Additional discharge permit is (check one): ☐ RGP ☐ DGP ■ CGP ☐ MSGP ☐ Individual NPDES permit ☐ Other; if so, specify: Same operator for Site CGP and RGP	Check one: Yes ☐ No ☐ NA ■
Signature:	Date: 12-1-17
Print Name and Title: Elio DiBiase, P.M. BOND.	

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ATTACHMENT 2

FIGURE 1 – SITE LOCUS MAP

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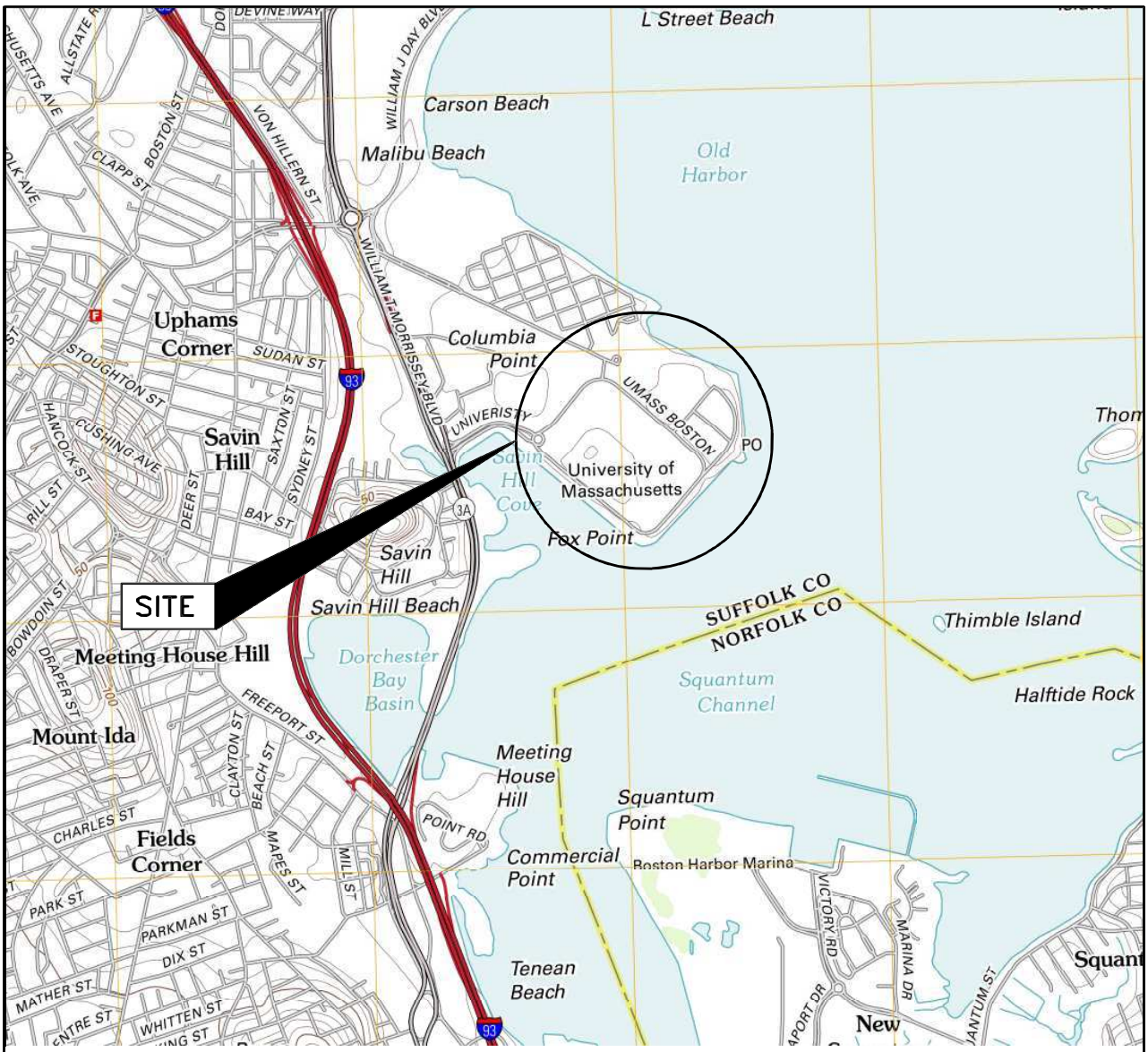
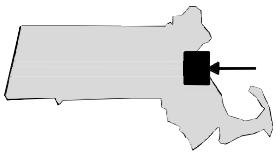


APPROXIMATE SCALE IN FEET

0' 1000' 2000' 4000'

N W E S

MASSACHUSETTS



QUADRANGLE LOCATION

SOURCE:

BASE MAP FROM THE FOLLOWING USGS QUADRANGLE MAP:
BOSTON SOUTH, MASSACHUSETTS (2012)

DIGITAL TOPOGRAPHIC MAPS PROVIDED BY THE USGSSTORE.GOV.

CONTOUR ELEVATIONS REFERENCE NAVD 88,
CONTOURS ARE SHOWN IN FEET AT 10 FOOT INTERVALS

UMASS BOSTON UTILITY CORRIDOR AND ROADWAY
UNIVERSITY OF MASSACHUSETTS
BOSTON, MASSACHUSETTS

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
BVH INTEGRATED SERVICES

LOCUS MAP
NPDES RGP NOTICE OF INTENT

PROJ MGR: JER	REVIEWED BY: RP	CHECKED BY: RP	FIGURE
DESIGNED BY: JER	DRAWN BY: SBB	SCALE: 1" = 2000'	1
JUNE 2017	PROJECT NO. 33930.02	REVISION NO. 0	

ATTACHMENT 3

FIGURE 2 – SITE PLAN

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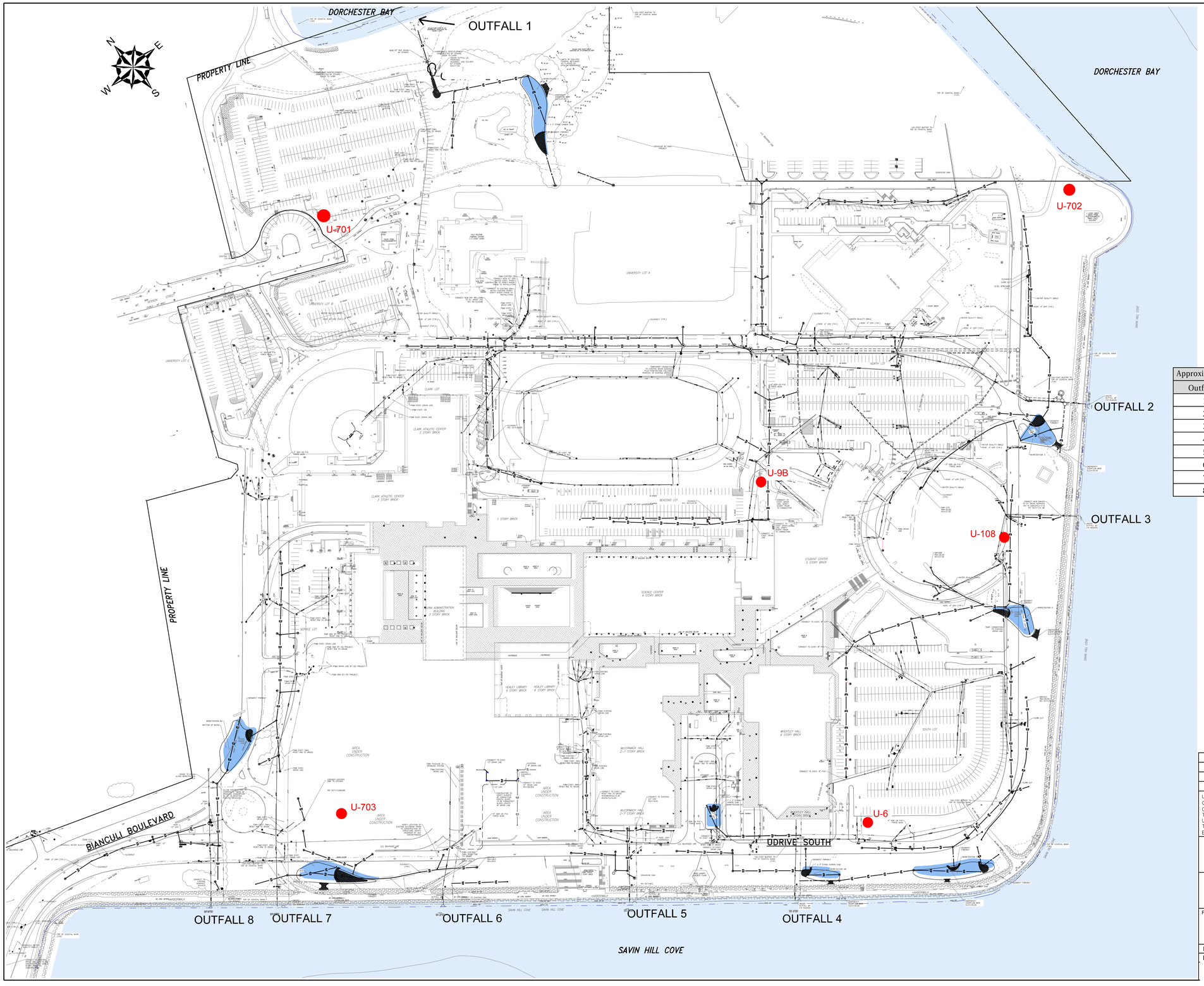

GENERAL NOTES

1. BASE MAP DEVELOPED FROM AUTOCAD DRAWING FILE UCRR EXISTING AND PROPOSED STORM.DWG PREPARED BY BVH TRANSMITTED TO GZA ON 10-23-2014.

LEGEND

- PROPOSED STORM DRAIN/MANHOLE. DISCHARGE POINT UNDER THE RGP.
- EXISTING STORM DRAIN/MANHOLE. DISCHARGE POINT UNDER THE RGP.
- OUTFALL 4 — STORM WATER OUTFALL DESIGNATION. DISCHARGE FROM STORM DRAIN SYSTEM TO WATER BODY.
- APPROXIMATE WATER BODY LOCATION
- PROPOSED BIODETENTION AREA

Approximate Coordinates of Outfalls - Discharge from Storm Drain System to Water Body		
Outfall ID	Latitude (N)	Longitude (E)
1	42.317269	-71.036709
2	42.312507	-71.034123
3	42.311916	-71.034907
4	42.311173	-71.039166
5	42.311848	-71.040284
6	42.312683	-71.041638
7	42.313408	-71.042813
8	42.313692	-71.043281

0 60 120 240 360

1" = 120'

NO.	ISSUE/DESCRIPTION	BY	DATE

UMASS BOSTON UTILITY CORRIDOR AND ROADWAY
UNIVERSITY OF MASSACHUSETTS
BOSTON, MASSACHUSETTS

NPDES RGP NOTICE OF INTENT
SITE PLAN

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
BVH INTEGRATED SERVICES

PROJ MGR:	JER	REVIEWED BY:	RP	CHECKED BY: RP
DESIGNED BY:	JER	DRAWN BY:	CRB	SCALE: 1"=120'
JUNE 2017		PROJECT NO. 33930.02		REVISION NO. 0

FIGURE 2

ATTACHMENT 4

FIGURE 3 – PROCESS FLOW DIAGRAM

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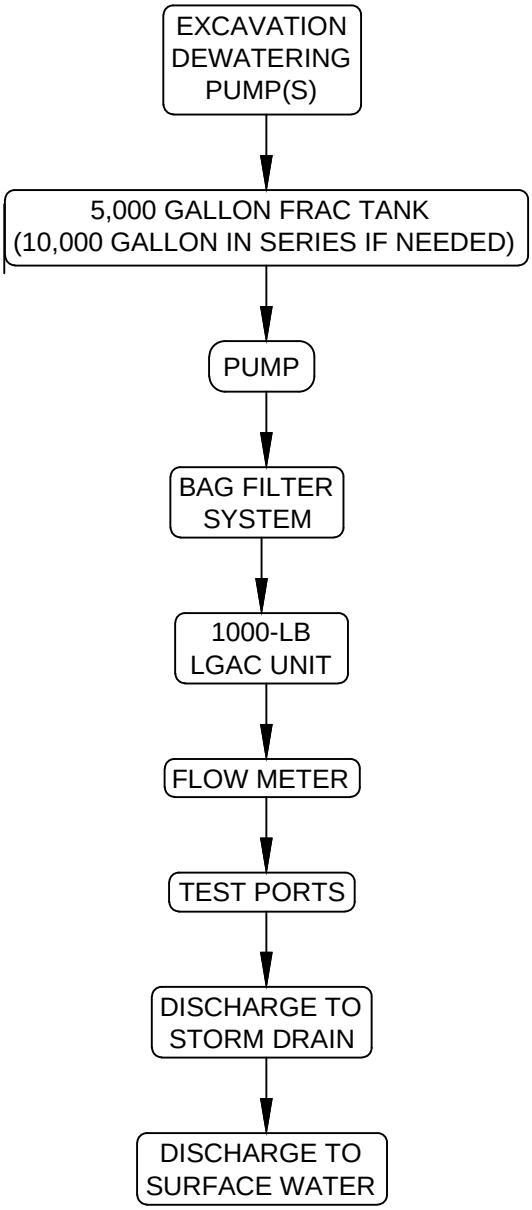

NO.	ISSUE/DESCRIPTION	BY	DATE

UMASS BOSTON UTILITY CORRIDOR AND ROADWAY
UNIVERSITY OF MASSACHUSETTS
BOSTON, MASSACHUSETTS

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
BVH INTEGRATED SERVICE

PROCESS FLOW DIAGRAM

PROJ MGR: JER	REVIEWED BY: RP	CHECKED BY: RP	FIGURE 3
DESIGNED BY: JER	DRAWN BY: SBB	SCALE: NTS	
I JUNE 2017	PROJECT NO. 33930.02	REVISION NO. 0	

ATTACHMENT 5

ESA AND EFH DOCUMENTATION

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FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN MASSACHUSETTS

COUNTY	SPECIES	FEDERAL STATUS	GENERAL LOCATION/HABITAT	TOWNS
Barnstable	Piping Plover	Threatened	Coastal Beaches	All Towns
	Roseate Tern	Endangered	Coastal beaches and the Atlantic Ocean	All Towns
	Northeastern beach tiger beetle	Threatened	Coastal Beaches	Chatham
	Sandplain gerardia	Endangered	Open areas with sandy soils.	Sandwich and Falmouth.
	Northern Red-bellied Cooter	Endangered	Inland Ponds and Rivers	Bourne (north of the Cape Cod Canal)
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Berkshire	Bog Turtle	Threatened	Wetlands	Egremont and Sheffield
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Bristol	Piping Plover	Threatened	Coastal Beaches	Fairhaven, Dartmouth, Westport
	Roseate Tern	Endangered	Coastal beaches and the Atlantic Ocean	Fairhaven, New Bedford, Dartmouth, Westport
	Northern Red-bellied Cooter	Endangered	Inland Ponds and Rivers	Taunton
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Dukes	Roseate Tern	Endangered	Coastal beaches and the Atlantic Ocean	All Towns
	Piping Plover	Threatened	Coastal Beaches	All Towns
	Northeastern beach tiger beetle	Threatened	Coastal Beaches	Aquinnah and Chilmark
	Sandplain gerardia	Endangered	Open areas with sandy soils.	West Tisbury
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide

Updated 01/09/2015

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FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN MASSACHUSETTS

COUNTY	SPECIES	FEDERAL STATUS	GENERAL LOCATION/HABITAT	TOWNS
Essex	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Gloucester, Essex and Manchester
	Piping Plover	Threatened	Coastal Beaches	Gloucester, Essex, Ipswich, Rowley, Revere, Newbury, Newburyport and Salisbury
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Franklin	Northeastern bulrush	Endangered	Wetlands	Montague, Warwick
	Dwarf wedgemussel	Endangered	Mill River	Whately
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Hampshire	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Hadley
	Puritan tiger beetle	Threatened	Sandy beaches along the Connecticut River	Northampton and Hadley
	Dwarf wedgemussel	Endangered	Rivers and Streams.	Hatfield, Amherst and Northampton
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Hampden	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Southwick
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Middlesex	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Groton
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Nantucket	Piping Plover	Threatened	Coastal Beaches	Nantucket
	Roseate Tern	Endangered	Coastal beaches and the Atlantic Ocean	Nantucket
	American burying beetle	Endangered	Upland grassy meadows	Nantucket
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide

Updated 01/09/2015

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FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN MASSACHUSETTS

COUNTY	SPECIES	FEDERAL STATUS	GENERAL LOCATION/HABITAT	TOWNS
Plymouth	Piping Plover	Threatened	Coastal Beaches	Scituate, Marshfield, Duxbury, Plymouth, Wareham and Mattapoisett
	Northern Red-bellied Cooter	Endangered	Inland Ponds and Rivers	Kingston, Middleborough, Carver, Plymouth, Bourne, Wareham, Halifax, and Pembroke
	Roseate Tern	Endangered	Coastal beaches and the Atlantic Ocean	Plymouth, Marion, Wareham, and Mattapoisett.
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Suffolk	Piping Plover	Threatened	Coastal Beaches	Revere, Winthrop
	Red Knot[1]	Threatened	Coastal Beaches and Rocky Shores, sand and mud flats	Coastal Towns
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide
Worcester	Small whorled Pogonia	Threatened	Forests with somewhat poorly drained soils and/or a seasonally high water table	Leominster
	Northern Long-eared Bat	Proposed Endangered	Winter- mines and caves, Summer – wide variety of forested habitats	Statewide

[1]Migratory only, scattered along the coast in small numbers

-Eastern cougar and gray wolf are considered extirpated in Massachusetts.
-Endangered gray wolves are not known to be present in Massachusetts, but dispersing individuals from source populations in Canada may occur statewide.
-Critical habitat for the Northern Red-bellied Cooter is present in Plymouth County.

Updated 01/09/2015

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ATTACHMENT 6

MHC REPORT

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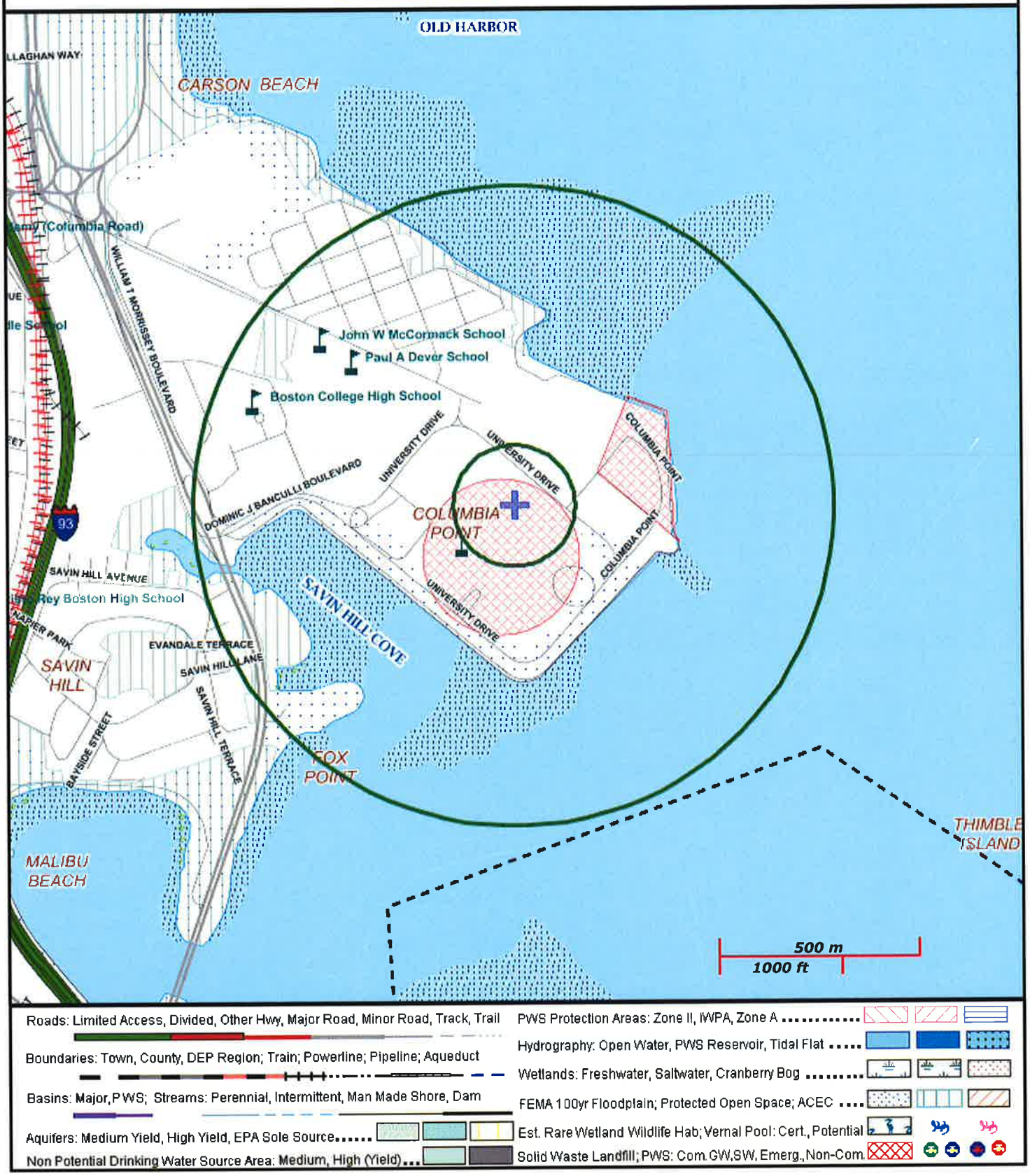
MassDEP - Bureau of Waste Site Cleanup

Phase 1 Site Assessment Map: 500 feet & 0.5 Mile Radii

Site Information:
100 MORRISSEY BLVD BOSTON, MA
NAD83 UTM Meters:
5208177mN , -7907879mE (Zone: 18)
June 19, 2017

The information shown is the best available at the date of printing. However, it may be incomplete. The responsible party and LSP are ultimately responsible for ascertaining the true conditions surrounding the site. Metadata for data layers shown on this map can be found at: http://www.mass.gov/mgis/.

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection



United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104
http://www.fws.gov/newengland

In Reply Refer To:
Consultation Code: 05E1NE00-2017-SLI-1805
Event Code: 05E1NE00-2017-E-03954
Project Name: UMASS UCRR

June 08, 2017

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the

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human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

Project Summary

Consultation Code: 05E1NE00-2017-SLI-1805

Event Code: 05E1NE00-2017-E-03954

Project Name: UMASS UCRR

Project Type: DREDGE / EXCAVATION

Project Description: Utility Excavations

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/42.314043609538814N71.03799706418644W

Counties: Suffolk, MA

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area. Please contact the designated FWS office if you have questions.

Birds

NAME	STATUS
Red Knot *(Calidris canutus rufa)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Roseate Tern *(Sterna dougallii dougallii)* Population: northeast U.S. nesting pop. No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2083	Endangered

Critical habitats

There are no critical habitats within your project area.

Evaluation of Select Endangered Species Habitats

100 Morrissey Blvd

Boston, Massachusetts

The northern long-eared bat (*Myotis septentrionalis*) has a federal status of Threatened and a state status of Endangered within Massachusetts.

The northern long-eared bat is a migratory species which utilizes a variety of habitats during the year depending on the season. Between early November and April, this species hibernates in crevices in portions of caves and abandoned mine shafts which have high humidity, constant temperatures, and little air flow. Individuals tend to return to the same hibernaculum from year to year although they are also known to sometimes use other hibernacula. Hibernacula are generally located within approximately 35 miles of summer foraging habitat. Between April and October, northern long-eared bats roost and forage in forested areas. Preferred roost sites include clusters of large, live or dead, hardwood trees with cavities or peeling bark. Preferred foraging sites include wooded areas around vernal pools or small ponds or along streams. Thus, transitional zones between forested uplands and wetlands represent prime summer roosting and foraging habitat.

The parcel at 100 Morrissey Boulevard in Boston, MA (Site) is located within a busy and densely developed area used as a University campus, athletic fields, and parking facilities. The Site is a predominantly open area with few trees and no ponds, vernal pools, caves, or mine shafts. The Site is bounded on three sides by the saline waters of Dorchester Bay. The lack of trees for roosting and the regular disturbances from noise from ongoing construction activities and campus activities make this Site a poor habitat for northern long-eared bats. It is unlikely that this species utilizes this area. Furthermore, there is no planned removal of the few existing Site trees.

The Red Knot is listed as a threatened species which is observed along coastal towns of Massachusetts. The work site does not involve the removal of trees or brush and the shoreline along the property is not being disturbed. The discharge is not expected to cause take of this species.

The Roseate Tern is listed as an endangered species which is observed along coastal towns of Massachusetts. However, review of the FWS's Environmental Conservation Online System (ECOS), indicates that coastal sections along Suffolk county are not listed as locations where the Roseate Tern nesting population is known or is believed to occur.

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U.S. Fish & Wildlife Service

Northern Long-Eared Bat

Myotis septentrionalis

The northern long-eared bat is federally listed as a threatened species under the Endangered Species Act. ***Endangered*** species are animals and plants that are in danger of becoming extinct. ***Threatened*** species are animals and plants that are likely to become endangered in the foreseeable future. Identifying, protecting and restoring endangered and threatened species is the primary objective of the U.S. Fish and Wildlife Service's Endangered Species Program.

Photo by Steve Taylor, University of Illinois

This northern long-eared bat, observed during an Illinois mine survey, shows visible symptoms of white-nose syndrome.

What is the northern long-eared bat?

Appearance: The northern long-eared bat is a medium-sized bat with a body length of 3 to 3.7 inches and a wingspan of 9 to 10 inches. Their fur color can be medium to dark brown on the back and tawny to pale-brown on the underside. As its name suggests, this bat is distinguished by its long ears, particularly as compared to other bats in its genus, *Myotis*.

Winter Habitat: Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible.

Summer Habitat: During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. They rarely roost in human structures like barns and sheds.

Reproduction: Breeding begins in late summer or early fall when males begin to swarm near hibernacula. After copulation, females store sperm during hibernation until spring. In spring, females emerge from their hibernacula, ovulate and the stored sperm fertilizes an egg. This strategy is called delayed fertilization.

After fertilization, pregnant bats migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies of females and young generally have 30 to 60 bats at the beginning of the summer, although larger maternity colonies have also been observed. Numbers of bats in roosts typically decrease from the time of pregnancy to post-lactation. Most bats within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Maximum lifespan for the northern long-eared bat is estimated to be up to 18.5 years.

Feeding Habits: Like most bats, northern long-eared bats emerge at dusk to feed. They primarily fly through the understory of forested areas feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation or by gleaning motionless insects from vegetation.

Range: The northern long-eared bat's range includes much of the eastern and north central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. The species' range includes 37 States and the District of Columbia: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming.

Why is the northern long-eared bat in trouble?

White-nose Syndrome: No other threat is as severe and immediate as

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this. If this disease had not emerged, it is unlikely that northern long-eared bat populations would be experiencing such dramatic declines. Since symptoms were first observed in New York in 2006, white-nose syndrome has spread rapidly from the Northeast to the Midwest and Southeast; an area that includes the core of the northern long-eared bat's range, where it was most common before this disease. Numbers of northern long-eared bats (from hibernacula counts) have declined by up to 99 percent in the Northeast. Although there is uncertainty about the rate that white-nose syndrome will spread throughout the species' range, it is expected to continue to spread throughout the United States in the foreseeable future.

Other Sources of Mortality:
Although no significant population declines have been observed due to the sources of mortality listed below, they may now be important factors affecting this bat's viability until we find ways to address WNS.

Impacts to Hibernacula: Gates or other structures intended to exclude people from caves and mines not only restrict bat flight and movement, but also change airflow and microclimates. A change of even a few degrees can make a cave unsuitable for hibernating bats. Also, cave-dwelling bats are vulnerable to human disturbance while hibernating. Arousal during hibernation causes bats to use up their energy stores, which may lead to bats not surviving through winter.

Loss or Degradation of Summer Habitat: Highway construction, commercial development, surface mining, and wind facility construction permanently remove habitat and are activities prevalent in many areas of this bat's range. Many forest management activities benefit bats by keeping areas forested rather than converted to other uses. But, depending on type and timing, some forest management activities can cause mortality and temporarily remove or degrade roosting and foraging habitat.

Wind Farm Operation: Wind turbines kill bats, and, depending on the species, in very large numbers. Mortality from windmills has been documented for northern long-eared bats, although a small number have been found to date. However, there are many wind projects within a large portion of the bat's range and many more are planned.

What Is Being Done to Help the Northern Long-Eared Bat?

Disease Management: Actions have been taken to try to reduce or slow the spread of white-nose syndrome through human transmission of the fungus into caves (e.g. cave and mine closures and advisories; national decontamination protocols). A national plan was prepared by the Service and other state and federal agencies that details actions needed to investigate and manage white-nose syndrome. Many state and federal agencies, universities and non-governmental organizations are researching this disease to try to control its spread and address its affect. See www.whitenosesyndrome.org/ for more.

Addressing Wind Turbine Mortality: The Service and others are working to minimize bat mortality from wind turbines on several fronts. We fund and conduct research to determine why bats are susceptible to turbines, how to operate turbines to minimize mortality and where important bird and bat migration routes are located. The Service, state natural resource agencies, and the wind energy industry are developing a Midwest Wind Energy Habitat Conservation Plan, which will provide wind farms a mechanism to continue operating legally while minimizing and mitigating listed bat mortality.

Listing: The northern long-eared bat is listed as a threatened species under the federal Endangered Species Act. Listing a species affords it the protections of the Act and also increases the priority of the species for funds, grants, and recovery opportunities.

Hibernacula Protection: Many federal and state natural resource agencies and conservation organizations have protected caves and mines that are important hibernacula for cave-dwelling bats.

What Can I Do?

Do Not Disturb Hibernating Bats: To protect bats and their habitats, comply with all cave and mine closures, advisories, and regulations. In areas without a cave and mine closure policy, follow approved decontamination protocols (see http://whitenosesyndrome.org/topics/decontamination). Under no circumstances should clothing, footwear, or equipment that was used in a white-nose syndrome affected state or region be used in unaffected states or regions.

Leave Dead and Dying Trees Standing: Like most eastern bats, the northern long-eared bat roosts in trees during summer. Where possible and not a safety hazard, leave dead or dying trees on your property. Northern long-eared bats and many other animals use these trees.

Install a Bat Box: Dead and dying trees are usually not left standing, so trees suitable for roosting may be in short supply and bat boxes may provide additional roost sites. Bat boxes are especially needed from April to August when females look for safe and quiet places to give birth and raise their pups.

Support Sustainability: Support efforts in your community, county and state to ensure that sustainability is a development goal. Only through sustainable living will we provide rare and declining species, like the northern long-eared bat, the habitat and resources they need to survive alongside us.

Spread the Word: Understanding the important ecological role that bats play is a key to conserving the northern long-eared and other bats. Helping people learn more about the northern long-eared bat and other endangered species can lead to more effective recovery efforts. For more information, visit www.fws.gov/midwest/nleb and www.whitenosesyndrome.org

Join and Volunteer: Join a conservation group; many have local chapters. Volunteer at a local nature center, zoo, or national wildlife refuge. Many state natural resource agencies benefit greatly from citizen involvement in monitoring wildlife. Check your state agency websites and get involved in citizen science efforts in your area.

Northern Long-Eared Bat (*Myotis septentrionalis*) Species Guidance

Family: Vespertilionidae- the evening bats

State Status: Threatened

State Rank: S1S3

Federal Status: None

Global Rank: G4

Wildlife Action Plan Area of Importance Score: 3

Range of the northern long-eared bat in Wisconsin. Source: WI Bat Program 2012

Dave Redell, Wisconsin DNR

Species Information

General Description: The northern long-eared bat, also referred to as the northern bat, is a medium-sized member of the genus *Myotis.* Adults weigh five to nine grams (0.2-0.3 oz). Individual weights vary seasonally and are lowest in the spring as bats emerge from hibernation (WI Bat Program 2010). Total length is 77-92 mm (3.0-3.63 in), adult forearm length is 34-38 mm (1.3-1.5 in), and females are generally larger than males (Kurta 1995). Wingspan is 23-26 cm (9.1-10.2 in; Barbour and Davis 1969). Fur color is light to dark brown. The northern long-eared bat is classified as a cave bat because it uses caves and mines for hibernation.

Similar Species: Three bat species in Wisconsin- the northern long-eared bat, the little brown bat (*Myotis lucifugus*) and the Indiana (*Myotis sodalis*) bat – are best distinguished by close (in-hand) inspection. The northern long-eared bat is most often confused with the little brown bat. The northern long-eared bat has longer ears than the little brown bat, and when folded alongside the head, the tips of the ears should extend 3 mm or more past the tip of the nose. Little brown bat ear length in Wisconsin, however, can be highly variable, and tragus shape and length in relation to the rest of the ear are the two best features to use to distinguish these two species (Fig. 1). The tragus of the northern long-eared bat is more pointed and spear-like than that of the little brown bat. The little brown bat also has a glossier appearance than the northern long-eared. The northern long-eared bat may also be confused with the Indiana bat, but the two can be distinguished much the same way as the little brown bat from the northern long-eared bat. The Indiana bat's keeled calcar, a spur of cartilage extended from the ankle and supporting the interfemoral membrane, is a distinguishing feature that the northern long-eared bat lacks. The northern long-eared bat can be identified by the echolocation call (Fig. 2), however both other *Myotis* species share similar call characteristics, and only trained individuals should positively identify the species through echolocation calls.

Figure 1. The asymmetrical tragus of the little brown bat (left), and the symmetrical, spear-like tragus of the northern long-eared bat (right). Dave Redell, Wisconsin DNR

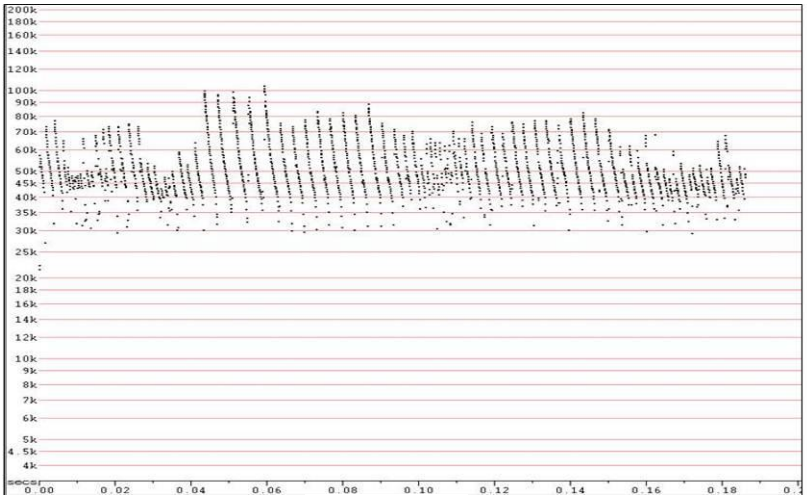


Figure 2. Echolocation call: Northern long-eared bats produce high-frequency calls of a shorter duration, broader bandwidth and lower intensity than other *Myotis* species. The call frequency ranges between 126 and 40 kHz (Caceres and Barclay 2000). The northern long-eared bat sonogram may appear similar to the little brown bat and the Indiana bat.

Associated Species: Northern long-eared bat predators include owls, hawks, occasionally snakes, and raccoons (*Procyon lotor*). As many as 13 feral cats have also been observed congregating at a mine entrance at dusk to prey upon bats as they leave the hibernaculum (D. Redell pers. obs.). Northern long-eared bats often share hibernacula with other bat species such as the tri-colored bat (*Perimyotis subflavus*), the little brown bat, the big brown bat (*Eptesicus fuscus*) and the Indiana bat, but the northern bat rarely, if ever, forms hibernating clusters with other species. Northern long-eared bats forage with other bat species, but there is no evidence of direct competition between species.

State Distribution and Abundance: Northern long-eared bats are found throughout the state of Wisconsin (but see "Threats" section below), but they are never abundant (Jackson 1961, WDNR 2013).

Global Distribution and Abundance: Northern long-eared bats are widely distributed in the eastern United States and Canada, with the exception of the very southeastern United States and Texas (see Fig. 3, BCI 2012).

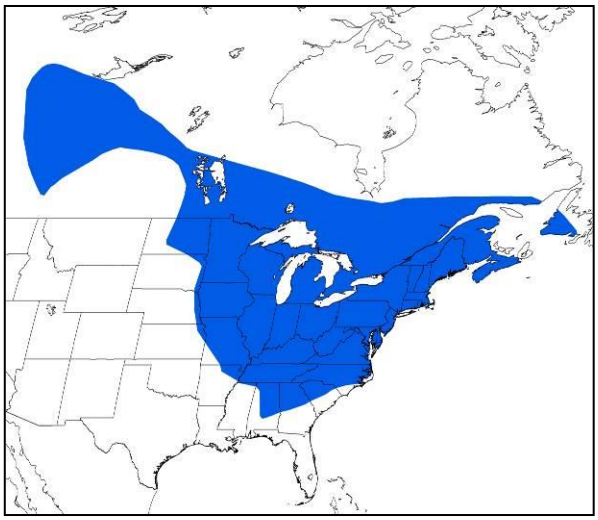
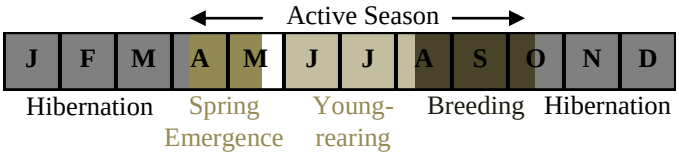


Figure 3. Global distribution of *Myotis septentrionalis*. (BCI 2012)

Diet: The northern long-eared bat is insectivorous and uses echolocation to locate and capture prey. Northern long-eared bat prey includes moths (*Lepidoptera*), flies (*Diptera*) and beetles (*Coleoptera*). This species is commonly referred to as a gleaning bat because it often catches insects that are at rest on leaves or twigs, in addition to catching insects that are flying (Lee and McCracken 2004).

Reproductive Cycle: The reproductive cycle for the northern long-eared bat begins when breeding occurs in the fall and sometimes into winter hibernation. Sperm is stored in the uterus of the female until April or May when the females emerge from hibernation and fertilization occurs. Females form small maternity colonies of up to 30 bats in late spring and females give birth to a single pup in June or early July (Caceres and Barclay 2000, Owen et. al. 2002). Pups are born hairless and flightless. The pup nurses for about a month and is left at the roost nightly while the mother goes out to feed. The pup begins to fly and explore on its own at four to six weeks. Maternity colonies disperse shortly after young are volant (able to fly) and bats move closer to hibernacula in the fall and mate before they hibernate. Young of the year do not usually mate, but some juvenile males appear reproductively active (WI Bat Program 2009, 2010). More research is needed to determine breeding and reproductive behavior of the northern long-eared bat.



Ecology: Female and male northern long-eared bats emerge from hibernation in April and May. In summer, the northern long-eared bat roosts alone, or females may form a colony with some other females. The northern long-eared bat chooses day roosts in tall trees and snags. Night roosts for this species include caves and rock shelters where they will rest between feeding bouts (Caceres and Barclay 2000). Roost fidelity is low in this species, and individual bats switch roosts about every two days in the summer (Foster and Kurta 1999). This species is a relatively long lived mammal for its size, and usually lives up to 8-10 years. Banding records indicated a northern long-eared bat caught in the wild lived up to 18 years (Caceres and Barclay 2000). In the fall, northern long-eared bats will make short migrations from summer habitat to winter hibernacula (caves and abandoned mines), and will often return to the same hibernaculum but not always in sequential seasons (Caceres and Barclay 2000). This species hibernates with other species such as the little brown bat and tri-colored bat, but often in different parts of the hibernaculum. The northern long-eared bat hibernates deep in crevices, rather than clustering on exposed surfaces like other cave bats, which makes it difficult to survey and monitor for this species during the winter (Caceres and Barclay 2000). More research is needed on northern long-eared bats' basic life history and behavior.

Natural Community Associations: (WDNR 2005 and WDNR 2009)

Many bat species are associated more with structural features within natural communities than with any particular natural community or group of natural communities (see "Habitat" section).

Significant: coldwater streams, coolwater streams, ephemeral pond
Moderate: alder thicket, bog relict, boreal rich fen, calcareous fen (southern), central sands pine – oak forest, coastal plain marsh, emergent aquatic, floodplain forest, hemlock relict, inland lakes, northern dry forest, northern dry-mesic forest, northern hardwood swamp, northern mesic forest, northern sedge meadow, oak barrens, oak woodland, open bog, shrub carr, southern dry forest, southern

dry-mesic forest, southern hardwood swamp, southern mesic forest, southern sedge meadow, submergent aquatic, submergent aquatic-oligotrophic marsh, warmwater rivers, warmwater streams, white pine – red maple swamp
Minimal: none

Habitat: Northern long-eared bat habitat use changes over the course of the year, and varies based on sex and reproductive status. Reproductive females often use different summer habitat from males and non-reproductive females.

Summer: Northern long-eared bats commonly roost in trees but have been known to roost in man-made structures. This species often roosts under bark or close to the tree trunk in crevices of tree species such as maples and ashes (Foster and Kurta 1999). Northern long-eared bats prefer to roost in tall trees with a dynamic forest structure including old growth and some young trees (Foster and Kurta 1999). Females form small maternity colonies which are located in trees, under shingles, and in buildings. Northern long-eared bats commonly forage within the forest and below the canopy mainly in upland forests on hillsides and ridges (Owen et al. 2003), but have also been noted to forage along paths, ponds and streams, and at forest edges. Foster and Kurta (1999) found all roost trees to be close to wetlands. More information is needed to more fully describe northern long-eared bat foraging habitats and summer roosting in Wisconsin.

Home range: Northern long-eared bats use approximately 150 acres for their home range in summer (Owen et al. 2003). More information is needed to accurately describe northern long-eared bat home range and habitat in Wisconsin.

Winter: The northern long-eared bat hibernates in caves and abandoned mines in winter and tends to be found in deep crevices (Kurta 1994, Caceres and Barclay 2000). More research is needed to determine what characteristics make suitable caves and mines for northern long-eared bat hibernation.

Northern long-eared bat hibernacula in southwestern Wisconsin: Passage of a mine in Grant County that houses northern bats (left), and solitary northern long-eared bat in a crevice in Pierce County (right). Heather Kaarakka, Wisconsin DNR

Edge habitat (transition zone between two types of vegetation) is important for northern long-eared bats as they migrate and forage. When bats migrate from wintering caves to summer habitat or commute from roosts to feeding grounds, they move through the landscape in a manner that protects them from wind and predators. Instead of flying the shortest distance across a field, for instance, bats will take longer routes that follow edge habitat. In addition to offering protection, this behavior may also allow bats more feeding opportunities because food is more abundant around edge habitat (Limpens and Kapteyn 1991). Commuting along edge habitat may assist the bats with navigation and orientation through use of linear edges as landmarks (Verboom and Huitema 1997).

Threats: Lack of information on bat species' basic ecology is one of the greatest threats to bat conservation in Wisconsin. The northern long-eared bat faces two emerging threats, and several ongoing threats. White-nose syndrome (WNS) was discovered in 2006 in a hibernaculum in New York State, and appears as a white, powdery substance on the bat's face, tail and wings. White-nose syndrome has spread rapidly since 2007 to other hibernacula in neighboring states (USFWS 2012). Infected little brown bat and northern bat hibernacula in New York and surrounding states have experienced mortality rates of over 90%. White-nose syndrome has been called the "most precipitous wildlife decline in the past century in North America" (BCI 2009), and is caused by a fungus called *Geomyces destructans* (Lorch et al. 2011). This fungus grows best in the cool, wet conditions of hibernacula (Verant et al. 2012). Mortality from the fungus appears to come from increased arousals during torpor, which deplete bats' fat reserves and cause starvation (Reeder et al. 2012) and dehydration (Cryan et al. 2010). For up-to-date WNS information, see the USFWS WNS website and the USGS National Wildlife Health Center website (see *Additional Information).* Neither the fungus nor the disease has been found in Wisconsin as of this writing. Cave-hibernating bats, including the northern long-eared bat, should be monitored closely for any

indication of WNS; the Wisconsin Bat Program conducts WNS surveillance and monitoring in the state.

Wind power is another emerging threat to bats – wind turbines have been shown to fatally impact all bat species in Wisconsin (Johnson 2003, Arnett et al. 2008). Wind-turbine blades cause mortality through direct impact or through the pressure differential caused by the motion of the spinning blades. This pressure differential causes a bat's lungs to fill with fluid as it flies near the spinning blades, and this phenomenon (known as barotrauma) kills the bat instantly (Baerwald et. al. 2008). More research is under way to better understand bat wind-turbine vulnerabilities, but current studies suggest that bats face the greatest risk during migration from summer foraging sites to wintering grounds (tree bats) or hibernacula (cave bats) (Johnson 2003, Kunz et al. 2007). Research is needed on all Wisconsin bat species to better understand wind-turbine mortality in the state and the long term population impacts of turbine-related deaths.

Northern long-eared bats also face the ongoing threat of habitat degradation. Habitat degradation is caused by increased agricultural, industrial, and household pesticide use, and it has negative effects on bats through direct exposure and through dietary accumulation (O'Shea et al. 2001). Pesticides are a threat to many taxa, but bats may be more vulnerable than other small mammals due to certain life characteristics (Shore et al. 1996, O'Shea et al. 2001). Bats' longevity and high trophic level means pesticides can concentrate in their body fat (Clark and Prouty 1977, Clark 1988). Even after pesticide exposure ceases, residues can be passed on to nursing young (Clark 1988). Bat species that migrate long distances may be more affected because pesticide residues become increasingly concentrated in the brain tissue as fat reserves are depleted during long-distance flights. This concentration can lead to convulsions and even death (Geluso et al. 1976, Clark 1978).

Northern long-eared bats also face the ongoing threat of hibernaculum disturbance from humans entering hibernacula in winter and waking bats from torpor. Bats in torpor reduce their metabolism and body temperature to low levels that require less energy than being fully awake. Interrupting torpor costs energy; a little brown bat uses up to 100 mg of fat reserves waking and the returning to torpor (and more if the bat starts flying), or the energetic equivalent of up to 67 days of torpor (Thomas et al. 1990, Thomas 1992). This loss clearly represents a large percentage of total body weight of the bat, and repeated arousals may cause bats to run out of energy reserves before spring arrives and therefore starve in the hibernaculum or die from exposure if they seek food outside (Thomas 1995).

Climate Change Impacts: The effects of climate change on the northern long-eared bat are unclear. Predictions suggest a northward expansion in the ranges of all cave-bat species, in pursuit of optimal hibernation (Humphries et al. 2002, USFWS 2007). This prediction assumes an abundance of suitable caves and other hibernaculum structures further north, but this assumption may not hold for karst-free regions at higher latitudes. Bat species may adapt by reducing torpor depth and duration during winter if prey insect species are available for more of the year (Weller et al. 2009), but bats' adaptive capacities in this regard may be limited and are not well known. Shifts in prey insect emergence may also cause mismatches with bat emergence and cause food shortages in the spring or fall.

Survey Guidelines: Persons handling northern long-eared bats must possess a valid Endangered and Threatened Species Permit. If surveys are being conducted for regulatory purposes, survey protocols and surveyor qualifications must first be approved by the Endangered Resources Review Program (see *Contact Information*).

Acoustic surveys, which should be done by trained individuals, are performed for all Wisconsin bat species in spring, summer, and fall; and are used to determine presence/absence, phenology, and distribution around the state. The Wisconsin Bat Program's eventual goal is to use acoustic survey data to determine bat population trends in Wisconsin. Northern long-eared bats are ubiquitous around the state, and therefore surveys can be done wherever appropriate habitat exists. Acoustic recording systems that detect echolocation calls can survey bats as they fly through an area. The bat detection system detects and records these acoustic signals as bats fly by, and records the date and time of each encounter. The Wisconsin Bat Program currently uses broadband frequency division ultrasound detection equipment with a PDA (Personal Data Assistant) and a Global Positioning System. Start acoustic surveys half an hour after sunset, but only if the daytime temperature exceeds 50° F, and conduct the survey for at least one hour. There are three seasons for acoustic surveys: spring (April and May), summer (June and July), and fall (August and September). Acoustic surveys record bat passes, which can then be identified to species by trained individuals. These surveys could be used by land managers to create inventories of species distribution and relative abundance. Visit the Wisconsin bat monitoring website for additional information.

Wisconsin DNR also conducts a roost monitoring program to determine abundance of bats roosting in buildings and bat houses. People with bat houses or other roost sites identify species and count bats over the summer at night as bats leave the roost. People who find a bat roost while doing field surveys should contact the Wisconsin Bat Program to report the information.

Summarize results, including survey dates, times, weather conditions, number of detections, detection locations, and behavioral data and submit via the WDNR online report: <http://dnr.wi.gov, keyword "rare animal field report form">

Management Guidelines

The following guidelines typically describe actions that will help maintain or enhance habitat for the species. These actions are not mandatory unless required by a permit, authorization or approval.

Summer Management

Roost availability is thought to limit northern long-eared bat populations, as it does for many bat species, and thus habitat management is important for the continued survival of this species (Duchamp et al. 2007). Northern long-eared bats are forest dwelling bats, and forest management to promote occupation by this species should increase roosting and foraging habitat (see Habitat section above). Northern long-eared bats have been shown to use both live and dead trees for roosting sites (Foster and Kurta 1999). These bats often roost under exfoliating bark, and therefore snags and dying trees may be important for encouraging northern long-eared bats. Forest managers are encouraged to promote mixed-species, mixed-aged plots as the northern long-eared bat chooses trees based on suitability of crevices and bark as roosts, rather than on tree species (Foster and Kurta 1999). The northern long-eared bat is known to switch roost trees frequently (about every 2 days) over the course of the summer, and therefore this species needs a large number of trees (Foster and Kurta 1999). As with many bat species, suitable forested habitat for northern long-eared bats is a multi-species matrix that contains some open areas (Owen et al. 2003).

Linear corridors are important for migrating and commuting bats, and forests may be managed such that suitable foraging habitat is connected by corridors; this may include managing edge habitat along roads, logging trails and riparian habitat. Land managers should also make an effort to reduce or eliminate burdock (*Arctium minus*), an exotic weed that produces seeds that trap bats and cause death from exposure.

Special consideration should be given to protecting snags or dying trees, especially those near known roost locations, particularly from June 1 through August 15 while bats may have pups at the roost.

Seasonal pools in woodlands may be important foraging and water sources for the northern long-eared bat and other Wisconsin bat species because they provide areas for feeding and drinking in an otherwise closed-canopy forest (Francl 2008). Pool size and depth do not appear to determine usage by northern long-eared bats; instead the presence of an opening in the forest is enough to encourage foraging and drinking (Francl 2008).

Fall Management

During fall swarm, large proportions of Wisconsin's cave bat population gather near entrances of the state's hibernacula (see "Habitat" section), and become concentrated and vulnerable to direct impacts. To avoid disturbance during crucial life history events, management activities such as logging and use of heavy machinery within 0.25 miles of hibernacula entrances should be avoided during fall swarm (August 15-October 15) or during spring emergence (April 1-May 15) because bats may use the surrounding area for roosting during those time periods.

Winter Management

Little is known about how northern long-eared bats choose hibernation sites, but suitable Wisconsin hibernacula typically have steady temperatures between 4° C and 12° C (39-53° F), high humidity, and no human disturbance. Artificial sites that can mimic this environment may provide suitable hibernacula. Artificial hibernacula include bunkers, food storage-caves and basements. Contact the Wisconsin Bat Program to inquire about developing artificial hibernacula.

Natural hibernacula can also be managed to encourage bat use. For example, closing but not sealing the entrance to an abandoned mine not only buffers temperature and humidity, but also reduces disturbance from humans and predators. Eliminating disturbance from humans, except for WNS surveillance, is the best management activity for natural cave hibernacula. Contact the Wisconsin Bat Program for more information about managing bat hibernacula.

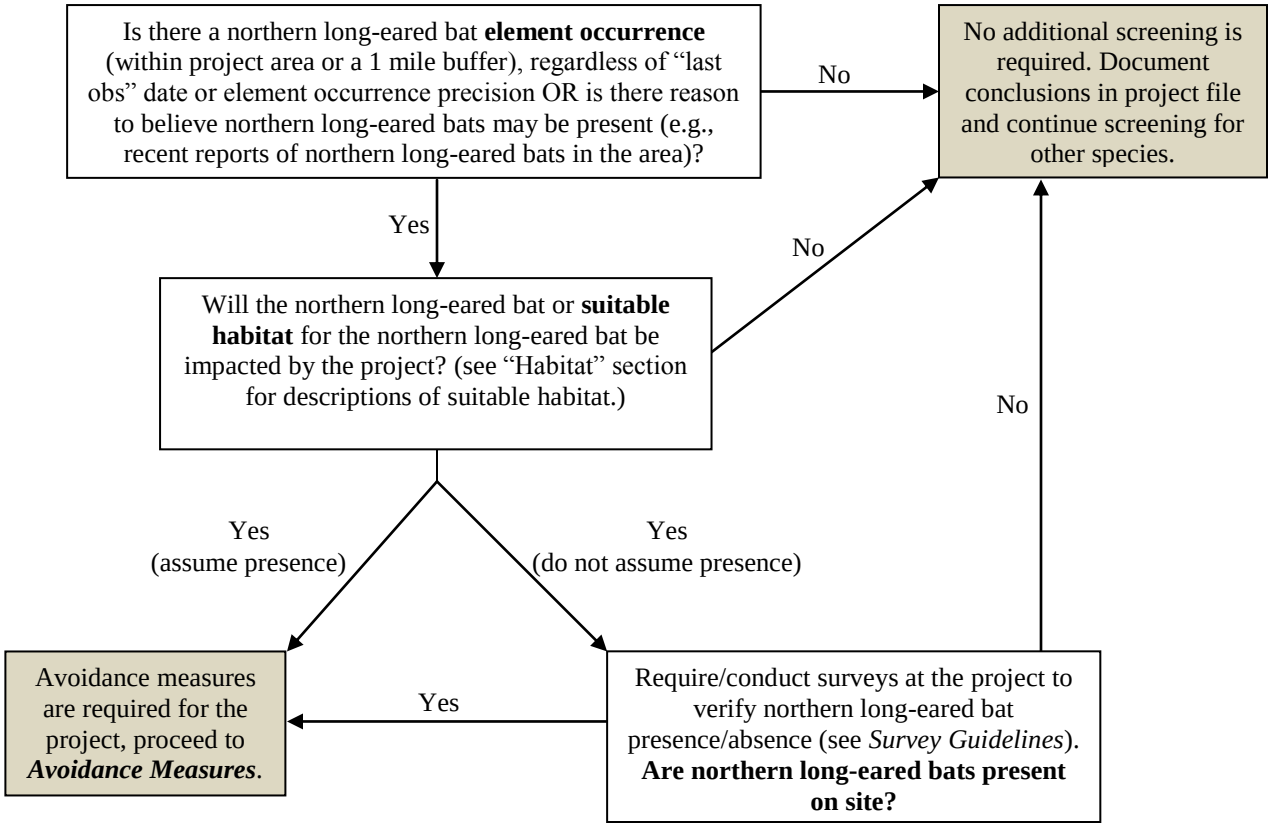
Northern long-eared bats – and their populations as a whole – are particularly vulnerable during winter hibernation because they are concentrated in just a few major hibernacula and because repeated disturbance during hibernation can lead to mortality (see "Threats" section above). Each time a bat is aroused from torpor, it uses up a substantial proportion of the fat reserves it relies on to hibernate through the winter and faces greater odds of starvation before spring (see "Threats" section above). Therefore, avoid entering hibernacula from October 1 through May 15 unless conducting approved and permitted management, surveillance, or research.

Screening Procedures

The following procedures must be followed by DNR staff reviewing proposed projects for potential impacts to the species.

Follow the "Conducting Endangered Resources Reviews: A Step-by-Step Guide for Wisconsin DNR Staff" document (summarized below) to determine if northern long-eared bats will be impacted by a project (WDNR 2012):

Those seeking to complete wind farm projects should review and follow the Guidance for Minimizing Impacts to Natural Resources from Terrestrial Commercial Wind Energy Development created by the WDNR.



Avoidance Measures

The following measures are specific actions required by DNR to avoid take (mortality) of state threatened or endangered species per Wisconsin's Endangered Species law (s. 29.604, Wis. Stats.) These guidelines are typically not mandatory for non-listed species (e.g., special concern species) unless required by a permit, authorization or approval.

According to Wisconsin's Endangered Species Law (s. 29.604, Wis. Stats.), it is illegal to take, transport, possess, process, or sell any wild animal on the Wisconsin Endangered and Threatened Species List (ch. NR 27, Wis. Admin. Code). Take of an animal is defined as shooting, shooting at, pursuing, hunting, catching or killing.

If *Screening Procedures* above indicate that avoidance measures are required for a project, follow the measures below. If you have not yet read through *Screening Procedures*, please review them first to determine if avoidance measures are necessary for the project.

1. The simplest and preferred method to avoid take of northern long-eared bats is to avoid directly impacting individuals, known northern long-eared bat locations, or areas of suitable habitat (described above in the "Habitat" section and in *Screening Procedures*). The U.S. Fish and Wildlife Services identifies humans and their equipment as a possible vectors for spores of *Geomyces destructans* – the fungus that causes white-nose syndrome (WNS) – and therefore simply entering hibernacula at any time of year and moving between them poses threats to bats. Cavers and researchers must observe all cave and mine closures and decontamination protocols (s. NR 40.07, Wis. Admin. Code; see *Additional Information*). In addition, it is illegal to use pesticides and poisons when attempting to evict bats from house roosts (s. 94.708, Wis. Stats.).

2. If suitable habitat cannot be avoided, follow these time-of-year restrictions to avoid take:

Summer Avoidance **(June 1-Aug 15)**

Reproductive females and their young are highly vulnerable to mass mortality during the species' maternity period (June 1 – August 15) because they may aggregate in maternity colonies, and because pups cannot fly and therefore cannot leave the roost for several weeks after birth. Maternity colonies may occur in human structures, and those seeking to exclude bats from a building or other roost must follow the Cave Bat Broad Incidental Take Permit and Authorization (see *Additional Information*).

3. If impacts cannot be avoided during restoration or management activities, including wind projects and forestry management, but activities are covered under the Cave Bat Broad Incidental Take Permit and Authorization; the project is covered for any unintentional take that may occur. For information about natural roost avoidance, see *Management Guidelines* and "Habitat" section above.

4. If northern long-eared bat impacts cannot be avoided, please contact the Natural Heritage Conservation Incidental Take Coordinator (see *Contact Information*) to discuss possible project-specific avoidance measures. If take cannot be avoided, an Incidental Take Permit or Authorization (see *Additional Information*) is necessary.

Additional Information

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Linked Websites:

- Cave bat Broad Incidental Take Permit and Authorization:< http://dnr.wi.gov/topic/erreview/itbats.html>
- Natural Communities of Wisconsin: <http://dnr.wi.gov/org/land/er/communities/>
- Natural Heritage Conservation Permit Requirements: <http://dnr.wi.gov/topic/EndangeredResources/permits.html>

- Rare Animal Field Report Form: <http://dnr.wi.gov, key word "rare animal field report form">
- USFW WNS Website: <http://www.whitenosesyndrome.org>
- USGS National Wildlife Health Center: <http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/>
- Wind Guidance: <http://dnr.wi.gov/topic/Sectors/documents/energy/WindGuidelines.pdf>
- Wisconsin Bat Program Exclusion Instructions: <http://wiatri.net/inventory/bats/Monitoring/Roosts/docs/BatExclusion.pdf>
- Wisconsin Bat Program: <http://wiatri.net/inventory/bats>
- WDNR Decontamination Protocols for Preventing Spread of White-nose syndrome: <http://dnr.wi.gov/topic/WildlifeHabitat/documents/WNS_DeconProtocols.pdf>
- Wisconsin Endangered and Threatened Species: <http://dnr.wi.gov, key word "endangered resources">
- Wisconsin Endangered and Threatened Species Permit: <http://dnr.wi.gov, key word "endangered species permit">"
- Wisconsin Initiative on Climate Change Impacts: <http://www.wicci.wisc.edu/>
- Wisconsin Natural Heritage Inventory Working List Key: <http://dnr.wi.gov/topic/NHI/WList.html>
- Wisconsin's Wildlife Action Plan: <http://dnr.wi.gov/topic/wildlifehabitat/actionplan.html>

Funding

- Natural Resources Foundation of Wisconsin: <http://www.wisconservation.org/>
- USFWS State Wildlife Grants Program: <http://wsfrprograms.fws.gov/subpages/grantprograms/swg/swg.htm>
- Wisconsin Natural Heritage Conservation Fund
- Wisconsin DNR Division of Forestry

Endangered Resources Review Program Contacts

- General information (608-264-6057, DNRERReview@wisconsin.gov)
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U.S. Fish & Wildlife Service

Rufa red knot

Calidris canutus rufa

Skilled aviator Rear Admiral Richard E. Byrd flew over both the North and South poles. But what this renowned man accomplished with the help of sled dogs, ships and airplanes, a little shorebird weighing less than a cup of coffee completes every year of its life. The red knot is truly a master of long-distance aviation.

On wingspans of 20 inches, some red knots fly more than 9,300 miles from south to north every spring and repeat the trip in reverse every autumn, making this bird one of the longest-distance migrants in the animal kingdom. About 9 inches long, red knots are about the size of a robin. Biologists have identified six subspecies, three of them living in the Western Hemisphere: *C.c. islandica*, *C.c. roselaari*, and *C.c. rufa*. This last, the red knot known as rufa, winters at the tip of South America in Tierra del Fuego, in northern Brazil, throughout the Caribbean, and along the U.S. coasts from Texas to North Carolina. The rufa red knot breeds in the tundra of the central Canadian Arctic from northern Hudson Bay to the southern Queen Elizabeth Islands.

Surveys of wintering knots along the coasts of southern Chile and Argentina and during spring migration in Delaware Bay on the U.S. coast indicated a serious population decline during the 2000. Biologists from the U.S. Fish and Wildlife Service, state natural resource agencies,

A red knot banded in May 1987 was seen on Delaware Bay in May 2000. During those 13 years, the bird had flown about 242,350 miles, a distance farther than from the earth to the moon.

and non-profit organizations all share a concern for the rufa red knot and are pooling efforts to identify what needs to be done to prevent further losses.

Strength in numbers

Red knots winter and migrate in large flocks containing hundreds of birds. While we can guess at some of the benefits of traveling in large flocks, such as protection from predators, we can also see the downside - susceptibility to habitat change and loss, oil spills, toxins, red tides, diseases, collisions with wind turbines, storms, and hunting. Red knots were heavily hunted in the early 20th century, and may have never recovered in eastern North America. Knots are still hunted in parts of the Caribbean and South America.

Eating like a bird

For much of the year red knots eat small clams, mussels, snails and other invertebrates, swallowing their prey whole – shell and all. Migrating knots can complete nonstop flights of 1,500 miles and more, converging on critical stopover areas to rest and refuel along the way. In order to endure their long journeys, red knots undergo extensive physical changes. Flight muscles enlarge, while leg muscles shrink. Stomachs and gizzards decrease, while fat mass increases by more than 50 percent. Due to these physical changes, knots arriving from long migration flights are not able to feed maximally until their digestive systems regenerate, a process that may take several days. Thus, migrating birds require stopover habitats rich in easily digested foods – with thin or no shells – in order to gain enough weight to fuel the next flight. In spring, migrating knots seem to follow a northward "wave" in quality prey – by timing their stopovers with the spawning seasons of intertidal invertebrates, knots take advantage of readily digestible food resources like juvenile clams and mussels and horseshoe crab eggs. Red knots arrive at stopovers areas very thin, sometimes emaciated. They eat constantly to gain enough weight to continue their journeys, adding up to 10 percent of their body weight each day and nearly doubling their body weights during some stopovers.

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Requirements for survival

The red knot's unique and impressive life history depends on suitable habitat, food, and weather conditions at far-flung sites across the Western Hemisphere, from the extreme south of Tierra del Fuego to the far north of the central Canadian Arctic. Further, red knots need to encounter these favorable habitat, food, and weather conditions within narrow seasonal windows as the birds hopscotch along migration stopovers between wintering and breeding areas. For example, the red knot population decline that occurred in the 2000s was caused primarily by reduced food availability from increased harvests of horseshoe crabs, exacerbated by small changes in the timing that red knots arrived at the Delaware Bay. Red knots may also be particularly vulnerable to global climate change, which is likely to affect the arctic tundra ecosystem where the knots breed; the quality and quantity of coastal habitats due to rising sea levels; the quantity and timing of invertebrate food resources throughout the bird's range; and the severity, timing, and location of storm and weather patterns.

Horseshoe crab harvests are now managed with explicit goals to stabilize and recover red knot populations; red knot number appear to have stabilized in the past few years, but at low levels relative to earlier decades. Red knots fascinate biologists, bird watchers and people who appreciate the complex beauty of the natural world. Together with these partners, the U.S. Fish and Wildlife Service is dedicated to working to conserve this extraordinary bird.

Northeast Region
U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035
413/253 8200
http://northeast.fws.gov

Federal Relay Service
for the deaf and hard-of-hearing
1 800/877 8339

U.S. Fish and Wildlife Service
http://www.fws.gov
1 800/344 WILD
September 2013

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Summary of Essential Fish Habitat (EFH) Designations

Name of Estuary/ Bay/ River: **Boston Harbor, Massachusetts**

10□ x 10□ latitude and longitude squares included in this bay or estuary or river (southeast corner boundaries):

4220/7100; 4210/7050; 4210/7100

Species	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Atlantic salmon *(Salmo salar)*					
Atlantic cod *(Gadus morhua)*	S	S	M,S	M,S	S
haddock *(Melanogrammus aeglefinus)*	S	S			
pollock *(Pollachius virens)*	S	S	M,S		
whiting *(Merluccius bilinearis)*	S	S	M,S	M,S	
offshore hake *(Merluccius albidus)*					
red hake *(Urophycis chuss)*		S	S	S	
white hake *(Urophycis tenuis)*	S	S	S	S	
redfish *(Sebastes fasciatus)*	n/a				
witch flounder *(Glyptocephalus cynoglossus)*					
winter flounder *(Pleuronectes americanus)*	M,S	M,S	M,S	M,S	M,S
yellowtail flounder *(Pleuronectes ferruginea)*	S	S	S	S	S
windowpane flounder *(Scopthalmus aquosus)*	M,S	M,S	M,S	M,S	M,S
American plaice *(Hippoglossoides platessoides)*	S	S	S	S	S
ocean pout *(Macrozoarces americanus)*			S	S	
Atlantic halibut *(Hippoglossus hippoglossus)*	S	S	S	S	S
Atlantic sea scallop *(Placopecten magellanicus)*					
Atlantic sea herring *(Clupea harengus)*		S	M,S	M,S	
monkfish *(Lophius americanus)*					
bluefish *(Pomatomus saltatrix)*			M,S	M,S	
long finned squid *(Loligo pealei)*	n/a	n/a			
short finned squid *(Illex illecebrosus)*	n/a	n/a			

Atlantic butterfish *(Peprilus triacanthus)*	S	S			
Atlantic mackerel *(Scomber scombrus)*	M,S	M,S	M,S	M,S	
summer flounder *(Paralicthys dentatus)*					
scup *(Stenotomus chrysops)*					
black sea bass *(Centropristus striata)*					
surf clam *(Spisula solidissima)*	n/a	n/a			
ocean quahog *(Artica islandica)*	n/a	n/a			
spiny dogfish *(Squalus acanthias)*	n/a	n/a			
tilefish *(Lopholatilus chamaeleonticeps)*					

NPS Form 10-900
(Rev. 8-86)

OMB No. 1024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

MAR 2 0 1990

NATIONAL REGISTER

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name Calf Pasture Pumping Station Complex

other names/site number

2. Location

street & number 435 Mount Vernon Street [N/A] not for publication

city, town Boston, (Dorchester) [N/A] vicinity

state Massachusetts code 025 county Suffolk code 025 zip code 02125

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
		Contributing	Noncontributing
[ ] private	[X] building(s)	3	1 buildings
[X] public-local	[ ] district		sites
[ ] public-State	[ ] site		structures
[ ] public-Federal	[ ] structure		objects
	[ ] object	3	1 Total

Name of related multiple property listing:
N/A

Number of contributing resources previously listed in the National Register 0

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this [X] nomination [ ] request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property [X] meets [ ] does not meet the National Register criteria. [ ] See continuation sheet.

Valerie A Talmage — June. 11, 1990

Signature of certifying official Executive Director, Massachusetts Historical Commission; State Historic Preservation Officer — Date

State or Federal agency and bureau

In my opinion, the property [ ] meets [ ] does not meet the National Register criteria. [ ] See continuation sheet.

Signature of commenting or other official — Date

State or Federal agency and bureau

5. National Park Service Certification

I, hereby, certify that this property is:

[ ] entered in the National Register.
[ ] See continuation sheet.
[ ] determined eligible for the National Register. [ ] See continuation sheet.
[ ] determined not eligible for the National Register.
[ ] removed from the National Register.
[ ] other, (explain:) _____

Signature of the Keeper — Date of Action

6. Function or Use Calf Pasture Pumping Station, Boston (Dorchester), Massachusetts

Historic Functions (enter categories from instructions)	Current Functions (enter categories from instructions)
Government: Public Works	Government: Public Works

7. Description

Architectural Classification (enter categories from instructions)	Materials (enter categories from instructions)
Romanesque Revival	foundation Stone: Granite
Queen Anne	walls Stone: Granite
	roof Asphalt
	other

Describe present and historic physical appearance.

Portions redacted

The Calf Pasture Pumping Station is located on Columbia Point, a 350 acre peninsula, two miles south of Boston in the neighborhood of Dorchester. The pumping station and two related outbuildings, a gate house and shaft entrance, share a 9.5 acre lot and face northeast onto Dorchester Bay. The landscape of the peninsula is generally flat, with the exception of a hilly area to the east of the pumping station. A modern building, the switch house, is located north of the pumping station complex, and is not included in the nomination.

Columbia Point was the landing place in Dorchester for Puritan Settlers. Native Americans called the site "Mattaponnock". Between 1630 and 1869, the marshlands of the peninsula were used as a cow or "calf pasture." Its land mass originally totalled only 14 acres; however, numerous landfills from the mid-19th through the mid-20th centuries have increased the acreage to its present size, 350 acres.

Calf Pasture's pumping station shares Columbia Point with several notable buildings. To the northwest is the recently renovated Harbor Point Complex, originally built in 1953 as one of the nation's first public housing projects, it is now a mixed income development. Calf Pasture's rear facade faces the University of Massachusetts Boston Harbor Campus, constructed in 1970. It is a large red brick complex which has a total of 1.6 million square feet of classrooms, offices and recreation space. In 1979, the John F. Kennedy Library was constructed from designs by I.M. Pei and Associates. The dramatic white concrete and glass structure stands at the eastern tip of Columbia Point, facing Dorchester Bay. Finally, the Massachusetts Archives building, designed by Jim Batchelor and completed in 1986, is located to the east of the Pumping Station. This structure houses the Commonwealth Museum, the State Records Center and the Central Micrographics unit.

The plan of the structure is L-shaped. The engine room, the main section, measures 201 feet by 72 feet. The boiler room, an ell off of the engine room, measures 80 feet by 60 feet. The main elevation is divided into 5 sections, arranged in a step fashion. The lowest sections are 23 feet high and are on the outside. The intermediate sections measure 45 feet while the center section is 84 feet.

[X] See continuation sheet

The central section has a very steeply pitched gable-on-hip roof; the roof on the four remaining sections is flat. Copper flashing is evident on the main facade. This central section on both the front and rear elevations is framed by narrow castellated turrets which functioned as ventilators for the steam driven pumps. The gable-on-gable roof on the one story ell, which served as a boiler room, features a row of clerestory windows.

The exterior walls are constructed of rough cut, rock faced granite. Dark colored granite is used for most of the exterior; light granite is used to highlight certain architectural elements. Decorative detailing in lighter granite includes the belt courses, window and door frames and the castellated cornice. The central section of the main elevation has two plaques; the one to the left reading "B.I.S." (Boston Improved Sewer), and the one to the right with the construction date, 1883. All original granite appears to be intact and in excellent condition. However, years of accumulated dirt hide the polychromatic scheme. The structure's foundation is made of granite.

The structure is articulated by round arch and rectangular windows, spaced evenly throughout the elevations. The central section of the main elevation is dominated by a huge round arch window, measuring 26 feet in diameter. This window is set directly above the large double doors which serve as the main entrance. The outer, one story sections each contain four rectangular windows. The fenestration of the rear elevation is similar to the front. This pattern continues on the sides of the lower section.

A prominent belt course at the second story of the central section becomes the cornice line of the intermediate section. It is highlighted by rough cut, exagerated dentils, giving the structure a castle-like appearance. Enhancing that sense are the castellated turrets which rise above the cornice line.

The ell housing the boiler room is one story with long rectangular windows along its length. A round arch loading bay is placed at the center of the ell. Remnants of the coal room, partially demolished in the 1940s, are clearly evident at the rear of the ell.

The gatehouse and filth hoist is a compact one story rectangular structure with a hipped roof. Copper flashing is visible on all elevations. It is constructed of rough hewn granite in a style similar to the pumping station. Each elevation, with the exception of the main elevation, is dominated by two large, round arch windows. The main elevation has a door in place of one window. A granite chimney rises above the cornice line.

The west shaft entrance is a rectangular building with a hipped roof. The rectangular structure has two windows on each side bay, one window on one end

(continued)

bay and a door on the other. Unlike the other structures, it is built of brick with granite accents. Granite voissoirs over the round arch windows, a heavy granite beltcourse and clasping buttresses highlight the exterior.

The interior of the main engine room is large and spacious. Above the floor level are several wrought iron catwalks supported by decorative iron brackets. Reached by circular stairs in the turrets, these were originally constructed so that the steam pumps could be serviced. The engine room has partial flooring at the grade level; stairs lead down to where the pumps are now located, below grade. The interior features decorative red and buff brickwork in the upper central section of the engine room.

The only category of archaeological resources that may be present at the Calf Pasture Pumping Station property is prehistoric.

but no archaeological survey has yet been conducted. There is no specific documentation for potentially significant historic period archaeological remains.

In 1968, the majority of the windows were bricked in to prevent vandalism. Since that time, the rear coal storage room collapsed and was removed. A brick wall was erected at the end of the adjacent boiler room. In general, the structure has not been well maintained, evidenced in a leaking roof and rusting ironwork. Exterior and interior walls require cleaning as they have lost the distinction between light and darker colored granite.

Access to the pumping station is from Mount Vernon Street through the Harbor Point development, and via the University of Massachusetts access road which provides a route to all buildings on the eastern side of Columbia Road from Morrissey Boulevard.

(end)

8. **Statement of Significance** Calf Pasture Pumping Station, Boston (Dorchester), Massachusetts

Certifying official has considered the significance of this property in relation to other properties:

☐ nationally ☐ statewide ☒ locally

Applicable National Register Criteria ☒ A ☐ B ☒ C ☐ D

Criteria Considerations (Exceptions) ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☐ G

Areas of Significance (enter categories from instructions)	Period of Significance	Significant Dates
Architecture	1883-1905	1883
Community Planning and Development		1905
Engineering		
Invention		

Cultural Affiliation: N/A

Significant Person: N/A

Architect/Builder: Clough, George Albert

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

The significance of the Calf Pasture Pumping Station is manifold. Historically, it is the first sewage pumping station in Boston, and represents the city's first major effort to establish a comprehensive public sewage system. It is an excellent example of Richardsonian Romanesque architecture, designed by City architect, George Clough and represents an evolving industrial building type to house innovative equipment. The pumping station is the only remaining 19th century building on Columbia Point. Calf Pasture Pumping Station retains integrity of location, design, setting, materials, workmanship, feeling and association, and therefore meets Criterion A and C of the National Register of Historic Places on the local level.

In 1872, the Board of Health for the City of Boston reported that "large territories have been at once and frequently enveloped in an atmosphere of stench so strong as to arouse the sleeping, terrify the weak and nauseate and exasperate everybody." Such conditions were prevalent in post-Civil War American cities with the increase of immigrant populations, living in close cramped quarters. Cholera and typhoid were two diseases which threatened the residents of poorer sections of the city as the public drinking water was contaminated by private sewer disposal pipes. With specific reference to the North End, a report entitled "The Sewage of Boston" found that this neighborhood had many "open mouthed" cesspools. Consequently, the report wrote, "no dispensary physician who has (the haymarket) district can have failed to notice the deleterious influence of such conditions upon the health of people who are absolutely powerless to help themselves."

Joseph P. Davis, the City Engineer, was sent to Europe in September, 1876, to examine the sewage systems of other major cities. After his return in 1878, he presented detailed suggestions for Boston's new system. Davis' plan recommended that all established sewer pipes be connected to a central, but distant point via a series of intermediate connecting pipes. At that central location, sewage would be pumped through pipes to holding tanks on Moon Island and then discharged into the ocean with the retreating tide.

☒ See continuation sheet

The Boston Improved Sewage Commission decided that the Old Harbor Point in Dorchester, with its salt marshes, low land values and remote location would be an ideal site for this main drainage center. The Old Harbor Point provided an intermediate route to Moon Island in Dorchester Bay, where sewage was to be stored until it could be released with the outgoing tide. In addition, it was close to the ocean, allowing coal-filled barges to have easy access to the building. Therefore, as planned, the Calf Pasture Pumping Station was built at the Old Harbor Point as the keystone of the sewage disposal network known as the Boston Improved Sewage System.

Between 1875 and 1883, a series of citywide intercepting sewers were built to receive sewage from existing pipes. The new sewage system, including two pumping engines cost $6,551,064. The two great steam pumping engines were designed by Erasmus D. Leavitt of Cambridgeport, Massachusetts. Both engines raised sewage to 35 feet, a height which caused the sewage to flow to Moon Island by gravity. The Leavitt Pumps were the world's largest at the time, their fly wheels each weighing 72.5 tons and measuring 50 feet in diameter.

In April, 1882, the City Council was petitioned to allot extra funding to construct a pumphouse of fireproof quality to house this large equipment. The City Architect's department was given this commission and $300,000 was allocated to the construction and design.

As designed, the layout consisted of an engine room, a coal room and two boiler rooms. The boiler rooms connected the larger engine and coal rooms, and thus created a square plan with a central courtyard. However, only the large engine room, one boiler room and a coal shed were built, hence the structure was shaped like an L rather than being square.

The structure had been designed to accommodate eight pumps with boilers. On January 1, 1884, when the station began pumping, only two pumps were in place. At that time, only three quaters of the engine room had been constructed. The northeast wing was added in 1905.

The plans for the Calf Pasture Pumping Station are dated August 1, 1881; when the structure was completed in 1883, several designed elements were not included. Originally the four turrets were designed with conical towers; however, they were built with castellated tops, most likely to accommodate a steam release ventilation system. The roof was more steeply pitched in the original design, and there was more detailing and articulation of the stone work.

At its completion in 1905, the Calf Pasture Pumping Station was a dramatic sight at Old Harbor Point. Its heavy proportions and castle-like silhouette dominated the slim peninsula. A gatehouse of compatible design and materials

(continued)

was built at the northwest side of the pumping station to house gates that controlled the flow of sewage into the station. The gatehouse also contained the filth hoists which measured the height of the sewage coming from the pipes to the pumping station and also screened the sewage for solids.

Another smaller structure, an entrance to the West Shaft, lies east of the pumping stations, along water's edge. A very narrow peninsula once stretched from the pumping station to this small building, but the area has since been landfilled. The structure covers the west shaft, which was used as an access way to the underground tunnel that carried sewage from Calf Pasture to Moon Island. This entrance allowed workers on small barges to scrape sludge from the bottom of the tunnel.

The plan and elevation of the structure indicates the functions which occur inside. The roof height is lower where two Worthington pumps, used in case of heavy rainfall, were originally placed, and taller to accommodate the Leavitt pumps. The decorative castellated turrets served as ventilation units, and the many windows provided adequate lighting for all areas on the interior.

Stylistically, the Calf Pasture Pumping Station responds to the eclectic nature of architectural design in the late 19th century. The steeply pitched roof and crenellated turrets appear to be inspired by medieval architecture whose elements were often used in the Queen Anne style. Also evident is the influence of Henry Hobson Richardson's Romanesque Revival style. Although lacking the polychromatic stonework, the structure's predominant features including supporting arches, rough cut granite and the heavy proportions indicate Richardson's influence.

In his book American City Planning, Mel Scott wrote that by 1915, Boston "had park, water supply and sanitation systems unmatched in the entire nation." Within 35 years of its construction, the Calf Pasture Pumping Station was the keystone of a sewage disposal system that was a model for the rest of the country.

The architectural significance of the Pumping Station has often been overshadowed by the industrial importance of the complex, as Boston's first sewage pumping station. The designer of the pumping station, City Architect, George Albert Clough, had previously designed parts of the fresh water system for Chestnut Hill and Framingham.

Clough was born on March 27, 1843, in Blue Hill Maine. He attended Blue Hill Academy and worked as a draftsman for his father, Asa Clough, a shipbuilder. In 1863, after his father's death, Clough went to Boston to study architecture in the office of Snell and Gregerson. He stayed with the firm until 1869 when he opened his own office in the City of Boston. An 1897 directory of Maine

(continued)

business professionals, Men of Progress, wrote of Clough: "his lifelong and thorough training, combined with his natural aptitude for the profession, made him successful from the start."

Clough was appointed Boston's first City Architect in 1874, five years after leaving the firm of Snell and Gregerson. Under his ten-year direction of that office, Clough was responsible for an extensive number of public structures in Boston including the Latin and English High School, the Suffolk County Courthouse, the Prince School on Newbury Street, and the Congress Street Fire Station in the Fort Point Channel. He also provided the first plans accepted by the trustees of the Boston Public Library in 1880 and carried out the first restoration of the State House in 1881. Clough designed 85 school buildings in Maine, Massachusetts, New York and Pennsylvania.

The Calf Pasture Pumping Station appears to have brought an end to Clough's term as City Architect. City Council records consistently indicated that the construction of the pumping station should be carried out by laborers from the City of Boston. Clough created controversy when he dismissed all masons working on the project, claiming they were actually from Maine. He replaced them with men of his own choice; the City Council felt these men were poor craftsmen. The City Aldermen believed that the fired men were from Boston, and not Maine as Clough contended.

After being removed from his position as City Architect, Clough resumed his private practice with an office at 53 Tremont Street. He designed numerous public buildings and homes in Blue Hill, Maine. In 1905, Clough established a firm called Clough and Wardner, which designed several homes in Boston and Brookline. Clough died in Brookline, Massachusetts in January, 1911.

In 1940, one of the two Leavitt pumps cracked. As a result both the Leavitt and the Worthingon pumps were dismantled and removed. The entire system was changed from steam power to electric power. Today, the interior of the Pumping Station does not retain any of its historically significant engineering equipment, although the gatehouse retains its original filth hoist apparatus. After the 1940s, the station no longer required the enormous space designed to house the pumps and the coal room was no longer necessary. When the roof of the coal room collapsed in 1946, this section was demolished. In 1954, after numerous break-ins, the building's windows were bricked up. Until 1968, Calf Pasture Pumping Station was the system's headworks, handling all of the city's sewage.

A new sewage treatment plant was constructed on Deer Island in Boston Harbor in 1968. A new headworks near Columbia Circle was constructed as the primary gatherer of sewage to be transported to the new treatment plant. The new system proved to be inadequate, requiring that Calf Pasture and Moon Island

(continued)

remain open, on a stand-by basis, in case of heavy rains.

Although little maintenance has been done in recent years, the Calf Pasture Pumping Station is reported to be structurally sound.

Administration of the pumping station passed from the Boston Improved Sewage Commission to the City's Street Department, later the Public Works Department. Sewage treatment and disposal were operated by Sewage Division of Public Works until 1977, when the Boston Water and Sewer Commission was established. At present, the Boston Water and Sewer Commission owns and operates Calf Pasture Pumping Station. With the new efforts of the Massachusetts Water Resources Authority to clean up Boston Harbor and update the Deer Island facilities, it is expected that the Calf Pasture Pumping Station will no longer be needed.

(end)

9. Major Bibliographical References

Archives, Boston Water and Sewer Commission, Boston, Mass.
-Collection of drawings of Calf Pasture Pumping Station
-Collection of Photographs
-Collection of maps explaining history of sewers in Boston

Book

Clark, Eliot C., Main Drainage Works of the City of Boston, Boston, Rockwell and Churchill, 1885.

☒ See continuation sheet

Previous documentation on file (NPS):
- ☐ preliminary determination of individual listing (36 CFR 67) has been requested
- ☐ previously listed in the National Register
- ☐ previously determined eligible by the National Register
- ☐ designated a National Historic Landmark
- ☐ recorded by Historic American Buildings Survey # _____
- ☐ recorded by Historic American Engineering Record # _____

Primary location of additional data:
- ☒ State historic preservation office
- ☐ Other State agency
- ☐ Federal agency
- ☒ Local government
- ☐ University
- ☐ Other

Specify repository:
Massachusetts Historical Commission
Boston Landmarks Commission

10. Geographical Data

Acreage of property 9.5 Acres

UTM References

	Zone	Easting	Northing
A	19	332400	4686350
B			
C			
D			

☐ See continuation sheet

Verbal Boundary Description

The nominated property conforms to the city of Boston Tax Assessor's parcel number 3413, Ward 13, Precinct 3.

☐ See continuation sheet

Boundary Justification

The bounaries for this complex encompass the pumping station and its gate/filth hoist house, both of which have historically fallen within the boundaries of this complex. A third structure which covered the west Shaft is no longer within the complex's parcel but is connected to the parcel via underground property rights. The parcel of land belonging to the pumping station complex was once much larger but has since been subdivided.

☐ See continuation sheet

11. Form Prepared By

name/title Katherine L. Kottaridis, Boston Landmarks Commission, with Betsy Friedberg, NR Director, Mass. Historical Commission
organization _____ date February 3, 1988
street & number 80 Boylston Street telephone 617-727-8470
city or town Boston state Massachusetts zip code 02116

9. Major Bibliographical References (cont.)

Eliot, Samuel A., Biographical History of Massachusetts, Volume 3, Boston, Massachusetts Biographical Society, 1911.

Herndon, Richard, Men of Progress: Biographical Sketches of Leaders in Business and Professional Life in the State of Maine, Boston, New England Magazine, 1897.

Warner, Sam Bass, Streetcar Suburbs, Cambridge, Harvard University Press, 1978.

Periodicals

Engineering News, February 17, 1883.

Obituary of George Clough, Ellsworth (Maine) American, January 11, 1911, p.6.

Society for Industrial Archaeology, Thirteenth Annual Conference Tour Brochure: South Boston, Quincy, and Dorchester, Boston, 1984.

Reports

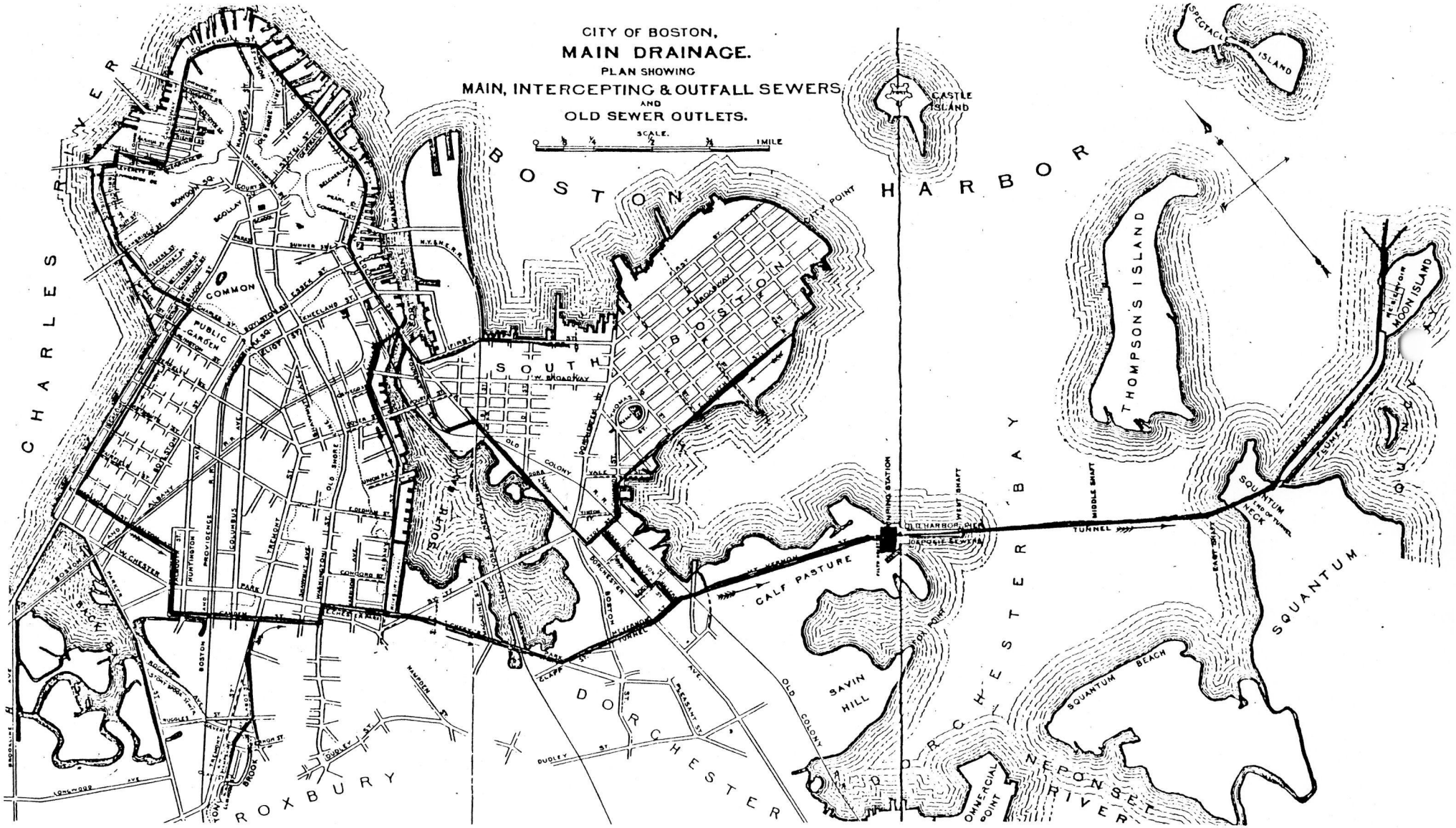
Boston City Council, Reports for the Municipal Years 1876, 1877, 1878, 1880, 1882, 1883, Boston, Rockwell and Churchill.

Massachusetts Water Resources Authority, Calf Pasture/Moon Island Feasibility Study Fact Sheet, Boston, April 25, 1986.

_____, Report of the Combined Sewerage Overflow Scheduling, Boston, February 27, 1987.

University of Massachusetts at Boston, Pumphouse Advisory Committee, The Pumphouse: A Proposal to Recycle the Calf Pasture Pumping Station at Columbia Point as a Community/University Center, 1975.

Weidlinger Associates, Structural Evaluation of the Calf Pasture Pumping Station, Cambridge, 1983.


CITY OF BOSTON,
MAIN DRAINAGE.
PLAN SHOWING
MAIN, INTERCEPTING & OUTFALL SEWERS
AND
OLD SEWER OUTLETS.
SCALE.
1 MILE
CHARLES RIVER
BOSTON HARBOR
CASTLE ISLAND
SPECTACLE ISLAND
THOMPSON'S ISLAND
GEORGES ISLAND
BOSTON COMMON
PUBLIC GARDEN
SOUTH BOSTON
CALF PASTURE
SAVIN HILL
SQUANTUM
SQUANTUM BEACH
SQUANTUM NECK
DORCHESTER BAY
DORCHESTER
ROXBURY
COMMERCIAL POINT
NEPONSET RIVER
PUMPING STATION
TUNNEL
MIDDLE SHAFT
WEST SHAFT
EAST SHAFT
OLD COLONY
OLD HARBOR PIER

Taken by Board of Aldermen Jan 29, 1879

[illegible]

CITY OF BOSTON.

IMPROVED SEWERAGE

MAIN INTERCEPTING SEWER

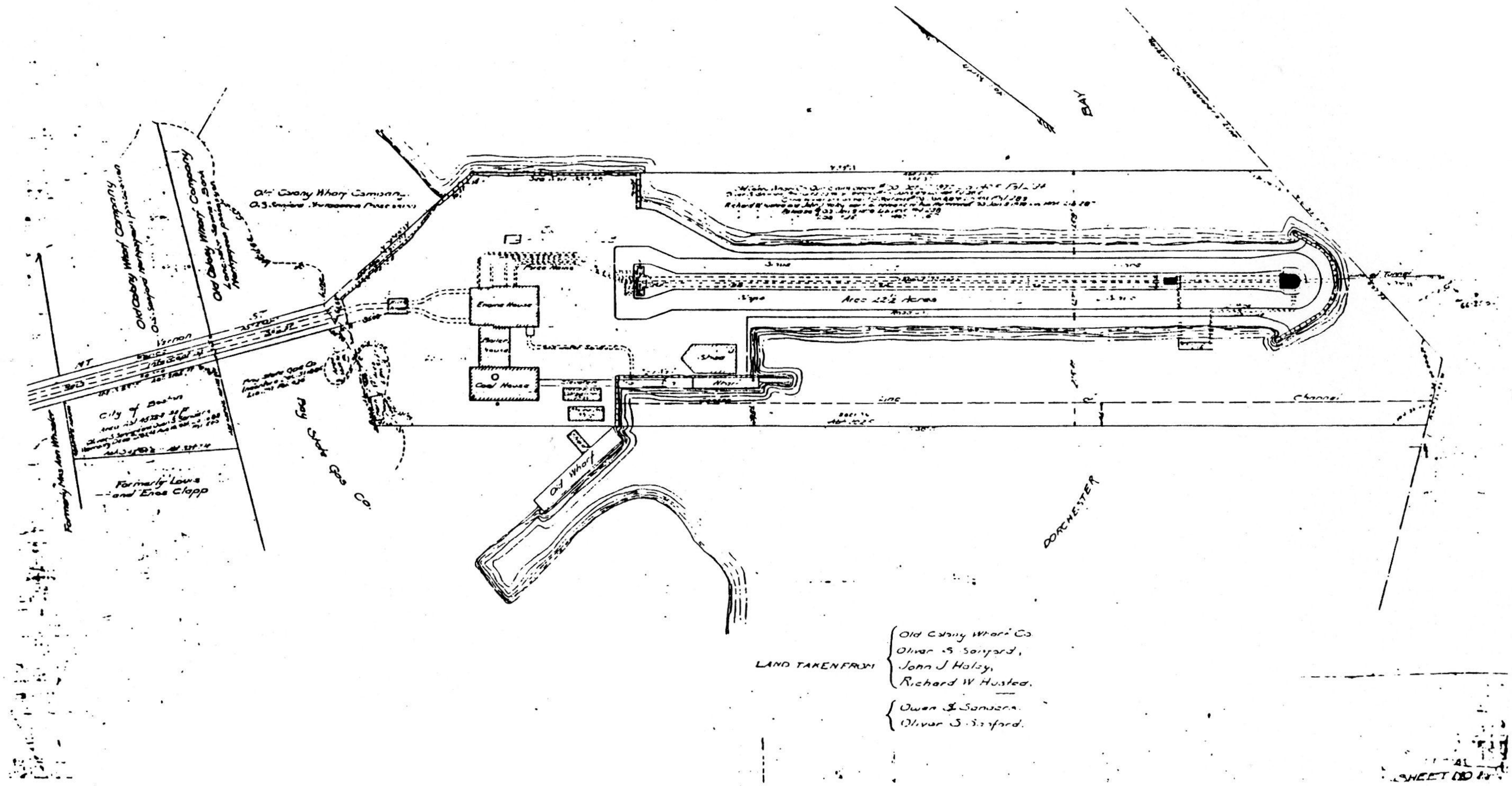
LAND PLAN.

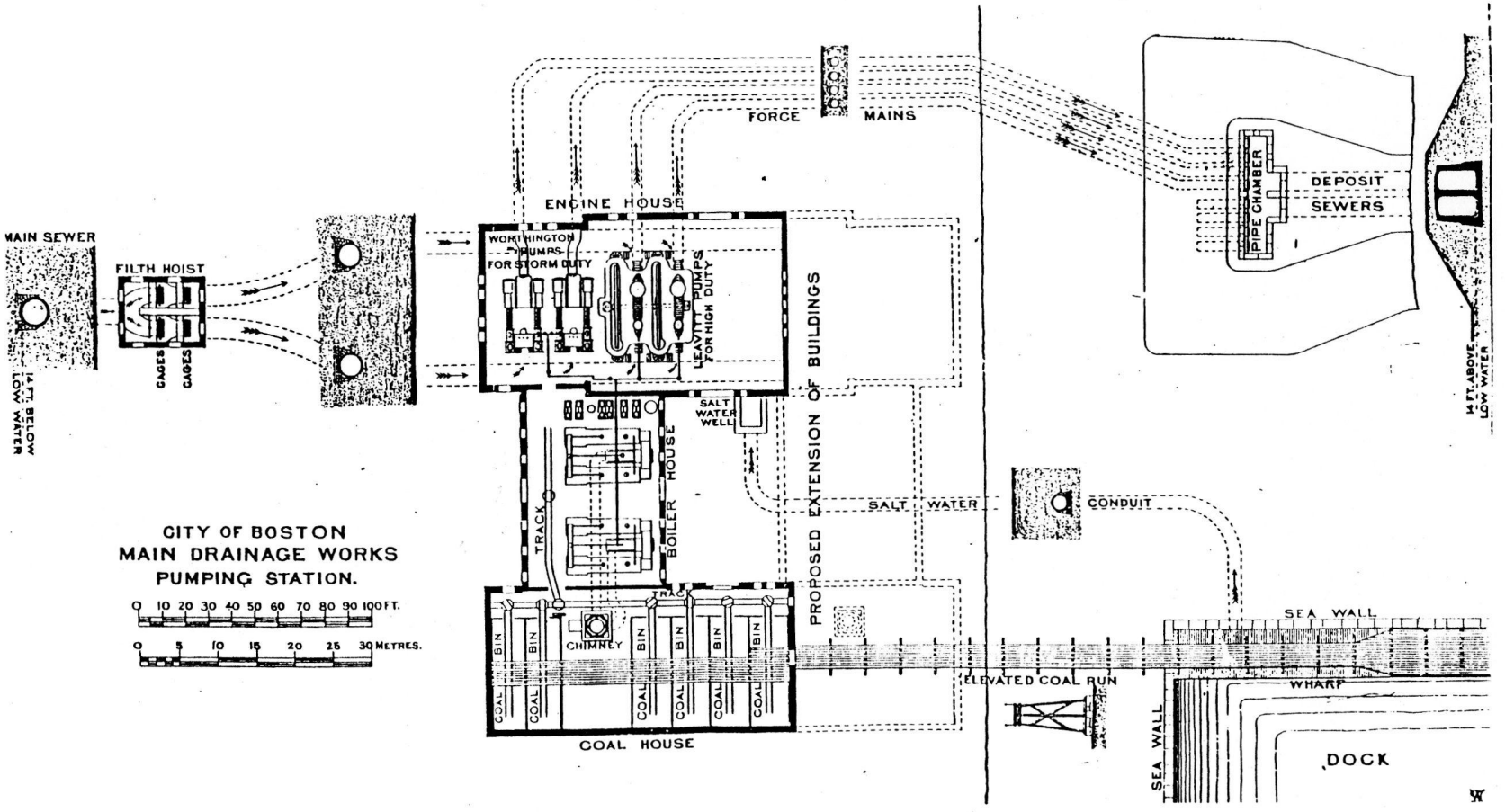
COPY

Scale: 100 ft to an inch

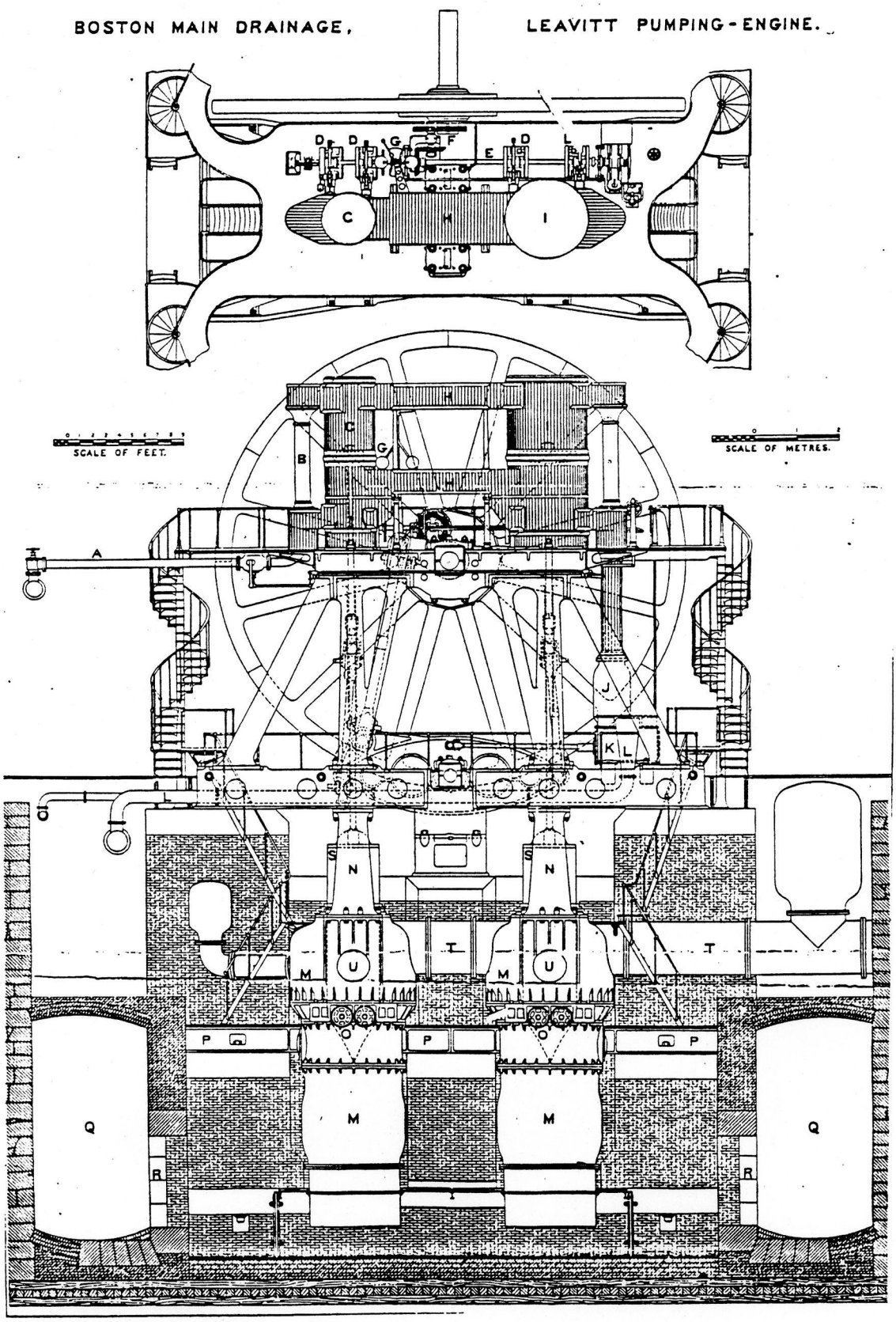
Aug. 1880.

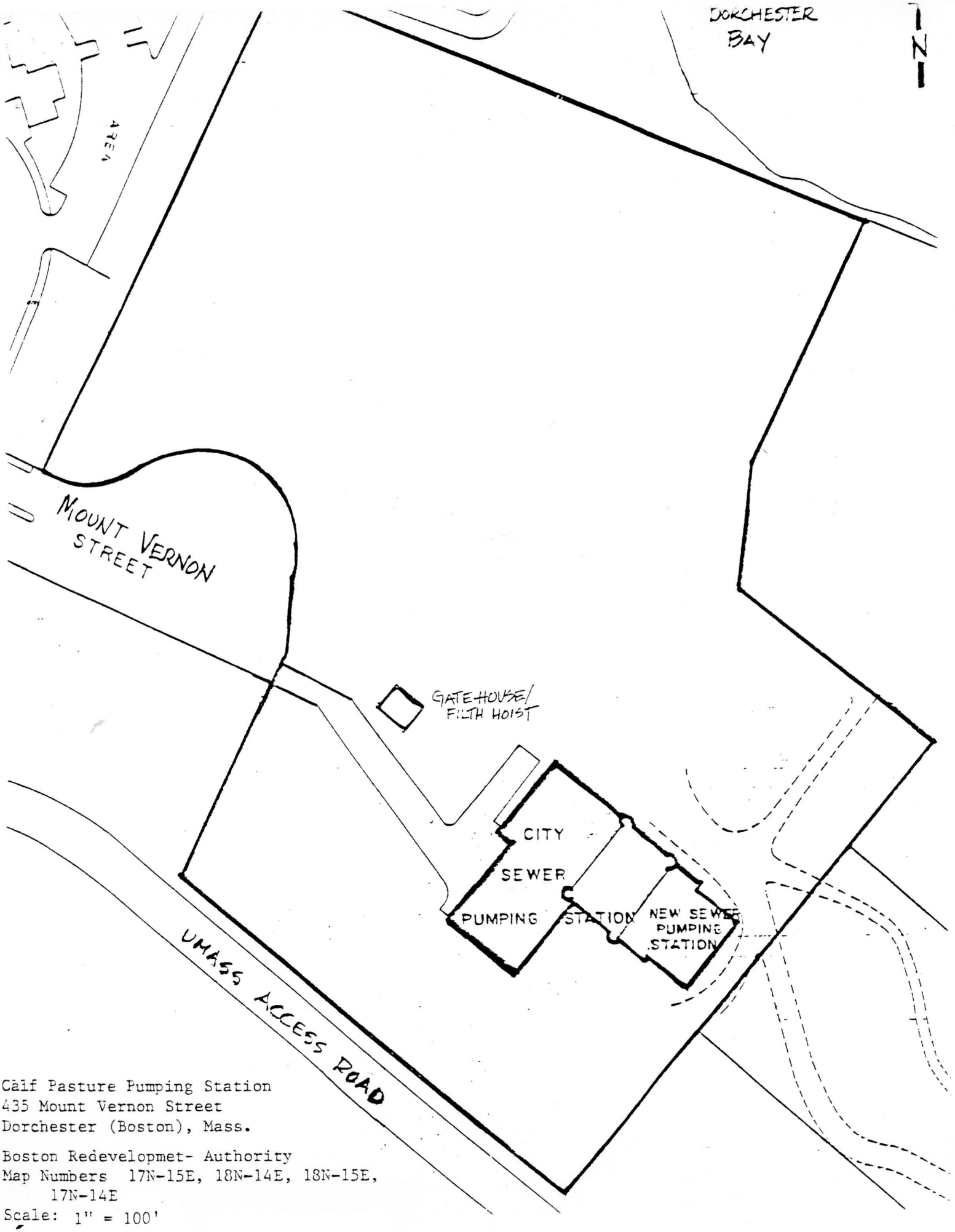
Note: Copied from plan made by Eliot C. Clarke Oct 10, 1877 and plans made by Wm Jackson May and June 1885




MAIN SEWER
14 FT. BELOW LOW WATER
FILTH HOIST
GAGES
GAGES
ENGINE HOUSE
WORTHINGTON PUMPS FOR STORM DUTY
LEAVITT PUMPS FOR HIGH DUTY
FORCE MAINS
PIPE CHAMBER
DEPOSIT SEWERS
14 FT. ABOVE LOW WATER
SALT WATER WELL
BOILER HOUSE
TRACK
PROPOSED EXTENSION OF BUILDINGS
SALT WATER CONDUIT
CITY OF BOSTON
MAIN DRAINAGE WORKS
PUMPING STATION.
0 10 20 30 40 50 60 70 80 90 100 FT.
0 5 10 15 20 25 30 METRES.
TRACK
CHIMNEY
BIN
COAL
COAL HOUSE
SEA WALL
ELEVATED COAL RUN
WHARF
SEA WALL
DOCK

BOSTON MAIN DRAINAGE. LEAVITT PUMPING-ENGINE.





Calf Pasture Pumping Station
435 Mount Vernon Street
Dorchester (Boston), Mass.

Boston Redevelopmet- Authority
Map Numbers 17N-15E, 18N-14E, 18N-15E,
17N-14E
Scale: 1" = 100'

-VICINITY PLAN-
CALF PASTURE PUMPING STATION

50 200
0 100 400

N

OLD HARBOR

JFK LIBRARY

WEST SHAFT

STATE ARCHIVES BUILDING

CALF PASTURE PUMPING STATION

HARBOR POINT RESIDENTIAL DEVELOPMENT

UNIV. OF MASS.

CALF PASTURE PUMPING STATION

~~19/332050/4683~~

19/332106/4686873

[NAD 1983]

corrected 9/2012

Feet	Meters
1	.3048
2	.6096
3	.9144
4	1.2192
5	1.5240
6	1.8288
7	2.1336
8	2.4384
9	2.7432
10	3.0480

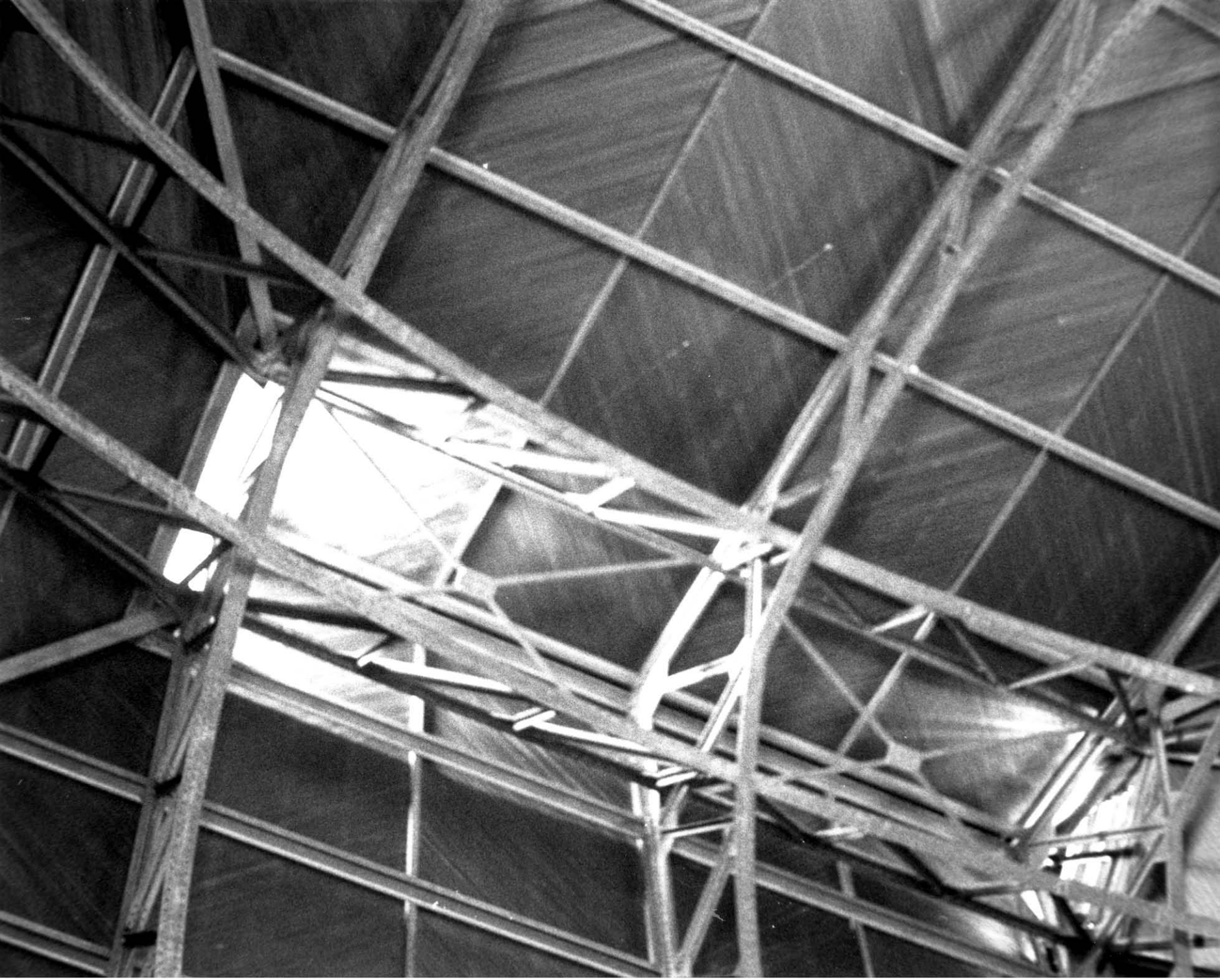
To convert feet to meters

1. Calf Pasture Pumping Station. Camera facing north (Photograph: Katherine L. Kottaridis, February 1988)

2. Calf Pasture Pumping Station. Camera facing east (Photograph: Katherine L. Kottaridis, February 1988)

3. Interior, camera facing southwest (Photograph: Katherine L. Kottaridis, February 1988)

4. Interior, camera facing southwest (Photograph: Katherine L. Kottaridis, February 1988)



5. Interior ceiling (Photograph: Katherine L. Kottaridis, February 1988)

6. Calf Pasture Pumping Station: Gatehouse/filthhoist. Camera facing northwest (Photograph: Katherine L. Kottaridis, February 1988)

7. Calf Pasture Pumping Station: West Shaft Cover. Camera facing east. (Photograph: Katherine L. Kottaridis, February 1988)

NPS Form 10-900-a
(8-86)

OMB Approval No. 1024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Section number _____ Page _____

SUPPLEMENTARY LISTING RECORD

NRIS Reference Number: 90001095 **Date Listed:** 08/02/90

Calf Pasture Pumping Station Complex | Suffolk | MA
Property Name | **County** | **State**

N/A
Multiple Name

This property is listed in the National Register of Historic Places in accordance with the attached nomination documentation subject to the following exceptions, exclusions, or amendments, notwithstanding the National Park Service certification included in the nomination documentation.

Barbara J. Savage — 8/2/90
for **Signature of the Keeper** — **Date of Action**

==========

Amended Items in Nomination:

4. State/Federal Agency Certification:

As clarified when resubmitted, the property is owned by the Boston Water and Sewer Commission, a public entity; thus, under public ownership the requested action is on a nomination, not a determination of eligibility.

This information was confirmed with Ann Tait, MASHPO, by telephone.

DISTRIBUTION:
National Register property file
Nominating Authority (without nomination attachment)

Massachusetts Cultural Resource Information System

MACRIS

MACRIS Search Results

Search Criteria: Street Name: morrissey blvd; Resource Type(s): Area, Building, Burial Ground, Object, Structure;

Inv. No.	Property Name	Street	Town	Year
BOS.9656	Old Harbor Reservation Parkway - Columbia Circle	Columbia Rd	Boston	1924
BOS.9169	Old Colony Railroad Bridge (Milepost #4.33)	Morrissey Blvd	Boston	1926
BOS.9189	Dorchester Bay Bridge - Beades Memorial Bridge	Morrissey Blvd	Boston	1927
BOS.9500	Savin Hill Beach - Malibu Beach	Morrissey Blvd	Boston	1899
BOS.9501	Savin Hill Beach - Malibu Beach Playground	Morrissey Blvd	Boston	2000
BOS.13803	Savin Hill Beach - Malibu Beach Bath House	Morrissey Blvd	Boston	r 1985
BOS.16665	Kennedy, John F. Library and Museum	Morrissey Blvd	Boston	1977
BOS.15601	Hayes, Annie House	992 Morrissey Blvd	Boston	c 1918

Massachusetts Cultural Resource Information System

Scanned Record Cover Page

Inventory No:	BOS.16665
Historic Name:	Kennedy, John F. Library and Museum
Common Name:	Smith, Stephen E. Center
Address:	Morrissey Blvd Mount Vernon St
City/Town:	Boston
Village/Neighborhood:	Dorchester; Dorchester Bay
Local No:	1303420000
Year Constructed:	1977
Architect(s):	HNTB; Kiley, Dan; Mellon, Rachael; Pei, I. M. and Partners; Prescott, Einhorn Yaffee; Tyndall, Ian; Walker, Peter Ker
Architectural Style(s):	International Style
Use(s):	Library; Meeting Hall; Museum; Theater
Significance:	Architecture; Community Planning; Education; Landscape Architecture; Politics Government
Area(s):	
Designation(s):	
Building Materials(s):	Roof: Asphalt Shingle Wall: Cast Concrete; Glass; Steel Foundation: Concrete Unspecified

Commonwealth of Massachusetts
Massachusetts Historical Commission
220 Morrissey Boulevard, Boston, Massachusetts 02125
www.sec.state.ma.us/mhc

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FORM B – BUILDING

Assessor's Number	USGS Quad	Area(s)	Form Number
1303420000			16665

MASSACHUSETTS HISTORICAL COMMISSION
MASSACHUSETTS ARCHIVES BUILDING
220 MORRISSEY BOULEVARD
BOSTON, MASSACHUSETTS 02125

Town/City: Boston

Place: *(neighborhood or village)*: Columbia Point

Address: Mount Vernon Street *(Assessor's Address)*

Historic Name: John F. Kennedy Library and Museum

Uses: Present: Library and museum

Original: same

Date of Construction: 1977-1979; 1991

Source: J.F. Kennedy Library

Style/Form: International

Architect/Builder: I.M. Pei, architect;
Dan Kiley, Landscape architect
Einhorn Yaffee Prescott (2009-11)

Exterior Material:

Foundation: concrete

Wall/Trim: white, pre-cast concrete panels, glass

Roof: asphalt

Outbuildings/Secondary Structures:

Major Alterations *(with dates):*
Stephen E. Smith Center completed 1991
New collections storage wing (2009-11)

Condition: Excellent

Moved: **no** ☒ **yes** ☐ **Date:**

Acreage: 545,557 sq ft (12.5 acres)

Setting: Northeast corner of Columbia Point, facing on the north and east, Dorchester Bay and Boston Harbor. To the south are the contemporary institutional buildings of the Massachusetts State Archives and the University of Massachusetts/Boston; to the west, the 1885 Calf Pastures Pumping Station (NRIND 8/2/1990)

Photograph

View to the northeast

Locus Map

Recorded by: P. Stott

Organization: MHC

Date (*month / year*): 14 Feb 2011; 23 Sept 2014

Page 52 of 148

INVENTORY FORM B CONTINUATION SHEET

BOSTON

MT. VERNON STREET
Assessor's address

MASSACHUSETTS HISTORICAL COMMISSION
220 MORRISSEY BOULEVARD, BOSTON, MASSACHUSETTS 02125

Area(s) Form No.

BOS.16665

☒ Recommended for listing in the National Register of Historic Places.
If checked, you must attach a completed National Register Criteria Statement form.

Use as much space as necessary to complete the following entries, allowing text to flow onto additional continuation sheets.

ARCHITECTURAL DESCRIPTION:

Describe architectural features. Evaluate the characteristics of this building in terms of other buildings within the community.

Text adopted in part from the web site of the JFK Library and Museum (See Bibliography, below):
The Kennedy Library was erected on a landfill site overlooking Boston, Dorchester Bay, and the ocean beyond. To overcome existing conditions, the site was raised 15 feet. Within a limited space and budget, the design had to fulfill a complex-mixed use program while symbolically remembering the late young president in terms both contemporary and timeless. A split-level design was developed, organizing museum spaces in a layer below ground, with key emotive elements dramatically isolated above.

Pei's solution consisted of a triangular nine-story tower housing archival, educational and administrative functions, a two-story base containing exhibition space and two 230-seat theaters, and a 115-foot high memorial pavilion, which gives coherence and focus to the whole. After viewing a film about President Kennedy's early life, visitors descend into linked exhibition areas highlighting the president's 1960 campaign, his administration, and his legacy. From this darkened setting they emerge into the sun-filled, silent void of the space-framed glass pavilion. Except for an enormous American flag suspended above, the space is empty to allow the viewer to contemplate what he has seen and experienced against a great panorama of sky, land and open sea.

The 115,000 square foot presidential library consists of a nine-story, stark white, precast concrete tower, 125 feet high, which is contiguous to a glass-and-steel contemplation pavilion measuring 80 feet long by 80 feet wide and 115 feet high. The upper floors of the tower contain office, research, and document storage facilities. The lower floors house two elliptical-shaped 230-seat theaters, and an 18,000 square foot exhibition area.

The precast panels cladding the concrete structural frame were cast in North Wilbraham, Massachusetts, trucked to the site, and fitted into place like a three-dimensional jigsaw puzzle. The space frames for the roof and walls of the Pavilion were first assembled on the ground and then lifted one at a time into place by crane, one entire space frame wall weighing no more than one of the larger precast wall panels.

The JFK Library, designed by I.M. Pei & Partners of New York, represents an important work of late modern architecture by an internationally renowned architect. With its space-framed, glass pavilion, and minimalist white concrete forms, it was the first of a series of signature buildings by the firm, which included the East Wing of the National Gallery in Washington, D.C., the Jacob Javits Center in New York, and the Louvre Museum addition in Paris. Though the JFK Library is the smallest of the projects, it is perhaps the most monumental, a composition of stark, platonic masses set on an isolated waterfront site at Columbia Point against a dramatic background of Boston's skyline to the north.

In 1991, the Kennedy Library added the 21,800 square foot Stephen E. Smith Center, also designed by I. M. Pei. Constructed in the same stark white precast concrete as the original building, the two-story addition contains spaces for lectures, conferences, and meetings as well as more archival storage. The new wing was named in honor of President Kennedy's brother-in-law who, as President of the John F. Kennedy Library Corporation, led the effort that resulted in the initial construction of the Library at Columbia Point.

The Library was expanded again in 2009-2011 to add a 30,000-square foot wing, designed by the Boston based firm of Einhorn Yaffee Prescott to house artifacts and documents previously stored off site. Renovations included archive and artifact storage areas, support space, offices, security areas, exhibit space, the main lobby and gift shop and some deferred maintenance.

Continuation sheet 1

Page 53 of 148

HISTORICAL NARRATIVE

Discuss the history of the building. Explain its associations with local (or state) history. Include uses of the building, and the role(s) the owners/occupants played within the community.

The following is adopted in part from "The Landscape Architecture Legacy of Dan Kiley" and from the web site of the JFK Library and Museum

Plans to build the John F. Kennedy Presidential Library and Museum were underway before Kennedy's assassination in 1963. President Kennedy had begun considering the structure of his library soon after taking office, and he wanted to include archives from his administration, a museum of personal items, and a political science institute. After the assassination, the list expanded to include a fitting memorial tribute to the slain president. Architect I.M. Pei of I.M. Pei & Associates was chosen to design the library, and the Kennedy family began planning for the Library with the architect in 1966. After a decade of financial and political setbacks, construction was finally begun on the site at Columbia Point in 1976. In 1978, Dan Kiley (1912-2004) of Kiley Tyndall Walker was hired to design the ten-acre grounds.

To prepare the site, a former landfill, the ground was covered with fifteen feet of topsoil. Because the bayside location was exposed to harsh winds, Kiley planted the entire site with hardy, native vegetation. The entry drive winds through swaths of American beach grass, beach plum, and bayberry. The drive's regular rhythm is established by closely-spaced white bollards along one side and Japanese black pines with more widely spaced Modernist street lighting along the opposite side. The drive culminates in a circle anchored with carefully pruned Sargent crabapples, then connects to a centralized parking area surrounded by rugosa rose groundcover and orthogonal rows of densely-planted Japanese black pines.

Kiley collaborated on the project with the Kennedy family, his partners Ian Tyndall and Peter Ker Walker, and philanthropist and horticulturalist Rachael "Bunny" Mellon. He took a minimalistic approach with the landscape design in order to highlight the dramatic architecture of Pei's building. He said: "Pei's beautiful building had to be revealed without screening its setting, without intrusion by irrelevant plantings. It had to be enhanced by the strength and structure of succinct plantings as they related spatially to the building, site and sea." In order to accomplish this he focused on the establishment of large massings of plantings that would highlight the structure.

A 1000-foot lawn, informally planted with groves of honey locusts, gradually slopes toward the water's edge, providing views to the Boston skyline. A narrow promenade meets the lawn at the waterfront and follows the seawall, which is edged with white concrete bollards and a heavy chain that evoke the waterfront's maritime past and Kennedy's interest in sailing. Entry to this walk is gained via a long set of sweeping stairs which wrap around the curve of Pei's building to an open overlook at the water's edge. This long concrete walk further connects the landscape to its surrounds providing visitors with open, panoramic views to the sea.

Upon completion in 1979 the Library included a 10-story triangular tower for administrative, research, and archival functions, a one-story circular base with two 330-seat theaters, and a below-grade museum, all connected to a 110-foot-high glazed pavilion facing north to the water. In 1991, the lower level was expanded to the west with the construction of the Smith Center, also designed by I.M. Pei, which included a large multifunction hall and smaller conference rooms. The Library was again renovated in 1992, at which time the museum spaces were completely reconfigured and upgraded under the architectural direction of HNTB of Kansas City. The most recent collections storage wing to the west, constructed in 2009-2011, was designed by the Boston-based firm, Einhorn Yaffee Prescott (EYP).

Landscape Architect Dan Kiley (1912-2004)
Dan Kiley was a "seminal landscape architect who combined modernist functionalism with classical design principles in more than 1,000 projects" (*New York Times* obituary 25 Feb 2004). Kiley's many notable projects, often done with the great architects of his time, included the Gateway Arch in St. Louis, where he worked with Eero Saarinen; the Ford Foundation's headquarters and Lincoln Center in Manhattan; and I. M. Pei's East Building, inside and out, for the National Gallery of Art in Washington. In addition to his work with the John F. Kennedy Library, other projects whose settings he enhanced included the Air Force Academy in Colorado; Rockefeller University in Manhattan, with its exquisite Scholar Garden; Dulles International Airport in Northern Virginia; the main pedestrian center of La Défense in Paris; and the four-acre Fountain Place in downtown Dallas.

Continuation sheet 2

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Presidential Libraries
Since the passage of the Presidential Libraries Act in 1955 establishing a system of privately erected and federally maintained libraries, thirteen presidential libraries have been established, maintained and operated by the National Archives and Records Administration, representing every U.S. president since Herbert Hoover.

BIBLIOGRAPHY and/or REFERENCES

"I.M. Pei, Architect," web page of John F. Kennedy Presidential Library and Museum, accessed 2/14/2011. http://www.jfklibrary.org/About-Us/About-the-JFK-Library/History/IM-Pei--Architect.aspx

Epsilon Associates, Inc, Final Environmental Assessment, John F. Kennedy Presidential Library and Museum Addition and Renovation (May 2009)

“John F. Kennedy Library,” web page of the Cultural Landscape Foundation’s, “The Landscape Architecture Legacy of Dan Kiley,” accessed 9/23/2014. http://tclf.org/sites/default/files/microsites/kiley-legacy/JFKLibrary.html

“Dan Kiley, Influential Landscape Architect, Dies at 91,” *New York Times*, 25 February 2004,

INVENTORY FORM B CONTINUATION SHEET

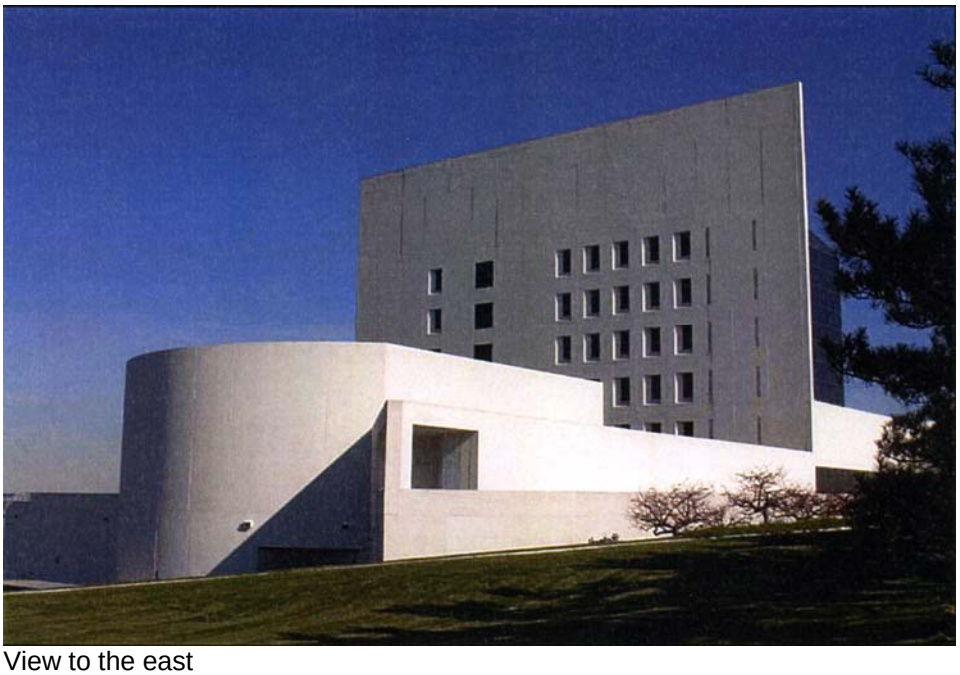
MASSACHUSETTS HISTORICAL COMMISSION
220 MORRISSEY BOULEVARD, BOSTON, MASSACHUSETTS 02125

BOSTON

MT. VERNON STREET
Assessor's address

Area(s) Form No.

BOS.16665



View to the east

View to the southeast

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INVENTORY FORM B CONTINUATION SHEET

MASSACHUSETTS HISTORICAL COMMISSION
220 MORRISSEY BOULEVARD, BOSTON, MASSACHUSETTS 02125

BOSTON

MT. VERNON STREET
Assessor's address

Area(s) Form No.

BOS.16665

View to the southeast showing 2009-2011 addition at right

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Original yellow form: Eligibility file
Copies: Inventory form
Town file(w/corresp.)
Macris
NR director _____

Community: BOSTON

MHC OPINION: ELIGIBILITY FOR NATIONAL REGISTER

Date Received: May 21, 2007 Date Reviewed: June 20, 2007

Type: _X_Individual __District (Attach map indicating boundaries)

Name: John F. Kennedy Library and Museum Inventory Form: BOS.16665

Address: Mount Vernon Street

Requested by: National Archives and Records Administration (NARA)

Action: __Honor __ITC __Grant __X_R & C __Other:

Agency: NARA Staff in charge of Review: AL

INDIVIDUAL PROPERTIES

_X_ Eligible
__ Eligible, also in district
__ Eligible only in district
__ Ineligible
__ More information needed

DISTRICTS

__ Eligible
__ Ineligible
__ More information needed

CRITERIA: _X_A __X B __X C __D

LEVEL: _X_Local __X State __X National

STATEMENT OF SIGNIFICANCE by Ann Lattinville

Planning for the JFK Library began in 1966, three years after the president's assassination, but it was not until 1976 that the site was selected and design of the building began. The library was to be both the repository for a collection of historical material from the Kennedy era as well as a memorial to the late president. Designed by I. M. Pei & Partners of New York, the JFK Library represents an important work of late modern architecture by an internationally renowned architect. With its space-framed glass pavilion and minimalist white concrete forms, it was the first of a series of signature buildings by the firm nationwide (others include the East Wing of the National Gallery in Washington, DC, the Jacob Javits Center in New York, and the Louvre Museum addition in Paris). The minimalist landscape design for the 12-acre site was by Dan Kiley, known for other landscape projects done in collaboration with prominent architects, including the Gateway Arch in St. Louis, Lincoln Center in Manhattan, and the National Gallery's East Wing in Washington, DC.

For its associations with President John F. Kennedy, with U.S. history in the mid 20th century, and as an important example of the work of architect I. M. Pei, the property is eligible for listing in the National Register under Criteria A, B, and C, as well as considerations F (commemorative) and G (less than 50 years old). The JFK Library is significant at the local, state, and national levels.

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ATTACHMENT 7

WQBEL CALCULATION SPREADSHEET

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Enter number values in green boxes below

Enter values in the units specified

↓

0	Q_R = Enter upstream flow in **MGD**
0.216	Q_P = Enter discharge flow in **MGD**
0	Downstream 7Q10

Enter a dilution factor, if other than zero

↓

0

Enter values in the units specified

↓

0	C_d = Enter influent hardness in **mg/L** $CaCO_3$
0	C_s = Enter receiving water hardness in **mg/L** $CaCO_3$

Enter **receiving water** concentrations in the units specified

↓

8	pH in **Standard Units**
14.9	Temperature in **°C**
0	Ammonia in **mg/L**
0	Hardness in **mg/L** $CaCO_3$
25.81	Salinity in **ppt**
0	Antimony in **µg/L**
0	Arsenic in **µg/L**
0	Cadmium in **µg/L**
0	Chromium III in **µg/L**
0	Chromium VI in **µg/L**
0	Copper in **µg/L**
0	Iron in **µg/L**
0	Lead in **µg/L**
0	Mercury in **µg/L**
0	Nickel in **µg/L**
0	Selenium in **µg/L**
0	Silver in **µg/L**
0	Zinc in **µg/L**

Page 60 of 148

Enter **influent** concentrations in the units specified

↓

0	TRC in **µg/L**
242	Ammonia in **mg/L**
32.4	Antimony in **µg/L**
6.7	Arsenic in **µg/L**
33.8	Cadmium in **µg/L**
0	Chromium III in **µg/L**
0	Chromium VI in **µg/L**
16.3	Copper in **µg/L**
9230	Iron in **µg/L**
36.3	Lead in **µg/L**
0	Mercury in **µg/L**
41.1	Nickel in **µg/L**
0	Selenium in **µg/L**
0	Silver in **µg/L**
977	Zinc in **µg/L**
0	Cyanide in **µg/L**
0	Phenol in **µg/L**
0	Carbon Tetrachloride in **µg/L**
0	Tetrachloroethylene in **µg/L**
0	Total Phthalates in **µg/L**
0	Diethylhexylphthalate in **µg/L**
0.25	Benzo(a)anthracene in **µg/L**
0.25	Benzo(a)pyrene in **µg/L**
0.31	Benzo(b)fluoranthene in **µg/L**
0.11	Benzo(k)fluoranthene in **µg/L**
0.27	Chrysene in **µg/L**
0.05	Dibenzo(a,h)anthracene in **µg/L**
0.19	Indeno(1,2,3-cd)pyrene in **µg/L**
0	Methyl-tert butyl ether in **µg/L**

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Dilution Factor	0.0			
	TBEL applies if bolded		WQBEL applies if bolded	
A. Inorganics				
Ammonia	**Report**	mg/L	---	
Chloride	**Report**	µg/L	---	
Total Residual Chlorine	0.2	mg/L	**7.5**	µg/L
Total Suspended Solids	**30**	mg/L	---	
Antimony	**206**	µg/L	640	µg/L
Arsenic	**104**	µg/L	36	µg/L
Cadmium	10.2	µg/L	**8.9**	µg/L
Chromium III	**323**	µg/L	100.0	µg/L
Chromium VI	**323**	µg/L	50	µg/L
Copper	242	µg/L	**3.7**	µg/L
Iron	**5000**	µg/L	---	µg/L
Lead	160	µg/L	**8.5**	µg/L
Mercury	**0.739**	µg/L	1.11	µg/L
Nickel	1450	µg/L	**8.3**	µg/L
Selenium	**235.8**	µg/L	71	µg/L
Silver	**35.1**	µg/L	2.2	µg/L
Zinc	420	µg/L	**86**	µg/L
Cyanide	**178**	mg/L	1.0	µg/L
B. Non-Halogenated VOCs				
Total BTEX	**100**	µg/L	---	
Benzene	**5.0**	µg/L	---	
1,4 Dioxane	**200**	µg/L	---	
Acetone	**7.97**	mg/L	---	
Phenol	**1,080**	µg/L	300	µg/L
C. Halogenated VOCs				
Carbon Tetrachloride	**4.4**		1.6	µg/L
1,2 Dichlorobenzene	**600**	µg/L	---	
1,3 Dichlorobenzene	**320**	µg/L	---	
1,4 Dichlorobenzene	**5.0**	µg/L	---	
Total dichlorobenzene	**---**	µg/L	---	
1,1 Dichloroethane	**70**	µg/L	---	
1,2 Dichloroethane	**5.0**	µg/L	---	
1,1 Dichloroethylene	**3.2**	µg/L	---	
Ethylene Dibromide	**0.05**	µg/L	---	
Methylene Chloride	**4.6**	µg/L	---	
1,1,1 Trichloroethane	**200**	µg/L	---	
1,1,2 Trichloroethane	**5.0**	µg/L	---	
Trichloroethylene	**5.0**	µg/L	---	
Tetrachloroethylene	**5.0**	µg/L	3.3	µg/L
cis-1,2 Dichloroethylene	**70**	µg/L	---	

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Vinyl Chloride	**2.0**	µg/L	---	
D. Non-Halogenated SVOCs				
Total Phthalates	**190**	µg/L	---	µg/L
Diethylhexyl phthalate	**101**	µg/L	2.2	µg/L
Total Group I Polycyclic Aromatic Hydrocarbons	**1.0**	µg/L	---	
Benzo(a)anthracene	1.0	µg/L	**0.0038**	µg/L
Benzo(a)pyrene	1.0	µg/L	**0.0038**	µg/L
Benzo(b)fluoranthene	1.0	µg/L	**0.0038**	µg/L
Benzo(k)fluoranthene	1.0	µg/L	**0.0038**	µg/L
Chrysene	1.0	µg/L	**0.0038**	µg/L
Dibenzo(a,h)anthracene	1.0	µg/L	**0.0038**	µg/L
Indeno(1,2,3-cd)pyrene	1.0	µg/L	**0.0038**	µg/L
Total Group II Polycyclic Aromatic Hydrocarbons	**100**	µg/L	---	
Naphthalene	**20**	µg/L	---	
E. Halogenated SVOCs				
Total Polychlorinated Biphenyls	**0.000064**	µg/L	---	
Pentachlorophenol	**1.0**	µg/L	---	
F. Fuels Parameters				
Total Petroleum Hydrocarbons	**5.0**	mg/L	---	
Ethanol	**Report**	mg/L	---	
Methyl-tert-Butyl Ether	**70**	µg/L	20	µg/L
tert-Butyl Alcohol	**120**	µg/L	---	
tert-Amyl Methyl Ether	**90**	µg/L	---	

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ATTACHMENT 8

CITY OF BOSTON NOTIFICATION

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GZA
Proactive by Design

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

249 Vanderbilt Avenue
Norwood, MA 02062
T: 781.278.3700
F: 781.278.5701
F: 781.278.5702
www.gza.com

Notification of Discharge under the 2016 Remediation General Permit

June 29, 2017
GZA File No. 03.0033930.08

Mr. Martin J. Walsh
City of Boston Mayor
1 City Hall Square
Boston, Massachusetts 02201

Re: Notification of Discharge under 2016 Remediation General Permit
Umass-UCRR
100 Morrissey Boulevard
Boston, Massachusetts

Dear Mr. Walsh:

Federal National Pollution Discharge Elimination System (NPDES) regulations require operators of discharges permitted under the 2016 Remediation General Permit (RGP) jointly administered by the United States Environmental Protection Agency (USEPA) and the Massachusetts Department of Environmental Protection (MassDEP), to notify the municipality of said discharge. These notice requirements are contained in Part 3.4(a) of the 2016 RGP. An electronic version of the 2016 RGP is available at https://www3.epa.gov/region1/npdes/rgp.html. In compliance with these requirements, GZA GeoEnvironmental, Inc. (GZA), on behalf of Umass Boston, is notifying the City of Boston of the discharge of treated water derived from the dewatering of utility excavations from the property located at 100 Morrissey Boulevard, in Boston Massachusetts.

A copy of the Notice of Intent (NOI) submitted to USEPA can be made available upon request.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Lawrence Feldman, LSP, Ph.D
Senior Principal

J:\Geo\33930.jer\Work\Well Installation NPDES NOI RPG .08\NOI for RGP\Attachment 8- Notice to City of Boston\City of BostonNotification.docx

ATTACHMENT 9

LABORATORY ANALYTICAL RESULTS

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ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Jason Ressler
GZA GeoEnvironmental, Inc.
530 Broadway
Providence, RI 02909

RE: UMASS Boston UCRR RGP (03.0033930.08 Task 1)
ESS Laboratory Work Order Number: 1706209

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 1:54 pm, Jun 22, 2017

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

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ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP

ESS Laboratory Work Order: 1706209

SAMPLE RECEIPT

The following samples were received on June 07, 2017 for the analyses specified on the enclosed Chain of Custody Record.

The samples and analyses listed below were analyzed in accordance with the 2017 Remediation General Permit under the National Pollutant Discharge Elimination System (NPDES).

Revision 1 June 22, 2017: This report has been revised to include revised phthalate results.

Lab Number	Sample Name	Matrix	Analysis
1706209-01	UGW-701-1	Ground Water	200.7, 245.1, 2540D, 300.0, 3113B, 350.1, 3500Cr B-2009, 524.2, 625 SIM, 8270D SIM
1706209-02	UGW-702-1	Ground Water	200.7, 245.1, 2540D, 300.0, 3113B, 350.1, 3500Cr B-2009, 524.2, 625 SIM, 8270D SIM
1706209-03	UGW-703-1	Ground Water	200.7, 245.1, 2540D, 300.0, 3113B, 350.1, 3500Cr B-2009, 524.2, 625 SIM, 8270D SIM
1706209-04	UGW-9B-1	Ground Water	200.7, 245.1, 2540D, 300.0, 3113B, 350.1, 3500Cr B-2009, 524.2, 625 SIM, 8270D SIM
1706209-05	UDB-1-1	Surface Water	350.1

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ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP

ESS Laboratory Work Order: 1706209

PROJECT NARRATIVE

524.2 Volatile Organic Compounds

CF70838-BSD1 **Blank Spike recovery is above upper control limit (B+).**
Tertiary-butyl Alcohol (132% @ 70-130%)

625(SIM) Semi-Volatile Organic Compounds

CF70834-BSD2 **Relative percent difference for duplicate is outside of criteria (D+).**
Dibenzo(a,h)Anthracene (23% @ 20%), Indeno(1,2,3-cd)Pyrene (24% @ 20%)

Total Metals

1706209-01 **Elevated Method Reporting Limits due to sample matrix (EL).**
Antimony , Copper , Iron , Silver

1706209-02 **Elevated Method Reporting Limits due to sample matrix (EL).**
Antimony

1706209-03 **Elevated Method Reporting Limits due to sample matrix (EL).**
Antimony

1706209-04 **Elevated Method Reporting Limits due to sample matrix (EL).**
Copper

CF70738-BSD1 **Blank Spike recovery is above upper control limit (B+).**
Cadmium (116% @ 85-115%)

CF70738-BSD1 **Blank Spike recovery is below lower control limit (B-).**
Silver (81% @ 85-115%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP

ESS Laboratory Work Order: 1706209

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH / VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035 - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

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ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-701-1
Date Sampled: 06/07/17 09:38
Percent Solids: N/A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-01
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 3005A

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	**EL** ND (50.0)		200.7		5	KJK	06/10/17 14:24	50	10	CF70738
Arsenic	ND (5.0)		3113B		5	KJK	06/09/17 16:47	50	10	CF70738
Cadmium	**33.8** (10.0)		200.7		5	KJK	06/09/17 14:51	50	10	CF70738
Chromium	ND (4.0)		200.7		1	KJK	06/09/17 13:52	50	10	CF70738
Chromium III	ND (10.0)		200.7		1	JLK	06/09/17 13:52	1	1	[CALC]
Copper	**EL** ND (20.0)		200.7		10	BJV	06/12/17 14:32	50	10	CF70738
Iron	**EL** ND (200)		200.7		10	KJK	06/09/17 15:11	50	10	CF70738
Lead	**12.0** (5.0)		3113B		5	KJK	06/10/17 2:19	50	10	CF70738
Mercury	ND (0.200)		245.1		1	MJV	06/09/17 14:32	20	40	CF70739
Nickel	**41.1** (20.0)		200.7		5	KJK	06/09/17 14:51	50	10	CF70738
Selenium	ND (10.0)		3113B		5	KJK	06/09/17 21:12	50	10	CF70738
Silver	**EL** ND (5.0)		200.7		5	KJK	06/09/17 14:51	50	10	CF70738
Zinc	**977** (50.0)		200.7		5	KJK	06/09/17 14:51	50	10	CF70738

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ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-701-1
Date Sampled: 06/07/17 09:38
Percent Solids: N/A
Initial Volume: 25
Final Volume: 25
Extraction Method: 524.2

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-01
Sample Matrix: Ground Water
Units: ug/L
Analyst: GEM

524.2 Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1-Trichloroethane	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
1,1,2-Trichloroethane	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
1,1-Dichloroethane	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
1,1-Dichloroethene	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
1,2-Dichlorobenzene	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
1,2-Dichloroethane	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
1,3-Dichlorobenzene	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
1,4-Dichlorobenzene	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Acetone	ND (5.0)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Benzene	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Carbon Tetrachloride	ND (0.3)		524.2		1	06/12/17 13:25	C7F0180	CF71237
cis-1,2-Dichloroethene	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Ethylbenzene	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Methyl tert-Butyl Ether	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Methylene Chloride	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Naphthalene	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Tertiary-amyl methyl ether	ND (1.0)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Tertiary-butyl Alcohol	ND (25.0)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Tetrachloroethene	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Toluene	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Trichloroethene	**0.8** (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Vinyl Chloride	ND (0.2)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Xylene O	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237
Xylene P,M	ND (0.5)		524.2		1	06/12/17 13:25	C7F0180	CF71237

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*114 %*		*80-120*
Surrogate: 4-Bromofluorobenzene	*109 %*		*80-120*

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-701-1
Date Sampled: 06/07/17 09:38
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 0.25
Extraction Method: 3510C

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-01
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 6/9/17 11:31

625(SIM) Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Acenaphthene	ND (0.19)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Acenaphthylene	ND (0.19)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Anthracene	ND (0.19)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Benzo(a)anthracene	ND (0.05)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Benzo(a)pyrene	ND (0.05)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Benzo(b)fluoranthene	ND (0.05)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Benzo(g,h,i)perylene	ND (0.19)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Benzo(k)fluoranthene	ND (0.05)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
bis(2-Ethylhexyl)phthalate	ND (0.93)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Butylbenzylphthalate	ND (2.34)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Chrysene	ND (0.05)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Dibenzo(a,h)Anthracene	ND (0.05)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Diethylphthalate	ND (2.34)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Dimethylphthalate	ND (2.34)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Di-n-butylphthalate	ND (2.34)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Di-n-octylphthalate	ND (2.34)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Fluoranthene	ND (0.19)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Fluorene	ND (0.19)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Indeno(1,2,3-cd)Pyrene	ND (0.05)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Naphthalene	ND (0.19)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Pentachlorophenol	ND (0.84)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Phenanthrene	ND (0.19)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834
Pyrene	ND (0.19)		625 SIM		1	06/11/17 1:47	C7F0163	CF70834

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*32 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*87 %*		*15-110*
Surrogate: 2-Fluorobiphenyl	*45 %*		*30-130*
Surrogate: Nitrobenzene-d5	*46 %*		*30-130*
Surrogate: p-Terphenyl-d14	*63 %*		*30-130*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-701-1
Date Sampled: 06/07/17 09:38
Percent Solids: N/A
Initial Volume: 500
Final Volume: 0.5
Extraction Method: 3535A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-01
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 6/8/17 14:00

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	ND (0.250)		8270D SIM		1	06/09/17 1:17	C7F0138	CF70831

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	45 %		15-115

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-701-1
Date Sampled: 06/07/17 09:38
Percent Solids: N/A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-01
Sample Matrix: Ground Water

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	JLK	06/12/17 17:52	mg/L	CF70923
Chloride	**11800000** (5000000)		300.0		10000	EEM	06/12/17 14:25	ug/L	CF71222
Hexavalent Chromium	ND (10.0)		3500Cr B-2009		1	JLK	06/07/17 21:26	ug/L	CF70761
Total Suspended Solids	ND (5)		2540D		1	JLK	06/08/17 20:48	mg/L	CF70849

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-702-1
Date Sampled: 06/07/17 15:10
Percent Solids: N/A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-02
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 3005A

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	**EL** ND (50.0)		200.7		5	KJK	06/10/17 14:30	50	10	CF70738
Arsenic	ND (5.0)		3113B		5	KJK	06/09/17 16:52	50	10	CF70738
Cadmium	ND (0.50)		3113B		10	KJK	06/14/17 22:25	50	10	CF70738
Chromium	ND (4.0)		200.7		1	KJK	06/09/17 13:58	50	10	CF70738
Chromium III	ND (10.0)		200.7		1	JLK	06/09/17 13:58	1	1	[CALC]
Copper	**15.6** (10.0)		200.7		5	KJK	06/10/17 14:30	50	10	CF70738
Iron	**140** (100)		200.7		5	KJK	06/09/17 14:57	50	10	CF70738
Lead	**32.9** (20.0)		200.7		5	KJK	06/09/17 14:57	50	10	CF70738
Mercury	ND (0.200)		245.1		1	MJV	06/09/17 14:34	20	40	CF70739
Nickel	ND (4.0)		200.7		1	KJK	06/09/17 13:58	50	10	CF70738
Selenium	ND (10.0)		3113B		5	KJK	06/09/17 21:35	50	10	CF70738
Silver	ND (1.0)		200.7		1	KJK	06/09/17 13:58	50	10	CF70738
Zinc	ND (50.0)		200.7		5	KJK	06/09/17 14:57	50	10	CF70738

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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-702-1
Date Sampled: 06/07/17 15:10
Percent Solids: N/A
Initial Volume: 25
Final Volume: 25
Extraction Method: 524.2

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-02
Sample Matrix: Ground Water
Units: ug/L
Analyst: GEM

524.2 Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1-Trichloroethane	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
1,1,2-Trichloroethane	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
1,1-Dichloroethane	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
1,1-Dichloroethene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
1,2-Dichlorobenzene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
1,2-Dichloroethane	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
1,3-Dichlorobenzene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
1,4-Dichlorobenzene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Acetone	ND (5.0)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Benzene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Carbon Tetrachloride	ND (0.3)		524.2		1	06/08/17 13:47	C7F0130	CF70838
cis-1,2-Dichloroethene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Ethylbenzene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Methyl tert-Butyl Ether	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Methylene Chloride	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Naphthalene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Tertiary-amyl methyl ether	ND (1.0)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Tertiary-butyl Alcohol	ND (25.0)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Tetrachloroethene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Toluene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Trichloroethene	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Vinyl Chloride	ND (0.2)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Xylene O	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838
Xylene P,M	ND (0.5)		524.2		1	06/08/17 13:47	C7F0130	CF70838

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*120 %*		*80-120*
Surrogate: 4-Bromofluorobenzene	*113 %*		*80-120*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-702-1
Date Sampled: 06/07/17 15:10
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 0.25
Extraction Method: 3510C

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-02
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 6/9/17 11:31

625(SIM) Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Acenaphthene	ND (0.19)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Acenaphthylene	ND (0.19)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Anthracene	ND (0.19)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Benzo(a)anthracene	ND (0.05)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Benzo(a)pyrene	ND (0.05)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Benzo(b)fluoranthene	ND (0.05)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Benzo(g,h,i)perylene	ND (0.19)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Benzo(k)fluoranthene	ND (0.05)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
bis(2-Ethylhexyl)phthalate	ND (0.93)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Butylbenzylphthalate	ND (2.34)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Chrysene	ND (0.05)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Dibenzo(a,h)Anthracene	ND (0.05)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Diethylphthalate	ND (2.34)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Dimethylphthalate	ND (2.34)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Di-n-butylphthalate	ND (2.34)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Di-n-octylphthalate	ND (2.34)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Fluoranthene	ND (0.19)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Fluorene	ND (0.19)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Indeno(1,2,3-cd)Pyrene	ND (0.05)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Naphthalene	ND (0.19)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Pentachlorophenol	ND (0.84)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Phenanthrene	ND (0.19)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834
Pyrene	ND (0.19)		625 SIM		1	06/11/17 2:38	C7F0163	CF70834

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*35 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*81 %*		*15-110*
Surrogate: 2-Fluorobiphenyl	*43 %*		*30-130*
Surrogate: Nitrobenzene-d5	*48 %*		*30-130*
Surrogate: p-Terphenyl-d14	*62 %*		*30-130*

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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-702-1
Date Sampled: 06/07/17 15:10
Percent Solids: N/A
Initial Volume: 500
Final Volume: 0.5
Extraction Method: 3535A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-02
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 6/8/17 14:00

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	ND (0.250)		8270D SIM		1	06/09/17 1:54	C7F0138	CF70831

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	46 %		15-115

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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-702-1
Date Sampled: 06/07/17 15:10
Percent Solids: N/A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-02
Sample Matrix: Ground Water

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.34** (0.10)		350.1		1	JLK	06/12/17 17:24	mg/L	CF70923
Chloride	**12900000** (5000000)		300.0		10000	EEM	06/12/17 14:41	ug/L	CF71222
Hexavalent Chromium	ND (10.0)		3500Cr B-2009		1	JLK	06/07/17 21:26	ug/L	CF70761
Total Suspended Solids	ND (5)		2540D		1	JLK	06/08/17 20:48	mg/L	CF70849

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Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-703-1
Date Sampled: 06/07/17 17:22
Percent Solids: N/A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-03
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 3005A

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	**EL** ND (20.0)		200.7		2	KJK	06/10/17 14:36	50	10	CF70738
Arsenic	**6.7** (5.0)		3113B		5	KJK	06/09/17 16:58	50	10	CF70738
Cadmium	**0.35** (0.25)		3113B		5	KJK	06/10/17 0:33	50	10	CF70738
Chromium	ND (4.0)		200.7		1	KJK	06/09/17 14:03	50	10	CF70738
Chromium III	ND (10.0)		200.7		1	JLK	06/09/17 14:03	1	1	[CALC]
Copper	**16.3** (4.0)		200.7		2	KJK	06/10/17 14:36	50	10	CF70738
Iron	**1460** (20.0)		200.7		1	KJK	06/09/17 14:03	50	10	CF70738
Lead	**36.3** (5.0)		3113B		5	KJK	06/10/17 2:36	50	10	CF70738
Mercury	ND (0.200)		245.1		1	MJV	06/09/17 14:36	20	40	CF70739
Nickel	**8.6** (4.0)		200.7		1	KJK	06/09/17 14:03	50	10	CF70738
Selenium	ND (10.0)		3113B		5	KJK	06/09/17 21:40	50	10	CF70738
Silver	ND (1.0)		200.7		1	KJK	06/09/17 14:03	50	10	CF70738
Zinc	**69.8** (10.0)		200.7		1	KJK	06/09/17 14:03	50	10	CF70738

ESS Laboratory
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BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-703-1
Date Sampled: 06/07/17 17:22
Percent Solids: N/A
Initial Volume: 25
Final Volume: 25
Extraction Method: 524.2

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-03
Sample Matrix: Ground Water
Units: ug/L
Analyst: GEM

524.2 Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1-Trichloroethane	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
1,1,2-Trichloroethane	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
1,1-Dichloroethane	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
1,1-Dichloroethene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
1,2-Dichlorobenzene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
1,2-Dichloroethane	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
1,3-Dichlorobenzene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
1,4-Dichlorobenzene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Acetone	**6.7** (5.0)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Benzene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Carbon Tetrachloride	ND (0.3)		524.2		1	06/12/17 14:00	C7F0180	CF71237
cis-1,2-Dichloroethene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Ethylbenzene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Methyl tert-Butyl Ether	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Methylene Chloride	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Naphthalene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Tertiary-amyl methyl ether	ND (1.0)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Tertiary-butyl Alcohol	ND (25.0)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Tetrachloroethene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Toluene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Trichloroethene	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Vinyl Chloride	ND (0.2)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Xylene O	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237
Xylene P,M	ND (0.5)		524.2		1	06/12/17 14:00	C7F0180	CF71237

	%Recovery	*Qualifier*	*Limits*
Surrogate: 1,2-Dichlorobenzene-d4	*108 %*		*80-120*
Surrogate: 4-Bromofluorobenzene	*100 %*		*80-120*

ESS Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-703-1
Date Sampled: 06/07/17 17:22
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 0.25
Extraction Method: 3510C

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-03
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 6/9/17 11:31

625(SIM) Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Acenaphthene	**0.90** (0.19)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Acenaphthylene	ND (0.19)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Anthracene	**0.28** (0.19)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Benzo(a)anthracene	**0.25** (0.05)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Benzo(a)pyrene	**0.25** (0.05)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Benzo(b)fluoranthene	**0.31** (0.05)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Benzo(g,h,i)perylene	**0.19** (0.19)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Benzo(k)fluoranthene	**0.11** (0.05)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
bis(2-Ethylhexyl)phthalate	ND (0.93)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Butylbenzylphthalate	ND (2.34)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Chrysene	**0.27** (0.05)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Dibenzo(a,h)Anthracene	**0.05** (0.05)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Diethylphthalate	ND (2.34)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Dimethylphthalate	ND (2.34)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Di-n-butylphthalate	ND (2.34)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Di-n-octylphthalate	ND (2.34)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Fluoranthene	**0.60** (0.19)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Fluorene	**0.49** (0.19)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Indeno(1,2,3-cd)Pyrene	**0.19** (0.05)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Naphthalene	ND (0.19)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Pentachlorophenol	ND (0.84)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Phenanthrene	**0.73** (0.19)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834
Pyrene	**0.59** (0.19)		625 SIM		1	06/11/17 3:28	C7F0163	CF70834

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*46 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*105 %*		*15-110*
Surrogate: 2-Fluorobiphenyl	*58 %*		*30-130*
Surrogate: Nitrobenzene-d5	*63 %*		*30-130*
Surrogate: p-Terphenyl-d14	*68 %*		*30-130*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-703-1
Date Sampled: 06/07/17 17:22
Percent Solids: N/A
Initial Volume: 500
Final Volume: 0.5
Extraction Method: 3535A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-03
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 6/8/17 14:00

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	ND (0.250)		8270D SIM		1	06/09/17 2:31	C7F0138	CF70831

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	42 %		15-115

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-703-1
Date Sampled: 06/07/17 17:22
Percent Solids: N/A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-03
Sample Matrix: Ground Water

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**13.5** (0.50)		350.1		5	JLK	06/12/17 17:52	mg/L	CF70923
Chloride	**264000** (50000)		300.0		100	EEM	06/08/17 17:55	ug/L	CF70815
Hexavalent Chromium	ND (10.0)		3500Cr B-2009		1	JLK	06/07/17 21:26	ug/L	CF70761
Total Suspended Solids	**46** (5)		2540D		1	JLK	06/08/17 20:48	mg/L	CF70849

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-9B-1
Date Sampled: 06/07/17 16:55
Percent Solids: N/A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-04
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 3005A

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	**32.4** (20.0)		200.7		2	KJK	06/10/17 14:41	50	10	CF70738
Arsenic	ND (5.0)		3113B		5	KJK	06/09/17 17:04	50	10	CF70738
Cadmium	ND (0.25)		3113B		5	KJK	06/14/17 22:19	50	10	CF70738
Chromium	ND (4.0)		200.7		1	KJK	06/09/17 14:09	50	10	CF70738
Chromium III	ND (10.0)		200.7		1	JLK	06/09/17 14:09	1	1	[CALC]
Copper	**EL** ND (4.0)		200.7		2	KJK	06/10/17 14:41	50	10	CF70738
Iron	**9230** (20.0)		200.7		1	KJK	06/09/17 14:09	50	10	CF70738
Lead	ND (5.0)		3113B		5	KJK	06/10/17 2:41	50	10	CF70738
Mercury	ND (0.200)		245.1		1	MJV	06/09/17 14:39	20	40	CF70739
Nickel	ND (4.0)		200.7		1	KJK	06/09/17 14:09	50	10	CF70738
Selenium	ND (10.0)		3113B		5	KJK	06/09/17 22:08	50	10	CF70738
Silver	ND (1.0)		200.7		1	KJK	06/09/17 14:09	50	10	CF70738
Zinc	**22.9** (10.0)		200.7		1	KJK	06/09/17 14:09	50	10	CF70738

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-9B-1
Date Sampled: 06/07/17 16:55
Percent Solids: N/A
Initial Volume: 25
Final Volume: 25
Extraction Method: 524.2

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-04
Sample Matrix: Ground Water
Units: ug/L
Analyst: GEM

524.2 Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1-Trichloroethane	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
1,1,2-Trichloroethane	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
1,1-Dichloroethane	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
1,1-Dichloroethene	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
1,2-Dichlorobenzene	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
1,2-Dichloroethane	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
1,3-Dichlorobenzene	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
1,4-Dichlorobenzene	**0.7** (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Acetone	ND (5.0)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Benzene	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Carbon Tetrachloride	ND (0.3)		524.2		1	06/08/17 14:56	C7F0130	CF70838
cis-1,2-Dichloroethene	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Ethylbenzene	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Methyl tert-Butyl Ether	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Methylene Chloride	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Naphthalene	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Tertiary-amyl methyl ether	ND (1.0)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Tertiary-butyl Alcohol	ND (25.0)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Tetrachloroethene	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Toluene	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Trichloroethene	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Vinyl Chloride	ND (0.2)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Xylene O	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838
Xylene P,M	ND (0.5)		524.2		1	06/08/17 14:56	C7F0130	CF70838

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*105 %*		*80-120*
Surrogate: 4-Bromofluorobenzene	*101 %*		*80-120*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-9B-1
Date Sampled: 06/07/17 16:55
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 0.25
Extraction Method: 3510C

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-04
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 6/9/17 11:31

625(SIM) Semi-Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Acenaphthene	**4.98** (0.19)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Acenaphthylene	ND (0.19)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Anthracene	**0.92** (0.19)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Benzo(a)anthracene	**0.12** (0.05)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Benzo(a)pyrene	**0.05** (0.05)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Benzo(b)fluoranthene	**0.06** (0.05)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Benzo(g,h,i)perylene	ND (0.19)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Benzo(k)fluoranthene	ND (0.05)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
bis(2-Ethylhexyl)phthalate	ND (0.93)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Butylbenzylphthalate	ND (2.34)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Chrysene	**0.13** (0.05)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Dibenzo(a,h)Anthracene	ND (0.05)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Diethylphthalate	ND (2.34)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Dimethylphthalate	ND (2.34)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Di-n-butylphthalate	ND (2.34)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Di-n-octylphthalate	ND (2.34)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Fluoranthene	**1.87** (0.19)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Fluorene	**4.59** (0.19)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Indeno(1,2,3-cd)Pyrene	ND (0.05)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Naphthalene	ND (0.19)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Pentachlorophenol	ND (0.84)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Phenanthrene	**2.29** (0.19)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834
Pyrene	**1.22** (0.19)		625 SIM		1	06/11/17 4:19	C7F0163	CF70834

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*42 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*97 %*		*15-110*
Surrogate: 2-Fluorobiphenyl	*49 %*		*30-130*
Surrogate: Nitrobenzene-d5	*58 %*		*30-130*
Surrogate: p-Terphenyl-d14	*61 %*		*30-130*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-9B-1
Date Sampled: 06/07/17 16:55
Percent Solids: N/A
Initial Volume: 500
Final Volume: 0.5
Extraction Method: 3535A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-04
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 6/8/17 14:00

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	**0.904** (0.250)		8270D SIM		1	06/09/17 3:09	C7F0138	CF70831

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	33 %		15-115

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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UGW-9B-1
Date Sampled: 06/07/17 16:55
Percent Solids: N/A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-04
Sample Matrix: Ground Water

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**24.2** (1.00)		350.1		10	JLK	06/12/17 17:53	mg/L	CF70923
Chloride	**1030000** (1000000)		300.0		2000	EEM	06/08/17 22:14	ug/L	CF70815
Hexavalent Chromium	ND (10.0)		3500Cr B-2009		1	JLK	06/07/17 21:26	ug/L	CF70761
Total Suspended Solids	**14** (5)		2540D		1	JLK	06/08/17 20:48	mg/L	CF70849

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP
Client Sample ID: UDB-1-1
Date Sampled: 06/07/17 16:15
Percent Solids: N/A

ESS Laboratory Work Order: 1706209
ESS Laboratory Sample ID: 1706209-05
Sample Matrix: Surface Water

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	JLK	06/12/17 17:54	mg/L	CF70923

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP

ESS Laboratory Work Order: 1706209

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch CF70738 - 3005A										
Blank										
Antimony	ND	10.0	ug/L							
Arsenic	ND	1.0	ug/L							
Cadmium	ND	2.00	ug/L							
Cadmium	ND	0.05	ug/L							
Chromium III	ND	4.00	ug/L							
Copper	ND	2.0	ug/L							
Iron	ND	20.0	ug/L							
Lead	ND	4.0	ug/L							
Lead	ND	1.0	ug/L							
Nickel	ND	4.0	ug/L							
Selenium	ND	2.0	ug/L							
Silver	ND	1.0	ug/L							
Zinc	ND	10.0	ug/L							
LCS										
Antimony	93.4	10.0	ug/L	100.0		93	85-115			
Arsenic	112	25.0	ug/L	100.0		112	85-115			
Cadmium	52.7	25.0	ug/L	50.00		105	85-115			
Cadmium	43.0	2.00	ug/L	50.00		86	85-115			
Chromium III	89.5	4.00	ug/L							
Copper	97.5	4.0	ug/L	100.0		98	85-115			
Iron	431	20.0	ug/L	500.0		86	85-115			
Lead	91.5	4.0	ug/L	100.0		91	85-115			
Lead	115	25.0	ug/L	100.0		115	85-115			
Nickel	93.4	10.0	ug/L	100.0		93	85-115			
Selenium	218	50.0	ug/L	200.0		109	85-115			
Silver	46.4	1.0	ug/L	50.00		93	85-115			
Zinc	90.2	10.0	ug/L	100.0		90	85-115			
LCS Dup										
Antimony	98.6	10.0	ug/L	100.0		99	85-115	5	20	
Arsenic	106	25.0	ug/L	100.0		106	85-115	5	20	
Cadmium	45.3	2.00	ug/L	50.00		91	85-115	5	20	
Cadmium	58.2	25.0	ug/L	50.00		116	85-115	10	20	B+
Chromium III	96.3	4.00	ug/L							
Copper	105	4.0	ug/L	100.0		105	85-115	8	20	
Iron	453	20.0	ug/L	500.0		91	85-115	5	20	
Lead	96.5	4.0	ug/L	100.0		97	85-115	5	20	
Lead	108	25.0	ug/L	100.0		108	85-115	7	20	
Nickel	99.1	10.0	ug/L	100.0		99	85-115	6	20	
Selenium	210	50.0	ug/L	200.0		105	85-115	4	20	
Silver	40.4	1.0	ug/L	50.00		81	85-115	14	20	B-
Zinc	96.4	10.0	ug/L	100.0		96	85-115	7	20	
Batch CF70739 - 245.1/7470A										
Blank										

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Client Project ID: UMASS Boston UCRR RGP

ESS Laboratory Work Order: 1706209

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch CF70739 - 245.1/7470A										
Mercury	ND	0.200	ug/L							
LCS										
Mercury	5.90	0.200	ug/L	6.000		98	85-115			
LCS Dup										
Mercury	5.83	0.200	ug/L	6.000		97	85-115	1	20	
Batch CF70761 - [CALC]										
Blank										
Chromium III	ND	10.0	ug/L							
LCS										
Chromium III	ND		ug/L							
LCS Dup										
Chromium III	ND		ug/L							
524.2 Volatile Organic Compounds										
Batch CF70838 - 524.2										
Blank										
1,1,1-Trichloroethane	ND	0.5	ug/L							
1,1,2-Trichloroethane	ND	0.5	ug/L							
1,1-Dichloroethane	ND	0.5	ug/L							
1,1-Dichloroethene	ND	0.5	ug/L							
1,2-Dichlorobenzene	ND	0.5	ug/L							
1,2-Dichloroethane	ND	0.5	ug/L							
1,3-Dichlorobenzene	ND	0.5	ug/L							
1,4-Dichlorobenzene	ND	0.5	ug/L							
Acetone	ND	5.0	ug/L							
Benzene	ND	0.5	ug/L							
Carbon Tetrachloride	ND	0.3	ug/L							
cis-1,2-Dichloroethene	ND	0.5	ug/L							
Ethylbenzene	ND	0.5	ug/L							
Methyl tert-Butyl Ether	ND	0.5	ug/L							
Methylene Chloride	ND	0.5	ug/L							
Naphthalene	ND	0.5	ug/L							
Tertiary-amyl methyl ether	ND	1.0	ug/L							
Tertiary-butyl Alcohol	ND	25.0	ug/L							
Tetrachloroethene	ND	0.5	ug/L							
Toluene	ND	0.5	ug/L							
Trichloroethene	ND	0.5	ug/L							
Vinyl Chloride	ND	0.2	ug/L							
Xylene O	ND	0.5	ug/L							
Xylene P,M	ND	0.5	ug/L							
Surrogate: 1,2-Dichlorobenzene-d4	*5.41*		ug/L	*5.000*		*108*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*5.28*		ug/L	*5.000*		*106*	*80-120*			
LCS										

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Client Project ID: UMASS Boston UCRR RGP

ESS Laboratory Work Order: 1706209

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
524.2 Volatile Organic Compounds										
Batch CF70838 - 524.2										
1,1,1-Trichloroethane	11.0		ug/L	10.00		110	70-130			
1,1,2-Trichloroethane	10.9		ug/L	10.00		109	70-130			
1,1-Dichloroethane	10.6		ug/L	10.00		106	70-130			
1,1-Dichloroethene	11.1		ug/L	10.00		111	70-130			
1,2-Dichlorobenzene	11.0		ug/L	10.00		110	70-130			
1,2-Dichloroethane	11.1		ug/L	10.00		111	70-130			
1,3-Dichlorobenzene	10.7		ug/L	10.00		107	70-130			
1,4-Dichlorobenzene	11.1		ug/L	10.00		111	70-130			
Acetone	53.9		ug/L	50.00		108	70-130			
Benzene	10.7		ug/L	10.00		107	70-130			
Carbon Tetrachloride	11.1		ug/L	10.00		111	70-130			
cis-1,2-Dichloroethene	10.7		ug/L	10.00		107	70-130			
Ethylbenzene	10.9		ug/L	10.00		109	70-130			
Methyl tert-Butyl Ether	10.5		ug/L	10.00		105	70-130			
Methylene Chloride	11.0		ug/L	10.00		110	70-130			
Naphthalene	11.3		ug/L	10.00		113	70-130			
Tertiary-amyl methyl ether	10.6		ug/L	10.00		106	70-130			
Tertiary-butyl Alcohol	62.9		ug/L	50.00		126	70-130			
Tetrachloroethene	8.0		ug/L	10.00		80	70-130			
Toluene	10.8		ug/L	10.00		108	70-130			
Trichloroethene	10.8		ug/L	10.00		108	70-130			
Vinyl Chloride	10.6		ug/L	10.00		106	70-130			
Xylene O	10.3		ug/L	10.00		103	70-130			
Xylene P,M	20.9		ug/L	20.00		105	70-130			
Surrogate: 1,2-Dichlorobenzene-d4	*5.54*		ug/L	*5.000*		*111*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*5.33*		ug/L	*5.000*		*107*	*80-120*			
LCS Dup										
1,1,1-Trichloroethane	10.9		ug/L	10.00		109	70-130	0.9	20	
1,1,2-Trichloroethane	11.4		ug/L	10.00		114	70-130	4	20	
1,1-Dichloroethane	10.6		ug/L	10.00		106	70-130	0.2	20	
1,1-Dichloroethene	11.3		ug/L	10.00		113	70-130	2	20	
1,2-Dichlorobenzene	11.2		ug/L	10.00		112	70-130	2	20	
1,2-Dichloroethane	10.9		ug/L	10.00		109	70-130	2	20	
1,3-Dichlorobenzene	10.9		ug/L	10.00		109	70-130	1	20	
1,4-Dichlorobenzene	11.3		ug/L	10.00		113	70-130	2	20	
Acetone	54.9		ug/L	50.00		110	70-130	2	20	
Benzene	10.6		ug/L	10.00		106	70-130	0.9	20	
Carbon Tetrachloride	11.4		ug/L	10.00		114	70-130	3	20	
cis-1,2-Dichloroethene	10.5		ug/L	10.00		105	70-130	2	20	
Ethylbenzene	11.2		ug/L	10.00		112	70-130	2	20	
Methyl tert-Butyl Ether	11.1		ug/L	10.00		111	70-130	6	20	
Methylene Chloride	11.4		ug/L	10.00		114	70-130	3	20	
Naphthalene	11.8		ug/L	10.00		118	70-130	4	20	
Tertiary-amyl methyl ether	11.0		ug/L	10.00		110	70-130	3	20	
Tertiary-butyl Alcohol	65.8		ug/L	50.00		132	70-130	5	25	B+

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Client Project ID: UMASS Boston UCRR RGP

ESS Laboratory Work Order: 1706209

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
524.2 Volatile Organic Compounds										
Batch CF70838 - 524.2										
Tetrachloroethene	8.2		ug/L	10.00		82	70-130	3	20	
Toluene	11.0		ug/L	10.00		110	70-130	1	20	
Trichloroethene	10.9		ug/L	10.00		109	70-130	1	20	
Vinyl Chloride	10.6		ug/L	10.00		106	70-130	0.09	20	
Xylene O	10.4		ug/L	10.00		104	70-130	1	20	
Xylene P,M	20.8		ug/L	20.00		104	70-130	0.6	20	
Surrogate: 1,2-Dichlorobenzene-d4	*5.49*		ug/L	*5.000*		*110*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*5.40*		ug/L	*5.000*		*108*	*80-120*			
Batch CF71237 - 524.2										
Blank										
1,1,1-Trichloroethane	ND	0.5	ug/L							
1,1,2-Trichloroethane	ND	0.5	ug/L							
1,1-Dichloroethane	ND	0.5	ug/L							
1,1-Dichloroethene	ND	0.5	ug/L							
1,2-Dichlorobenzene	ND	0.5	ug/L							
1,2-Dichloroethane	ND	0.5	ug/L							
1,3-Dichlorobenzene	ND	0.5	ug/L							
1,4-Dichlorobenzene	ND	0.5	ug/L							
Acetone	ND	5.0	ug/L							
Benzene	ND	0.5	ug/L							
Carbon Tetrachloride	ND	0.3	ug/L							
cis-1,2-Dichloroethene	ND	0.5	ug/L							
Ethylbenzene	ND	0.5	ug/L							
Methyl tert-Butyl Ether	ND	0.5	ug/L							
Methylene Chloride	ND	0.5	ug/L							
Naphthalene	ND	0.5	ug/L							
Tertiary-amyl methyl ether	ND	1.0	ug/L							
Tertiary-butyl Alcohol	ND	25.0	ug/L							
Tetrachloroethene	ND	0.5	ug/L							
Toluene	ND	0.5	ug/L							
Trichloroethene	ND	0.5	ug/L							
Vinyl Chloride	ND	0.2	ug/L							
Xylene O	ND	0.5	ug/L							
Xylene P,M	ND	0.5	ug/L							
Surrogate: 1,2-Dichlorobenzene-d4	*5.17*		ug/L	*5.000*		*103*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*5.18*		ug/L	*5.000*		*104*	*80-120*			
LCS										
1,1,1-Trichloroethane	10.5		ug/L	10.00		105	70-130			
1,1,2-Trichloroethane	9.9		ug/L	10.00		99	70-130			
1,1-Dichloroethane	10.0		ug/L	10.00		100	70-130			
1,1-Dichloroethene	10.6		ug/L	10.00		106	70-130			
1,2-Dichlorobenzene	9.7		ug/L	10.00		97	70-130			
1,2-Dichloroethane	10.6		ug/L	10.00		106	70-130			
1,3-Dichlorobenzene	9.8		ug/L	10.00		98	70-130			
1,4-Dichlorobenzene	10.1		ug/L	10.00		101	70-130			

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ESS Laboratory Work Order: 1706209

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
524.2 Volatile Organic Compounds										
Batch CF71237 - 524.2										
Acetone	46.2		ug/L	50.00		92	70-130			
Benzene	9.9		ug/L	10.00		99	70-130			
Carbon Tetrachloride	10.1		ug/L	10.00		101	70-130			
cis-1,2-Dichloroethene	9.8		ug/L	10.00		98	70-130			
Ethylbenzene	10.0		ug/L	10.00		100	70-130			
Methyl tert-Butyl Ether	10.4		ug/L	10.00		104	70-130			
Methylene Chloride	9.5		ug/L	10.00		95	70-130			
Naphthalene	10.2		ug/L	10.00		102	70-130			
Tertiary-amyl methyl ether	10.7		ug/L	10.00		107	70-130			
Tertiary-butyl Alcohol	53.6		ug/L	50.00		107	70-130			
Tetrachloroethene	10.3		ug/L	10.00		103	70-130			
Toluene	9.8		ug/L	10.00		98	70-130			
Trichloroethene	9.8		ug/L	10.00		98	70-130			
Vinyl Chloride	9.6		ug/L	10.00		96	70-130			
Xylene O	9.6		ug/L	10.00		96	70-130			
Xylene P,M	19.3		ug/L	20.00		96	70-130			
Surrogate: 1,2-Dichlorobenzene-d4	*5.30*		ug/L	*5.000*		*106*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*5.10*		ug/L	*5.000*		*102*	*80-120*			
LCS Dup										
1,1,1-Trichloroethane	11.2		ug/L	10.00		112	70-130	7	20	
1,1,2-Trichloroethane	10.6		ug/L	10.00		106	70-130	7	20	
1,1-Dichloroethane	11.1		ug/L	10.00		111	70-130	10	20	
1,1-Dichloroethene	11.1		ug/L	10.00		111	70-130	5	20	
1,2-Dichlorobenzene	10.4		ug/L	10.00		104	70-130	7	20	
1,2-Dichloroethane	11.4		ug/L	10.00		114	70-130	8	20	
1,3-Dichlorobenzene	10.4		ug/L	10.00		104	70-130	6	20	
1,4-Dichlorobenzene	10.7		ug/L	10.00		107	70-130	5	20	
Acetone	50.6		ug/L	50.00		101	70-130	9	20	
Benzene	10.8		ug/L	10.00		108	70-130	8	20	
Carbon Tetrachloride	11.2		ug/L	10.00		112	70-130	10	20	
cis-1,2-Dichloroethene	10.3		ug/L	10.00		103	70-130	5	20	
Ethylbenzene	10.6		ug/L	10.00		106	70-130	6	20	
Methyl tert-Butyl Ether	11.2		ug/L	10.00		112	70-130	8	20	
Methylene Chloride	9.9		ug/L	10.00		99	70-130	4	20	
Naphthalene	10.8		ug/L	10.00		108	70-130	6	20	
Tertiary-amyl methyl ether	11.1		ug/L	10.00		111	70-130	4	20	
Tertiary-butyl Alcohol	55.3		ug/L	50.00		111	70-130	3	25	
Tetrachloroethene	11.1		ug/L	10.00		111	70-130	7	20	
Toluene	10.2		ug/L	10.00		102	70-130	3	20	
Trichloroethene	10.7		ug/L	10.00		107	70-130	8	20	
Vinyl Chloride	10.0		ug/L	10.00		100	70-130	4	20	
Xylene O	10.1		ug/L	10.00		101	70-130	6	20	
Xylene P,M	20.4		ug/L	20.00		102	70-130	5	20	
Surrogate: 1,2-Dichlorobenzene-d4	*5.05*		ug/L	*5.000*		*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*5.16*		ug/L	*5.000*		*103*	*80-120*			

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ESS Laboratory Work Order: 1706209

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
625(SIM) Semi-Volatile Organic Compounds										
Batch CF70834 - 3510C										
Blank										
Acenaphthene	ND	0.20	ug/L							
Acenaphthylene	ND	0.20	ug/L							
Anthracene	ND	0.20	ug/L							
Benzo(a)anthracene	ND	0.05	ug/L							
Benzo(a)pyrene	ND	0.05	ug/L							
Benzo(b)fluoranthene	ND	0.05	ug/L							
Benzo(g,h,i)perylene	ND	0.20	ug/L							
Benzo(k)fluoranthene	ND	0.05	ug/L							
bis(2-Ethylhexyl)phthalate	1.34	1.00	ug/L							
Butylbenzylphthalate	ND	2.50	ug/L							
Chrysene	ND	0.05	ug/L							
Dibenzo(a,h)Anthracene	ND	0.05	ug/L							
Diethylphthalate	ND	2.50	ug/L							
Dimethylphthalate	ND	2.50	ug/L							
Di-n-butylphthalate	ND	2.50	ug/L							
Di-n-octylphthalate	ND	2.50	ug/L							
Fluoranthene	ND	0.20	ug/L							
Fluorene	ND	0.20	ug/L							
Indeno(1,2,3-cd)Pyrene	ND	0.05	ug/L							
Naphthalene	ND	0.20	ug/L							
Pentachlorophenol	ND	0.90	ug/L							
Phenanthrene	ND	0.20	ug/L							
Pyrene	ND	0.20	ug/L							
Surrogate: 1,2-Dichlorobenzene-d4	*0.765*		ug/L	*2.500*		*31*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*2.57*		ug/L	*3.750*		*68*	*15-110*			
Surrogate: 2-Fluorobiphenyl	*1.04*		ug/L	*2.500*		*42*	*30-130*			
Surrogate: Nitrobenzene-d5	*1.33*		ug/L	*2.500*		*53*	*30-130*			
Surrogate: p-Terphenyl-d14	*1.28*		ug/L	*2.500*		*51*	*30-130*			
LCS										
Acenaphthene	2.37	0.20	ug/L	4.000		59	40-140			
Acenaphthylene	2.41	0.20	ug/L	4.000		60	40-140			
Anthracene	2.41	0.20	ug/L	4.000		60	40-140			
Benzo(a)anthracene	2.44	0.05	ug/L	4.000		61	40-140			
Benzo(a)pyrene	2.72	0.05	ug/L	4.000		68	40-140			
Benzo(b)fluoranthene	2.64	0.05	ug/L	4.000		66	40-140			
Benzo(g,h,i)perylene	2.48	0.20	ug/L	4.000		62	40-140			
Benzo(k)fluoranthene	2.62	0.05	ug/L	4.000		65	40-140			
bis(2-Ethylhexyl)phthalate	3.92	2.50	ug/L	4.000		98	40-140			
Butylbenzylphthalate	2.95	2.50	ug/L	4.000		74	40-140			
Chrysene	2.42	0.05	ug/L	4.000		60	40-140			
Dibenzo(a,h)Anthracene	2.46	0.05	ug/L	4.000		62	40-140			
Diethylphthalate	2.48	2.50	ug/L	4.000		62	40-140			
Dimethylphthalate	2.59	2.50	ug/L	4.000		65	40-140			
Di-n-butylphthalate	2.71	2.50	ug/L	4.000		68	40-140			

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ESS Laboratory Work Order: 1706209

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
625(SIM) Semi-Volatile Organic Compounds										
Batch CF70834 - 3510C										
Di-n-octylphthalate	3.26	2.50	ug/L	4.000		82	40-140			
Fluoranthene	2.56	0.20	ug/L	4.000		64	40-140			
Fluorene	2.51	0.20	ug/L	4.000		63	40-140			
Indeno(1,2,3-cd)Pyrene	2.56	0.05	ug/L	4.000		64	40-140			
Naphthalene	1.99	0.20	ug/L	4.000		50	40-140			
Pentachlorophenol	3.03	0.90	ug/L	4.000		76	30-130			
Phenanthrene	2.28	0.20	ug/L	4.000		57	40-140			
Pyrene	2.49	0.20	ug/L	4.000		62	40-140			
Surrogate: 1,2-Dichlorobenzene-d4	*1.01*		ug/L	*2.500*		*40*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*3.06*		ug/L	*3.750*		*81*	*15-110*			
Surrogate: 2-Fluorobiphenyl	*1.23*		ug/L	*2.500*		*49*	*30-130*			
Surrogate: Nitrobenzene-d5	*1.34*		ug/L	*2.500*		*54*	*30-130*			
Surrogate: p-Terphenyl-d14	*1.37*		ug/L	*2.500*		*55*	*30-130*			
LCS Dup										
Acenaphthene	2.58	0.20	ug/L	4.000		64	40-140	8	20	
Acenaphthylene	2.61	0.20	ug/L	4.000		65	40-140	8	20	
Anthracene	2.58	0.20	ug/L	4.000		64	40-140	7	20	
Benzo(a)anthracene	2.72	0.05	ug/L	4.000		68	40-140	11	20	
Benzo(a)pyrene	3.07	0.05	ug/L	4.000		77	40-140	12	20	
Benzo(b)fluoranthene	3.20	0.05	ug/L	4.000		80	40-140	19	20	
Benzo(g,h,i)perylene	3.04	0.20	ug/L	4.000		76	40-140	20	20	
Benzo(k)fluoranthene	3.06	0.05	ug/L	4.000		76	40-140	16	20	
bis(2-Ethylhexyl)phthalate	3.50	2.50	ug/L	4.000		87	40-140	11	20	
Butylbenzylphthalate	3.36	2.50	ug/L	4.000		84	40-140	13	20	
Chrysene	2.63	0.05	ug/L	4.000		66	40-140	9	20	
Dibenzo(a,h)Anthracene	3.09	0.05	ug/L	4.000		77	40-140	23	20	D+
Diethylphthalate	2.68	2.50	ug/L	4.000		67	40-140	8	20	
Dimethylphthalate	2.73	2.50	ug/L	4.000		68	40-140	5	20	
Di-n-butylphthalate	3.03	2.50	ug/L	4.000		76	40-140	11	20	
Di-n-octylphthalate	3.83	2.50	ug/L	4.000		96	40-140	16	20	
Fluoranthene	2.79	0.20	ug/L	4.000		70	40-140	9	20	
Fluorene	2.66	0.20	ug/L	4.000		67	40-140	6	20	
Indeno(1,2,3-cd)Pyrene	3.25	0.05	ug/L	4.000		81	40-140	24	20	D+
Naphthalene	2.18	0.20	ug/L	4.000		54	40-140	9	20	
Pentachlorophenol	3.30	0.90	ug/L	4.000		83	30-130	9	20	
Phenanthrene	2.47	0.20	ug/L	4.000		62	40-140	8	20	
Pyrene	2.72	0.20	ug/L	4.000		68	40-140	9	20	
Surrogate: 1,2-Dichlorobenzene-d4	*1.10*		ug/L	*2.500*		*44*	*30-130*			
Surrogate: 2,4,6-Tribromophenol	*3.29*		ug/L	*3.750*		*88*	*15-110*			
Surrogate: 2-Fluorobiphenyl	*1.31*		ug/L	*2.500*		*52*	*30-130*			
Surrogate: Nitrobenzene-d5	*1.52*		ug/L	*2.500*		*61*	*30-130*			
Surrogate: p-Terphenyl-d14	*1.43*		ug/L	*2.500*		*57*	*30-130*			
8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution										
Batch CF70831 - 3535A										

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ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP

ESS Laboratory Work Order: 1706209

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution										
Batch CF70831 - 3535A										
Blank										
1,4-Dioxane	ND	0.250	ug/L							
Surrogate: 1,4-Dioxane-d8	*2.37*		ug/L	*5.000*		*47*	*15-115*			
LCS										
1,4-Dioxane	8.30	0.250	ug/L	10.00		83	40-140			
Surrogate: 1,4-Dioxane-d8	*2.90*		ug/L	*5.000*		*58*	*15-115*			
LCS Dup										
1,4-Dioxane	8.20	0.250	ug/L	10.00		82	40-140	1	20	
Surrogate: 1,4-Dioxane-d8	*2.89*		ug/L	*5.000*		*58*	*15-115*			
Classical Chemistry										
Batch CF70761 - General Preparation										
Blank										
Hexavalent Chromium	ND	10.0	ug/L							
LCS										
Hexavalent Chromium	0.495		mg/L	0.4998		99	90-110			
LCS Dup										
Hexavalent Chromium	0.495		mg/L	0.4998		99	90-110	0.1	20	
Batch CF70815 - General Preparation										
Blank										
Chloride	ND	500	ug/L							
LCS										
Chloride	2		mg/L	2.500		93	90-110			
Batch CF70849 - General Preparation										
Blank										
Total Suspended Solids	ND	5	mg/L							
LCS										
Total Suspended Solids	46		mg/L	43.50		106	80-120			
Batch CF70923 - General Preparation										
Blank										
Ammonia as N	ND	0.10	mg/L							
LCS										
Ammonia as N	0.10	0.10	mg/L	0.09994		96	80-120			
LCS										
Ammonia as N	1.13	0.10	mg/L	0.9994		113	80-120			
Batch CF71222 - General Preparation										
Blank										
Chloride	ND	500	ug/L							
LCS										
Chloride	2		mg/L	2.500		91	90-110			

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ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division
of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP ESS Laboratory Work Order: 1706209

Notes and Definitions

U	Analyte included in the analysis, but not detected
EL	Elevated Method Reporting Limits due to sample matrix (EL).
D+	Relative percent difference for duplicate is outside of criteria (D+).
D	Diluted.
B+	Blank Spike recovery is above upper control limit (B+).
B-	Blank Spike recovery is below lower control limit (B-).
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS Boston UCRR RGP

ESS Laboratory Work Order: 1706209

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: GZA - Providence, RI - GZA/HDM

Shipped/Delivered Via: Client

ESS Project ID: 1706209
Date Received: 6/7/2017
Project Due Date: 6/14/2017
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 13.6 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
10. Were any analyses received outside of hold time? Yes / No

11. Any Subcontracting needed? Yes / No
    ESS Sample IDs:
    Analysis:
    TAT:
12. Were VOAs received? Yes / No
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / NA
13. Are the samples properly preserved? Yes / No
    a. If metals preserved upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. Was there a need to contact the client? Yes / No
    Who was contacted? Date: Time: By:

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
01	139254	Yes	NA	Yes	500 mL Poly - H2SO4	H2SO4	
01	139261	Yes	NA	Yes	1L Amber - Unpres	NP	
01	139262	Yes	NA	Yes	1L Amber - Unpres	NP	
01	139267	Yes	NA	Yes	1L Amber - Unpres	NP	
01	139268	Yes	NA	Yes	1L Amber - Unpres	NP	
01	139272	Yes	NA	Yes	250 mL Poly - HNO3	HNO3	
01	139276	Yes	NA	Yes	250 mL Poly - Unpres	NP	
01	139286	Yes	No	Yes	VOA Vial - HCl	HCl	
01	139287	Yes	No	Yes	VOA Vial - HCl	HCl	
01	139288	Yes	No	Yes	VOA Vial - HCl	HCl	
01	139292	Yes	NA	Yes	1L Poly - Unpres	NP	
02	139253	Yes	NA	Yes	500 mL Poly - H2SO4	H2SO4	
02	139259	Yes	NA	Yes	1L Amber - Unpres	NP	
02	139260	Yes	NA	Yes	1L Amber - Unpres	NP	
02	139265	Yes	NA	Yes	1L Amber - Unpres	NP	
02	139266	Yes	NA	Yes	1L Amber - Unpres	NP	
02	139271	Yes	NA	Yes	250 mL Poly - HNO3	HNO3	
02	139275	Yes	NA	Yes	250 mL Poly - Unpres	NP	
02	139283	Yes	No	Yes	VOA Vial - HCl	HCl	
02	139284	Yes	No	Yes	VOA Vial - HCl	HCl	
02	139285	Yes	No	Yes	VOA Vial - HCl	HCl	
02	139291	Yes	NA	Yes	1L Poly - Unpres	NP	
03	139252	Yes	NA	Yes	500 mL Poly - H2SO4	H2SO4	
03	139257	Yes	NA	Yes	1L Amber - Unpres	NP	

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ESS Laboratory Sample and Cooler Receipt Checklist

Client: GZA - Providence, RI - GZA/HDM

ESS Project ID: 1706209

Date Received: 6/7/2017

03	139258	Yes	NA	Yes	1L Amber - Unpres	NP
03	139270	Yes	NA	Yes	250 mL Poly - HNO3	HNO3
03	139274	Yes	NA	Yes	250 mL Poly - Unpres	NP
03	139280	Yes	No	Yes	VOA Vial - HCl	HCl
03	139281	Yes	No	Yes	VOA Vial - HCl	HCl
03	139282	Yes	No	Yes	VOA Vial - HCl	HCl
04	139251	Yes	NA	Yes	500 mL Poly - H2SO4	H2SO4
04	139255	Yes	NA	Yes	1L Amber - Unpres	NP
04	139256	Yes	NA	Yes	1L Amber - Unpres	NP
04	139263	Yes	NA	Yes	1L Amber - Unpres	NP
04	139264	Yes	NA	Yes	1L Amber - Unpres	NP
04	139269	Yes	NA	Yes	250 mL Poly - HNO3	HNO3
04	139273	Yes	NA	Yes	250 mL Poly - Unpres	NP
04	139277	Yes	No	Yes	VOA Vial - HCl	HCl
04	139278	Yes	No	Yes	VOA Vial - HCl	HCl
04	139279	Yes	No	Yes	VOA Vial - HCl	HCl
04	139289	Yes	NA	Yes	1L Poly - Unpres	NP
05	139250	Yes	NA	Yes	500 mL Poly - H2SO4	H2SO4

2nd Review

Are barcode labels on correct containers? (Yes) No

Completed By: _____ Date & Time: 6/7/17 2330

Reviewed By: _____ Date & Time: 6/7/17 2342

Delivered By: _____ 6/7/17 2342

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ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston, RI 02910-2211
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS LAB PROJECT ID: 1706209

Turn Time ___X___ Standard Rush_____ Approved By: _____

Reporting Limits - As required by 2017 RGP

State where samples were collected: **MA**

Is this project for: Yes **RGP**

Electonic Deliverable Yes__X__ No____
Format: Excel_X__ Access___ PDF_X__ Other_____

Project Manager: ___Jason Ressler_____
Company: _GZA_____
Address: __530 Broadway _____
_____Providence, RI 02909_____
_____

Project # 33930.08 task 1
Project Name: UMASS Boston UCRR RGP (hdm 6/9/17)
PO #

Analysis

ESS Lab Sample ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample Identification	# of Containers	RGP Metals Total	RGP Metals Dissolved	Hardness (Calculation)	Ethanol ASTM D3695	Chloride 300.0*	Total Cyanide 4500 LL	TPH 1664	TSS 2540D*	TRC 4500-CL E*	Ammonia 350.1	Tri Cr (Calc. MUST run T. Cr)	Hex Cr 7196A	Phenol 420.1	RGP VOC Long List 524	1,4-Dioxane 8270-SIM	EDB 504.1	RGP SVOC Log List 625-SIM	PCB 608	Comment #
1 V-701	06/07/2017	9:38	G	GW	Influent Sample ID: UGW-701-1 Field Measured pH = _____ Field Measured temp. = _____	4 2 1	x 1				x 1			x 1		x 1	x 1	x 1		x 3	x 2		x 2		1,2
2 V-702	06/07/2017	15:10	G	GW	Influent Sample ID: UGW-702-1 Field Measured pH = _____ Field Measured temp. = _____	4 2 1	x 1				x 1			x 1		x 1	x 1	x 1		x 3	x 2		x 2		1,2
3 V-703	06/07/2017	17:22	G	GW	Influent Sample ID: UGW-703-1 Field Measured pH = _____ Field Measured temp. = _____	4 2 1	x 1				x 0			x 0		x 1	x 1	x 1		x 3	x 1		x 1		1,2
V-704	06/07/2017	12:23	G	GW	Influent Sample ID: UGW-704-1 Field Measured pH = _____ Field Measured temp. = _____	2	x				x			x		x	x	x		x	x		x		1,2
4 V-9B	06/07/2017	16:55	G	GW	Influent Sample ID: UGW-9B-1 Field Measured pH = _____ Field Measured temp. = _____	4 2 1	x 1				x 1			x 1		x 1	x 1	x 1		x 3	x 2		x 2		1,2
5 OUTFALL-1	06/07/2017	16:15	G	SW	Receiving Water Sample: UDB-1-1 Field Measured pH = _____ Field Measured temp. = _____ Field measured salinity = _____	1										X 1										
Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_____							4	4	4	1	1	5	2	1	1	3	-	1	3	2	1	2	1	1	
Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA							P	P	P	V	P	P	AG	P	P	P	-	P	AG	V	AG	V	AG	AG	
Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter																									

Unless the hold time is in jeopardy of exceedance ↓
* Contact Jay prior to running samples from V-703
* Do not test sample from V-704

Cooler Present ____Yes ____No
Seals Intact ___ Yes ___No NA: ___
Cooler Temperature: 12.5 + 13.6 ice a

Sampled by :

Comments: 1) RGP Metals include Sb, As, Cd, Cu, Fe, Pb, Ni, Se, Ag and Zn by 200.7/200.9 and Hg by 245.1
2) Parameters in **BOLD** have Short hold-time
TSS, TRC and Cl taken from the same container
PERMIT ATTACHED
DISCHARGE TO SALT WATER hdm 061517

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	06/07/2017	[signature] 6/7/17			
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	2045				

Please E-mail all changes to Chain of Custody in writing

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ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston, RI 02910-2211
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS LAB PROJECT ID: 1706209

Turn Time ___X___ Standard Rush_____ Approved By: _____

Reporting Limits - As required by 2017 RGP

State where samples were collected: **MA**

Is this project for: Yes **RGP**

Electonic Deliverable Yes__X__ No____
Format: Excel_X__ Access___ PDF_X__ Other_____

Project Manager: ___Jason Ressler_____
Company: _GZA_____
Address: __530 Broadway _____
_____Providence, RI 02909_____
_____

Project # 33930.08 task 1
Project Name: UMASS Boston UCRR
PO #

ESS Lab Sample ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample Identification	# of Containers	RGP Metals Total	RGP Metals Dissolved	Hardness (Calculation)	Ethanol ASTM D3695	Chloride 300.0*	Total Cyanide 4500 LL	TPH 1664	TSS 2540D*	TRC 4500-CL E*	Ammonia 350.1	Tri Cr (Calc. MUST run T. Cr)	Hex Cr 7196A	Phenol 420.1	RGP VOC Long List 524	1,4-Dioxane 8270-SIM	EDB 504.1	RGP SVOC Log List 625-SIM	PCB 608	Comment #
1 V-701	06/07/2017	9:38	G	GW	Influent Sample ID: UGW-701-1 Field Measured pH = _____ Field Measured temp. = _____	4 2 1	x 1				x 1			x 1		x 1	x 1	x 1		x 3	x 2		x 2		1,2
2 V-702	06/07/2017	15:10	G	GW	Influent Sample ID: UGW-702-1 Field Measured pH = _____ Field Measured temp. = _____	4 2 1	x 1				x 1			x 1		x 1	x 1	x 1		x 3	x 2		x 2		1,2
3 V-703	06/07/2017	17:22	G	GW	Influent Sample ID: UGW-703-1 Field Measured pH = _____ Field Measured temp. = _____	4 2 1	x 1				x 0			x 0		x 1	x 1	x 1		x 3	x 1		x 1		1,2
V-704	06/07/2017	12:23	G	GW	Influent Sample ID: UGW-704-1 Field Measured pH = _____ Field Measured temp. = _____	2	x				x			x		x	x	x		x	x		x		1,2
4 V-9B	06/07/2017	16:55	G	GW	Influent Sample ID: UGW-9B-1 Field Measured pH = _____ Field Measured temp. = _____	4 2 1	x 1				x 1			x 1		x 1	x 1	x 1		x 3	x 2		x 2		1,2
5 OUTFALL-1	06/07/2017	16:15	G	SW	Receiving Water Sample: UDB-1-1 Field Measured pH = _____ Field Measured temp. = _____ Field measured salinity = _____	1										X 1										
Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_____							4	4	4	1	1	5	2	1	1	3	-	1	3	2	1	2	1	1	
Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA							P	P	P	V	P	P	AG	P	P	P	-	P	AG	V	AG	V	AG	AG	
Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter																									

Under the hold time is in reference of exceedance
* Contact Jay prior to running samples from V-703
* Do not test sample from V-704

Cooler Present ____Yes ____No
Seals Intact ___ Yes ___No NA: ___
Cooler Temperature: 12.5 + 13.6 ice a

Sampled by :

Comments: 1) RGP Metals include Sb, As, Cd, Cu, Fe, Pb, Ni, Se, Ag and Zn by 200.7/200.9 and Hg by 245.1
2) Parameters in **BOLD** have Short hold-time **PERMIT ATTACHED** *
TSS, TRC and Cl taken from the same container

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	06/07/2017	[signature]			
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	2045				

Please E-mail all changes to Chain of Custody in writin

Page ____ of ____

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CERTIFICATE OF ANALYSIS

Jason Ressler
GZA GeoEnvironmental, Inc.
655 Winding Brook Drive Suite 402
Glastonbury, CT 06033

RE: UMASS - Boston NOI Application (05.0033930.02)
ESS Laboratory Work Order Number: 1410211

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 10:57 am, Oct 22, 2014

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with NELAC Standards, A2LA and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application

ESS Laboratory Work Order: 1410211

SAMPLE RECEIPT

The following samples were received on October 08, 2014 for the analyses specified on the enclosed Chain of Custody Record.

The samples and analyses listed below were analyzed in accordance with the 2010 Remediation General Permit (RGP) under the National Pollutant Discharge Elimination System (NPDES).

The cooler temperature for sample 1410211-01 was not within the acceptance limit of <6°C, however, samples were delivered on ice on the day of sampling.

Lab Number	Sample Name	Matrix	Analysis
1410211-01	U-6	Ground Water	1664A, 2540D, 300.0, 420.1, 4500 CN CE, 4500-Cl E, 6010C, 7010, 7196A, 7470A, 8011, 8082A, 8260B, 8270D, 8270D SIM, Calc
1410211-02	U-108	Ground Water	1664A, 2540D, 300.0, 420.1, 4500 CN CE, 4500-Cl E, 6010C, 7010, 7196A, 7470A, 8011, 8082A, 8260B, 8270D, 8270D SIM, Calc
1410211-03	U-9B	Ground Water	1664A, 2540D, 300.0, 420.1, 4500 CN CE, 4500-Cl E, 6010C, 7010, 7196A, 7470A, 8011, 8082A, 8260B, 8270D, 8270D SIM, Calc
1410211-04	Trip Blank	Aqueous	8260B

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application ESS Laboratory Work Order: 1410211

PROJECT NARRATIVE

8270C(SIM) Polynuclear Aromatic Hydrocarbons

CXJ0175-CCV1 **Continuing Calibration recovery is above upper control limit (C+).**
Di-n-octylphthalate (121% @ 80-120%)

Classical Chemistry

1410211-01 **The maximum holding time listed in 40 CFR Part 136 Table II for pH, Dissolved Oxygen, Sulfite and Residual Chlorine is fifteen minutes.**

1410211-02 **The maximum holding time listed in 40 CFR Part 136 Table II for pH, Dissolved Oxygen, Sulfite and Residual Chlorine is fifteen minutes.**

1410211-03 **The maximum holding time listed in 40 CFR Part 136 Table II for pH, Dissolved Oxygen, Sulfite and Residual Chlorine is fifteen minutes.**

Total Metals

1410211-01 **Elevated Method Reporting Limits due to sample matrix (EL).**
Arsenic , Cadmium , Lead

1410211-03 **Present in Method Blank (B).**
Lead

CJ41607-BS1 **Blank Spike recovery is below lower control limit (B-).**
Silver (78% @ 80-120%)

CJ41607-BSD1 **Blank Spike recovery is below lower control limit (B-).**
Silver (76% @ 80-120%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application

ESS Laboratory Work Order: 1410211

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015D - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH / VPH

Prep Methods

3005A - Aqueous ICP and Graphite Furnace Digestion
3020A - Aqueous ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035 - Solid Purge and Trap

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-6
Date Sampled: 10/08/14 08:30
Percent Solids: N/A

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-01
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 3005A/200.7

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (2.5)		7010		1	KJK	10/16/14 16:19	50	25	CJ40927
Arsenic	**EL** ND (25.0)		7010		10	KJK	10/09/14 22:40	50	25	CJ40927
Cadmium	**EL** ND (2.5)		6010C		1	KJK	10/10/14 15:02	50	25	CJ40927
Chromium	ND (10)		6010C		1	KJK	10/10/14 15:02	50	25	CJ40927
Copper	**18.6** (5.00)		6010C		1	ICP	10/10/14 15:02	50	25	CJ40927
Iron	ND (500)		6010C		10	KJK	10/10/14 17:21	50	25	CJ40927
Lead	**EL** ND (10)		6010C		1	ICP	10/10/14 15:02	50	25	CJ40927
Mercury	ND (0.20)		7470A		1	HG	10/10/14 14:32	20	40	CJ40933
Nickel	ND (5)		6010C		1	ICP	10/10/14 15:02	50	25	CJ40927
Selenium	ND (5.0)		7010		1	KJK	10/10/14 16:42	50	25	CJ40927
Silver	ND (0.2)		7010		1	KJK	10/18/14 18:20	100	20	CJ41607
Zinc	**96** (25)		6010C		1	KJK	10/10/14 15:02	50	25	CJ40927

ESS Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-6
Date Sampled: 10/08/14 08:30
Percent Solids: N/A

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-01
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: [CALC]

Total Metals Aqueous

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Chromium (III)	ND (10)		Calc		1	EEM	10/08/14 16:55	1	1	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-6
Date Sampled: 10/08/14 08:30
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 1
Extraction Method: 3510C

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-01
Sample Matrix: Ground Water
Units: ug/L
Analyst: TAJ
Prepared: 10/10/14 9:40
Cleanup Method: 3665A

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.09)		8082A		1	10/10/14 17:29		CJ40913
Aroclor 1221	ND (0.09)		8082A		1	10/10/14 17:29		CJ40913
Aroclor 1232	ND (0.09)		8082A		1	10/10/14 17:29		CJ40913
Aroclor 1242	ND (0.09)		8082A		1	10/10/14 17:29		CJ40913
Aroclor 1248	ND (0.09)		8082A		1	10/10/14 17:29		CJ40913
Aroclor 1254	ND (0.09)		8082A		1	10/10/14 17:29		CJ40913
Aroclor 1260	ND (0.09)		8082A		1	10/10/14 17:29		CJ40913
Aroclor 1262	ND (0.09)		8082A		1	10/10/14 17:29		CJ40913
Aroclor 1268	ND (0.09)		8082A		1	10/10/14 17:29		CJ40913

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*78 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*82 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*61 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*66 %*		*30-150*

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-6
Date Sampled: 10/08/14 08:30
Percent Solids: N/A
Initial Volume: 5
Final Volume: 5
Extraction Method: 5030B

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-01
Sample Matrix: Ground Water
Units: ug/L
Analyst: MD

8260B Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1-Trichloroethane	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
1,1,2-Trichloroethane	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
1,1-Dichloroethane	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
1,1-Dichloroethene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
1,2-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
1,2-Dichloroethane	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
1,3-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
1,4-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Acetone	ND (10.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Benzene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Carbon Tetrachloride	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
cis-1,2-Dichloroethene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Ethylbenzene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Methyl tert-Butyl Ether	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Methylene Chloride	ND (2.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Naphthalene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Tertiary-amyl methyl ether	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Tertiary-butyl Alcohol	ND (25.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Tetrachloroethene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Toluene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Trichloroethene	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Vinyl Chloride	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Xylene O	ND (1.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945
Xylene P,M	ND (2.0)		8260B		1	10/09/14 20:51	CXJ0142	CJ40945

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichloroethane-d4	*119 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*94 %*		*70-130*
Surrogate: Dibromofluoromethane	*113 %*		*70-130*
Surrogate: Toluene-d8	*101 %*		*70-130*

ESS Laboratory
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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-6
Date Sampled: 10/08/14 08:30
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 1
Extraction Method: 3520C

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-01
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 10/10/14 11:06

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	ND (0.2)		8270D		1	10/15/14 5:25	CXJ0187	CJ41006

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	*81 %*		*15-115*

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-6
Date Sampled: 10/08/14 08:30
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 0.25
Extraction Method: 3510C

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-01
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 10/9/14 15:17

8270C(SIM) Polynuclear Aromatic Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Acenaphthene	ND (0.19)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Acenaphthylene	ND (0.19)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Anthracene	ND (0.19)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Benzo(a)anthracene	ND (0.05)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Benzo(a)pyrene	ND (0.05)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Benzo(b)fluoranthene	ND (0.05)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Benzo(g,h,i)perylene	ND (0.19)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Benzo(k)fluoranthene	ND (0.05)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
bis(2-Ethylhexyl)phthalate	ND (2.34)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Butylbenzylphthalate	ND (2.34)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Chrysene	ND (0.05)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Dibenzo(a,h)Anthracene	ND (0.05)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Diethylphthalate	ND (2.34)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Dimethylphthalate	ND (2.34)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Di-n-butylphthalate	ND (2.34)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Di-n-octylphthalate	ND (2.34)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Fluoranthene	ND (0.19)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Fluorene	ND (0.19)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Indeno(1,2,3-cd)Pyrene	ND (0.05)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Naphthalene	ND (0.19)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Pentachlorophenol	ND (0.84)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Phenanthrene	ND (0.19)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911
Pyrene	ND (0.19)		8270D SIM		1	10/14/14 21:20	CXJ0175	CJ40911

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*30 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*27 %*		*15-110*
Surrogate: 2-Fluorobiphenyl	*33 %*		*30-130*
Surrogate: Nitrobenzene-d5	*43 %*		*30-130*
Surrogate: p-Terphenyl-d14	*44 %*		*30-130*

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-6
Date Sampled: 10/08/14 08:30
Percent Solids: N/A

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-01
Sample Matrix: Ground Water

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Chloride	**14500** (2500)		300.0		5000	JLK	10/16/14 15:18	mg/L	CJ41623
Hexavalent Chromium	ND (10)		7196A		1	EEM	10/08/14 16:55	ug/L	CJ40841
Phenols	ND (100)		420.1		1	JLK	10/15/14 15:42	ug/L	CJ41514
Total Cyanide (LL)	ND (5.0)		4500 CN CE		1	EEM	10/14/14 9:30	ug/L	CJ41417
Total Petroleum Hydrocarbon	ND (5)		1664A		1	CRR	10/16/14 0:00	mg/L	CJ41431
Total Residual Chlorine	ND (10)		4500-Cl E		1	EEM	10/08/14 17:00	ug/L	CJ40840
Total Suspended Solids	**56** (5)		2540D		1	EEM	10/10/14 16:10	mg/L	CJ41011

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-6
Date Sampled: 10/08/14 08:30
Percent Solids: N/A
Initial Volume: 35
Final Volume: 2
Extraction Method: 504/8011

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-01
Sample Matrix: Ground Water
Units: ug/L
Analyst: JXS
Prepared: 10/11/14 12:30

8011 1,2-Dibromoethane / 1,2-Dibromo-3-chloropropane

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
1,2-Dibromoethane	ND (0.015)		8011		1	JXS	10/11/14 13:06		CJ41101

	%Recovery	Qualifier	Limits
Surrogate: Pentachloroethane	*96 %*		*30-150*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-108
Date Sampled: 10/08/14 09:25
Percent Solids: N/A

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-02
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 3005A/200.7

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (2.5)		7010		1	KJK	10/16/14 16:25	50	25	CJ40927
Arsenic	ND (2.5)		7010		1	KJK	10/09/14 21:55	50	25	CJ40927
Cadmium	**0.12** (0.05)		7010		1	JP	10/21/14 21:20	100	20	CJ41607
Chromium	ND (10)		6010C		1	KJK	10/10/14 13:24	50	25	CJ40927
Copper	**6.38** (5.00)		6010C		1	ICP	10/10/14 13:24	50	25	CJ40927
Iron	**18000** (50.0)		6010C		1	KJK	10/10/14 13:24	50	25	CJ40927
Lead	**11** (10)		6010C		1	ICP	10/10/14 13:24	50	25	CJ40927
Mercury	ND (0.20)		7470A		1	HG	10/10/14 14:39	20	40	CJ40933
Nickel	ND (5)		6010C		1	ICP	10/10/14 13:24	50	25	CJ40927
Selenium	ND (5.0)		7010		1	KJK	10/10/14 16:12	50	25	CJ40927
Silver	ND (0.2)		7010		1	KJK	10/18/14 18:26	100	20	CJ41607
Zinc	**37** (25)		6010C		1	KJK	10/10/14 13:24	50	25	CJ40927

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-108
Date Sampled: 10/08/14 09:25
Percent Solids: N/A

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-02
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: [CALC]

Total Metals Aqueous

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Chromium (III)	ND (10)		Calc		1	EEM	10/08/14 16:55	1	1	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-108
Date Sampled: 10/08/14 09:25
Percent Solids: N/A
Initial Volume: 950
Final Volume: 1
Extraction Method: 3510C

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-02
Sample Matrix: Ground Water
Units: ug/L
Analyst: TAJ
Prepared: 10/10/14 9:40
Cleanup Method: 3665A

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.11)		8082A		1	10/15/14 23:22		CJ41522
Aroclor 1221	ND (0.11)		8082A		1	10/15/14 23:22		CJ41522
Aroclor 1232	ND (0.11)		8082A		1	10/15/14 23:22		CJ41522
Aroclor 1242	ND (0.11)		8082A		1	10/15/14 23:22		CJ41522
Aroclor 1248	ND (0.11)		8082A		1	10/15/14 23:22		CJ41522
Aroclor 1254	ND (0.11)		8082A		1	10/15/14 23:22		CJ41522
Aroclor 1260	ND (0.11)		8082A		1	10/15/14 23:22		CJ41522
Aroclor 1262	ND (0.11)		8082A		1	10/15/14 23:22		CJ41522
Aroclor 1268	ND (0.11)		8082A		1	10/15/14 23:22		CJ41522

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*66 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*64 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*60 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*65 %*		*30-150*

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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-108
Date Sampled: 10/08/14 09:25
Percent Solids: N/A
Initial Volume: 5
Final Volume: 5
Extraction Method: 5030B

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-02
Sample Matrix: Ground Water
Units: ug/L
Analyst: MD

8260B Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1-Trichloroethane	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
1,1,2-Trichloroethane	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
1,1-Dichloroethane	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
1,1-Dichloroethene	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
1,2-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
1,2-Dichloroethane	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
1,3-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
1,4-Dichlorobenzene	**5.4** (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Acetone	ND (10.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Benzene	**1.8** (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Carbon Tetrachloride	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
cis-1,2-Dichloroethene	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Ethylbenzene	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Methyl tert-Butyl Ether	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Methylene Chloride	ND (2.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Naphthalene	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Tertiary-amyl methyl ether	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Tertiary-butyl Alcohol	ND (25.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Tetrachloroethene	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Toluene	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Trichloroethene	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Vinyl Chloride	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Xylene O	ND (1.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945
Xylene P,M	ND (2.0)		8260B		1	10/09/14 21:16	CXJ0142	CJ40945

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichloroethane-d4	*116 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*96 %*		*70-130*
Surrogate: Dibromofluoromethane	*113 %*		*70-130*
Surrogate: Toluene-d8	*101 %*		*70-130*

ESS Laboratory
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BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-108
Date Sampled: 10/08/14 09:25
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 1
Extraction Method: 3520C

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-02
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 10/10/14 11:06

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	**0.2** (0.2)		8270D		1	10/15/14 6:14	CXJ0187	CJ41006

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	*76 %*		*15-115*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-108
Date Sampled: 10/08/14 09:25
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 0.25
Extraction Method: 3510C

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-02
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 10/9/14 15:17

8270C(SIM) Polynuclear Aromatic Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Acenaphthene	**1.13** (0.19)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Acenaphthylene	ND (0.19)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Anthracene	**0.24** (0.19)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Benzo(a)anthracene	**0.22** (0.05)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Benzo(a)pyrene	**0.22** (0.05)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Benzo(b)fluoranthene	**0.29** (0.05)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Benzo(g,h,i)perylene	ND (0.19)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Benzo(k)fluoranthene	**0.07** (0.05)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
bis(2-Ethylhexyl)phthalate	ND (2.34)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Butylbenzylphthalate	ND (2.34)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Chrysene	**0.24** (0.05)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Dibenzo(a,h)Anthracene	ND (0.05)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Diethylphthalate	ND (2.34)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Dimethylphthalate	ND (2.34)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Di-n-butylphthalate	ND (2.34)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Di-n-octylphthalate	ND (2.34)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Fluoranthene	**0.61** (0.19)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Fluorene	**0.72** (0.19)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Indeno(1,2,3-cd)Pyrene	**0.15** (0.05)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Naphthalene	ND (0.19)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Pentachlorophenol	ND (0.84)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Phenanthrene	**0.91** (0.19)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911
Pyrene	**0.51** (0.19)		8270D SIM		1	10/14/14 22:09	CXJ0175	CJ40911

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*36 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*31 %*		*15-110*
Surrogate: 2-Fluorobiphenyl	*38 %*		*30-130*
Surrogate: Nitrobenzene-d5	*51 %*		*30-130*
Surrogate: p-Terphenyl-d14	*42 %*		*30-130*

ESS Laboratory
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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-108
Date Sampled: 10/08/14 09:25
Percent Solids: N/A

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-02
Sample Matrix: Ground Water

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Chloride	**1030** (250)		300.0		500	JLK	10/16/14 13:23	mg/L	CJ41623
Hexavalent Chromium	ND (10)		7196A		1	EEM	10/08/14 16:55	ug/L	CJ40841
Phenols	ND (100)		420.1		1	JLK	10/15/14 15:42	ug/L	CJ41514
Total Cyanide (LL)	ND (5.0)		4500 CN CE		1	EEM	10/14/14 9:30	ug/L	CJ41417
Total Petroleum Hydrocarbon	ND (5)		1664A		1	CRR	10/16/14 0:00	mg/L	CJ41431
Total Residual Chlorine	ND (10)		4500-Cl E		1	EEM	10/08/14 17:00	ug/L	CJ40840
Total Suspended Solids	**70** (10)		2540D		1	EEM	10/10/14 16:10	mg/L	CJ41011

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-108
Date Sampled: 10/08/14 09:25
Percent Solids: N/A
Initial Volume: 35
Final Volume: 2
Extraction Method: 504/8011

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-02
Sample Matrix: Ground Water
Units: ug/L
Analyst: JXS
Prepared: 10/16/14 13:00

8011 1,2-Dibromoethane / 1,2-Dibromo-3-chloropropane

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
1,2-Dibromoethane	ND (0.015)		8011		1	JXS	10/16/14 14:09		CJ41608

	%Recovery	Qualifier	Limits
Surrogate: Pentachloroethane	*118 %*		*30-150*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-9B
Date Sampled: 10/08/14 11:10
Percent Solids: N/A

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-03
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 3005A/200.7

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (2.5)		7010		1	KJK	10/16/14 16:31	50	25	CJ40927
Arsenic	ND (2.5)		7010		1	KJK	10/09/14 22:01	50	25	CJ40927
Cadmium	**0.14** (0.05)		7010		1	JP	10/21/14 21:26	100	20	CJ41607
Chromium	ND (10)		6010C		1	KJK	10/10/14 15:18	50	25	CJ40927
Copper	**4.04** (4.00)		6010C		1	ICP	10/20/14 19:11	100	20	CJ41607
Iron	**7170** (50.0)		6010C		1	KJK	10/10/14 15:18	50	25	CJ40927
Lead	**B 8.0** (1.0)		7010		1	JP	10/21/14 3:35	100	20	CJ41607
Mercury	ND (0.20)		7470A		1	HG	10/10/14 14:41	20	40	CJ40933
Nickel	ND (5)		6010C		1	ICP	10/10/14 15:18	50	25	CJ40927
Selenium	ND (5.0)		7010		1	KJK	10/10/14 16:18	50	25	CJ40927
Silver	ND (0.2)		7010		1	KJK	10/18/14 18:32	100	20	CJ41607
Zinc	**93** (25)		6010C		1	KJK	10/10/14 15:18	50	25	CJ40927

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-9B
Date Sampled: 10/08/14 11:10
Percent Solids: N/A

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-03
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: [CALC]

Total Metals Aqueous

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Chromium (III)	ND (10)		Calc		1	EEM	10/08/14 16:55	1	1	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-9B
Date Sampled: 10/08/14 11:10
Percent Solids: N/A
Initial Volume: 970
Final Volume: 1
Extraction Method: 3510C

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-03
Sample Matrix: Ground Water
Units: ug/L
Analyst: TAJ
Prepared: 10/10/14 9:40
Cleanup Method: 3665A

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.10)		8082A		1	10/15/14 23:40		CJ41522
Aroclor 1221	ND (0.10)		8082A		1	10/15/14 23:40		CJ41522
Aroclor 1232	ND (0.10)		8082A		1	10/15/14 23:40		CJ41522
Aroclor 1242	ND (0.10)		8082A		1	10/15/14 23:40		CJ41522
Aroclor 1248	ND (0.10)		8082A		1	10/15/14 23:40		CJ41522
Aroclor 1254	ND (0.10)		8082A		1	10/15/14 23:40		CJ41522
Aroclor 1260	ND (0.10)		8082A		1	10/15/14 23:40		CJ41522
Aroclor 1262	ND (0.10)		8082A		1	10/15/14 23:40		CJ41522
Aroclor 1268	ND (0.10)		8082A		1	10/15/14 23:40		CJ41522

	%Recovery	Qualifier	Limits
Surrogate: Decachlorobiphenyl	*68 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*62 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*57 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*66 %*		*30-150*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-9B
Date Sampled: 10/08/14 11:10
Percent Solids: N/A
Initial Volume: 5
Final Volume: 5
Extraction Method: 5030B

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-03
Sample Matrix: Ground Water
Units: ug/L
Analyst: MD

8260B Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1-Trichloroethane	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
1,1,2-Trichloroethane	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
1,1-Dichloroethane	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
1,1-Dichloroethene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
1,2-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
1,2-Dichloroethane	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
1,3-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
1,4-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Acetone	ND (10.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Benzene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Carbon Tetrachloride	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
cis-1,2-Dichloroethene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Ethylbenzene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Methyl tert-Butyl Ether	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Methylene Chloride	ND (2.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Naphthalene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Tertiary-amyl methyl ether	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Tertiary-butyl Alcohol	ND (25.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Tetrachloroethene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Toluene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Trichloroethene	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Vinyl Chloride	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Xylene O	ND (1.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945
Xylene P,M	ND (2.0)		8260B		1	10/09/14 21:42	CXJ0142	CJ40945

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichloroethane-d4	*118 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*95 %*		*70-130*
Surrogate: Dibromofluoromethane	*114 %*		*70-130*
Surrogate: Toluene-d8	*102 %*		*70-130*

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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-9B
Date Sampled: 10/08/14 11:10
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 1
Extraction Method: 3520C

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-03
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 10/10/14 11:06

8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,4-Dioxane	**1.0** (0.2)		8270D		1	10/15/14 7:04	CXJ0187	CJ41006

	%Recovery	Qualifier	Limits
Surrogate: 1,4-Dioxane-d8	*72 %*		*15-115*

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BAL Laboratory
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CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-9B
Date Sampled: 10/08/14 11:10
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 0.25
Extraction Method: 3510C

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-03
Sample Matrix: Ground Water
Units: ug/L
Analyst: VSC
Prepared: 10/9/14 15:17

8270C(SIM) Polynuclear Aromatic Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Acenaphthene	**4.33** (0.19)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Acenaphthylene	ND (0.19)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Anthracene	**0.89** (0.19)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Benzo(a)anthracene	**0.29** (0.05)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Benzo(a)pyrene	**0.20** (0.05)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Benzo(b)fluoranthene	**0.24** (0.05)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Benzo(g,h,i)perylene	ND (0.19)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Benzo(k)fluoranthene	**0.07** (0.05)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
bis(2-Ethylhexyl)phthalate	ND (2.34)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Butylbenzylphthalate	ND (2.34)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Chrysene	**0.30** (0.05)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Dibenzo(a,h)Anthracene	ND (0.05)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Diethylphthalate	ND (2.34)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Dimethylphthalate	ND (2.34)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Di-n-butylphthalate	ND (2.34)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Di-n-octylphthalate	ND (2.34)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Fluoranthene	**2.10** (0.19)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Fluorene	**4.31** (0.19)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Indeno(1,2,3-cd)Pyrene	**0.13** (0.05)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Naphthalene	ND (0.19)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Pentachlorophenol	ND (0.84)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Phenanthrene	**2.23** (0.19)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911
Pyrene	**1.53** (0.19)		8270D SIM		1	10/14/14 22:58	CXJ0175	CJ40911

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichlorobenzene-d4	*38 %*		*30-130*
Surrogate: 2,4,6-Tribromophenol	*37 %*		*15-110*
Surrogate: 2-Fluorobiphenyl	*41 %*		*30-130*
Surrogate: Nitrobenzene-d5	*55 %*		*30-130*
Surrogate: p-Terphenyl-d14	*48 %*		*30-130*

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-9B
Date Sampled: 10/08/14 11:10
Percent Solids: N/A

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-03
Sample Matrix: Ground Water

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Chloride	**820** (100)		300.0		200	JLK	10/15/14 19:06	mg/L	CJ41517
Hexavalent Chromium	ND (10)		7196A		1	EEM	10/08/14 16:55	ug/L	CJ40841
Phenols	ND (100)		420.1		1	JLK	10/15/14 15:42	ug/L	CJ41514
Total Cyanide (LL)	ND (5.0)		4500 CN CE		1	EEM	10/14/14 9:30	ug/L	CJ41417
Total Petroleum Hydrocarbon	ND (5)		1664A		1	CRR	10/16/14 0:00	mg/L	CJ41431
Total Residual Chlorine	ND (10)		4500-Cl E		1	EEM	10/08/14 17:00	ug/L	CJ40840
Total Suspended Solids	**28** (5)		2540D		1	EEM	10/10/14 16:10	mg/L	CJ41011

ESS Laboratory
Division of Thielsch Engineering, Inc.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: U-9B
Date Sampled: 10/08/14 11:10
Percent Solids: N/A
Initial Volume: 35
Final Volume: 2
Extraction Method: 504/8011

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-03
Sample Matrix: Ground Water
Units: ug/L
Analyst: JXS
Prepared: 10/11/14 12:30

8011 1,2-Dibromoethane / 1,2-Dibromo-3-chloropropane

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
1,2-Dibromoethane	ND (0.015)		8011		1	JXS	10/11/14 14:59		CJ41101

	%Recovery	Qualifier	Limits
Surrogate: Pentachloroethane	*108 %*		*30-150*

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application
Client Sample ID: Trip Blank
Date Sampled: 10/08/14 00:00
Percent Solids: N/A
Initial Volume: 5
Final Volume: 5
Extraction Method: 5030B

ESS Laboratory Work Order: 1410211
ESS Laboratory Sample ID: 1410211-04
Sample Matrix: Aqueous
Units: ug/L
Analyst: MD

8260B Volatile Organic Compounds

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1-Trichloroethane	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
1,1,2-Trichloroethane	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
1,1-Dichloroethane	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
1,1-Dichloroethene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
1,2-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
1,2-Dichloroethane	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
1,3-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
1,4-Dichlorobenzene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Acetone	ND (10.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Benzene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Carbon Tetrachloride	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
cis-1,2-Dichloroethene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Ethylbenzene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Methyl tert-Butyl Ether	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Methylene Chloride	ND (2.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Naphthalene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Tertiary-amyl methyl ether	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Tertiary-butyl Alcohol	ND (25.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Tetrachloroethene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Toluene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Trichloroethene	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Vinyl Chloride	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Xylene O	ND (1.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945
Xylene P,M	ND (2.0)		8260B		1	10/09/14 17:04	CXJ0142	CJ40945

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichloroethane-d4	*110 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*93 %*		*70-130*
Surrogate: Dibromofluoromethane	*109 %*		*70-130*
Surrogate: Toluene-d8	*101 %*		*70-130*

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application

ESS Laboratory Work Order: 1410211

Quality Control Data

Total Metals

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch CJ40927 - 3005A/200.7										
Blank										
Antimony	ND	2.5	ug/L							
Cadmium	ND	2.5	ug/L							
Chromium	ND	10	ug/L							
Copper	ND	5.00	ug/L							
Iron	ND	50.0	ug/L							
Lead	ND	10	ug/L							
Nickel	ND	5	ug/L							
Selenium	ND	5.0	ug/L							
Zinc	ND	25	ug/L							
Blank										
Arsenic	ND	5.0	ug/L							
LCS										
Antimony	233	50.0	ug/L	250.0		93	80-120			
Arsenic	270	50.0	ug/L	250.0		108	80-120			
Cadmium	117	2.5	ug/L	125.0		94	80-120			
Chromium	241	10	ug/L	250.0		97	80-120			
Copper	242	5.00	ug/L	250.0		97	80-120			
Iron	1260	50.0	ug/L	1250		101	80-120			
Lead	249	10	ug/L	250.0		100	80-120			
Nickel	244	5	ug/L	250.0		98	80-120			
Selenium	502	100	ug/L	500.0		100	80-120			
Zinc	247	25	ug/L	250.0		99	80-120			
LCS Dup										
Antimony	235	50.0	ug/L	250.0		94	80-120	0.8	20	
Arsenic	281	50.0	ug/L	250.0		113	80-120	4	20	
Cadmium	119	2.5	ug/L	125.0		95	80-120	1	20	
Chromium	244	10	ug/L	250.0		98	80-120	1	20	
Copper	243	5.00	ug/L	250.0		97	80-120	0.4	20	
Iron	1260	50.0	ug/L	1250		101	80-120	0.4	20	
Lead	247	10	ug/L	250.0		99	80-120	0.5	20	
Nickel	246	5	ug/L	250.0		98	80-120	0.8	20	
Selenium	503	100	ug/L	500.0		101	80-120	0.2	20	
Zinc	244	25	ug/L	250.0		98	80-120	1	20	
Batch CJ40933 - 245.1/7470A										
Blank										
Mercury	ND	0.20	ug/L							
LCS										
Mercury	5.80	0.20	ug/L	6.000		97	80-120			
LCS Dup										
Mercury	5.81	0.20	ug/L	6.000		97	80-120	0.04	20	
Batch CJ41607 - 3005A/200.7										
Blank										

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application

ESS Laboratory Work Order: 1410211

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch CJ41607 - 3005A/200.7										
Cadmium	ND	0.05	ug/L							
Copper	ND	4.00	ug/L							
Lead	3.9	1.0	ug/L							
Silver	ND	0.2	ug/L							
LCS										
Cadmium	131	62.5	ug/L	125.0		105	80-120			
Lead	226	50.0	ug/L	250.0		91	80-120			
Silver	98.0	50.0	ug/L	125.0		78	80-120			B-
LCS Dup										
Cadmium	127	62.5	ug/L	125.0		102	80-120	3	20	
Lead	200	50.0	ug/L	250.0		80	80-120	12	20	
Silver	94.5	50.0	ug/L	125.0		76	80-120	4	20	B-
8082A Polychlorinated Biphenyls (PCB)										
Batch CJ40913 - 3510C										
Blank										
Aroclor 1016	ND	0.10	ug/L							
Aroclor 1221	ND	0.10	ug/L							
Aroclor 1232	ND	0.10	ug/L							
Aroclor 1242	ND	0.10	ug/L							
Aroclor 1248	ND	0.10	ug/L							
Aroclor 1254	ND	0.10	ug/L							
Aroclor 1260	ND	0.10	ug/L							
Aroclor 1262	ND	0.10	ug/L							
Aroclor 1268	ND	0.10	ug/L							
Surrogate: Decachlorobiphenyl	*0.0433*		ug/L	*0.05000*		*87*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0423*		ug/L	*0.05000*		*85*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0269*		ug/L	*0.05000*		*54*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0283*		ug/L	*0.05000*		*57*	*30-150*			
LCS										
Aroclor 1016	0.74	0.10	ug/L	1.000		74	40-140			
Aroclor 1260	0.79	0.10	ug/L	1.000		79	40-140			
Surrogate: Decachlorobiphenyl	*0.0394*		ug/L	*0.05000*		*79*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0413*		ug/L	*0.05000*		*83*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0266*		ug/L	*0.05000*		*53*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0275*		ug/L	*0.05000*		*55*	*30-150*			
LCS Dup										
Aroclor 1016	0.70	0.10	ug/L	1.000		70	40-140	5	20	
Aroclor 1260	0.71	0.10	ug/L	1.000		71	40-140	11	20	
Surrogate: Decachlorobiphenyl	*0.0354*		ug/L	*0.05000*		*71*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0357*		ug/L	*0.05000*		*71*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0259*		ug/L	*0.05000*		*52*	*30-150*			

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application

ESS Laboratory Work Order: 1410211

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8082A Polychlorinated Biphenyls (PCB)										
Batch CJ40913 - 3510C										
Surrogate: Tetrachloro-m-xylene [2C]	***0.0260***		ug/L	***0.05000***		***52***	***30-150***			
Batch CJ41522 - 3510C										
Blank										
Aroclor 1016	ND	0.10	ug/L							
Aroclor 1221	ND	0.10	ug/L							
Aroclor 1232	ND	0.10	ug/L							
Aroclor 1242	ND	0.10	ug/L							
Aroclor 1248	ND	0.10	ug/L							
Aroclor 1254	ND	0.10	ug/L							
Aroclor 1260	ND	0.10	ug/L							
Aroclor 1262	ND	0.10	ug/L							
Aroclor 1268	ND	0.10	ug/L							
Surrogate: Decachlorobiphenyl	***0.0432***		ug/L	***0.05000***		***86***	***30-150***			
Surrogate: Decachlorobiphenyl [2C]	***0.0437***		ug/L	***0.05000***		***87***	***30-150***			
Surrogate: Tetrachloro-m-xylene	***0.0266***		ug/L	***0.05000***		***53***	***30-150***			
Surrogate: Tetrachloro-m-xylene [2C]	***0.0289***		ug/L	***0.05000***		***58***	***30-150***			
LCS										
Aroclor 1016	0.83	0.10	ug/L	1.000		83	40-140			
Aroclor 1260	0.91	0.10	ug/L	1.000		91	40-140			
Surrogate: Decachlorobiphenyl	***0.0439***		ug/L	***0.05000***		***88***	***30-150***			
Surrogate: Decachlorobiphenyl [2C]	***0.0442***		ug/L	***0.05000***		***88***	***30-150***			
Surrogate: Tetrachloro-m-xylene	***0.0303***		ug/L	***0.05000***		***61***	***30-150***			
Surrogate: Tetrachloro-m-xylene [2C]	***0.0305***		ug/L	***0.05000***		***61***	***30-150***			
LCS Dup										
Aroclor 1016	0.81	0.10	ug/L	1.000		81	40-140	2	20	
Aroclor 1260	0.86	0.10	ug/L	1.000		86	40-140	6	20	
Surrogate: Decachlorobiphenyl	***0.0401***		ug/L	***0.05000***		***80***	***30-150***			
Surrogate: Decachlorobiphenyl [2C]	***0.0400***		ug/L	***0.05000***		***80***	***30-150***			
Surrogate: Tetrachloro-m-xylene	***0.0302***		ug/L	***0.05000***		***60***	***30-150***			
Surrogate: Tetrachloro-m-xylene [2C]	***0.0303***		ug/L	***0.05000***		***61***	***30-150***			
8260B Volatile Organic Compounds										
Batch CJ40945 - 5030B										
Blank										
1,1,1-Trichloroethane	ND	1.0	ug/L							
1,1,2-Trichloroethane	ND	1.0	ug/L							
1,1-Dichloroethane	ND	1.0	ug/L							
1,1-Dichloroethene	ND	1.0	ug/L							
1,2-Dichlorobenzene	ND	1.0	ug/L							
1,2-Dichloroethane	ND	1.0	ug/L							
1,3-Dichlorobenzene	ND	1.0	ug/L							

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application ESS Laboratory Work Order: 1410211

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8260B Volatile Organic Compounds										
Batch CJ40945 - 5030B										
1,4-Dichlorobenzene	ND	1.0	ug/L							
Acetone	ND	10.0	ug/L							
Benzene	ND	1.0	ug/L							
Carbon Tetrachloride	ND	1.0	ug/L							
cis-1,2-Dichloroethene	ND	1.0	ug/L							
Ethylbenzene	ND	1.0	ug/L							
Methyl tert-Butyl Ether	ND	1.0	ug/L							
Methylene Chloride	ND	2.0	ug/L							
Naphthalene	ND	1.0	ug/L							
Tertiary-amyl methyl ether	ND	1.0	ug/L							
Tertiary-butyl Alcohol	ND	25.0	ug/L							
Tetrachloroethene	ND	1.0	ug/L							
Toluene	ND	1.0	ug/L							
Trichloroethene	ND	1.0	ug/L							
Vinyl Chloride	ND	1.0	ug/L							
Xylene O	ND	1.0	ug/L							
Xylene P,M	ND	2.0	ug/L							
Surrogate: 1,2-Dichloroethane-d4	***27.3***		ug/L	***25.00***		***109***	***70-130***			
Surrogate: 4-Bromofluorobenzene	***23.2***		ug/L	***25.00***		***93***	***70-130***			
Surrogate: Dibromofluoromethane	***26.7***		ug/L	***25.00***		***107***	***70-130***			
Surrogate: Toluene-d8	***24.8***		ug/L	***25.00***		***99***	***70-130***			
LCS										
1,1,1-Trichloroethane	10.5		ug/L	10.00		105	70-130			
1,1,2-Trichloroethane	10.0		ug/L	10.00		100	70-130			
1,1-Dichloroethane	9.9		ug/L	10.00		99	70-130			
1,1-Dichloroethene	10.0		ug/L	10.00		100	70-130			
1,2-Dichlorobenzene	10.0		ug/L	10.00		100	70-130			
1,2-Dichloroethane	10.0		ug/L	10.00		100	70-130			
1,3-Dichlorobenzene	10.1		ug/L	10.00		101	70-130			
1,4-Dichlorobenzene	10.2		ug/L	10.00		102	70-130			
Acetone	42.7		ug/L	50.00		85	70-130			
Benzene	10.3		ug/L	10.00		103	70-130			
Carbon Tetrachloride	9.5		ug/L	10.00		95	70-130			
cis-1,2-Dichloroethene	10.2		ug/L	10.00		102	70-130			
Ethylbenzene	10.6		ug/L	10.00		106	70-130			
Methyl tert-Butyl Ether	9.8		ug/L	10.00		98	70-130			
Methylene Chloride	10.1		ug/L	10.00		101	70-130			
Naphthalene	9.0		ug/L	10.00		90	70-130			
Tertiary-amyl methyl ether	9.6		ug/L	10.00		96	70-130			
Tertiary-butyl Alcohol	50.8		ug/L	50.00		102	70-130			
Tetrachloroethene	10.2		ug/L	10.00		102	70-130			
Toluene	10.8		ug/L	10.00		108	70-130			
Trichloroethene	9.8		ug/L	10.00		98	70-130			
Vinyl Chloride	11.0		ug/L	10.00		110	70-130			
Xylene O	10.7		ug/L	10.00		107	70-130			

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application

ESS Laboratory Work Order: 1410211

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8260B Volatile Organic Compounds										
Batch CJ40945 - 5030B										
Xylene P,M	21.5		ug/L	20.00		108	70-130			
Surrogate: 1,2-Dichloroethane-d4	***24.1***		ug/L	***25.00***		***96***	***70-130***			
Surrogate: 4-Bromofluorobenzene	***22.0***		ug/L	***25.00***		***88***	***70-130***			
Surrogate: Dibromofluoromethane	***24.7***		ug/L	***25.00***		***99***	***70-130***			
Surrogate: Toluene-d8	***24.2***		ug/L	***25.00***		***97***	***70-130***			
LCS Dup										
1,1,1-Trichloroethane	10.6		ug/L	10.00		106	70-130	0.9	25	
1,1,2-Trichloroethane	10.0		ug/L	10.00		100	70-130	0.8	25	
1,1-Dichloroethane	10.0		ug/L	10.00		100	70-130	0.7	25	
1,1-Dichloroethene	10.2		ug/L	10.00		102	70-130	2	25	
1,2-Dichlorobenzene	10.0		ug/L	10.00		100	70-130	0.1	25	
1,2-Dichloroethane	10.0		ug/L	10.00		100	70-130	0.7	25	
1,3-Dichlorobenzene	10.0		ug/L	10.00		100	70-130	1	25	
1,4-Dichlorobenzene	10.1		ug/L	10.00		101	70-130	1	25	
Acetone	43.5		ug/L	50.00		87	70-130	2	25	
Benzene	10.4		ug/L	10.00		104	70-130	1	25	
Carbon Tetrachloride	9.6		ug/L	10.00		96	70-130	1	25	
cis-1,2-Dichloroethene	10.3		ug/L	10.00		103	70-130	2	25	
Ethylbenzene	10.6		ug/L	10.00		106	70-130	0	25	
Methyl tert-Butyl Ether	10.0		ug/L	10.00		100	70-130	2	25	
Methylene Chloride	10.2		ug/L	10.00		102	70-130	1	25	
Naphthalene	9.2		ug/L	10.00		92	70-130	2	25	
Tertiary-amyl methyl ether	9.4		ug/L	10.00		94	70-130	2	25	
Tertiary-butyl Alcohol	50.7		ug/L	50.00		101	70-130	0.1	25	
Tetrachloroethene	10.0		ug/L	10.00		100	70-130	2	25	
Toluene	10.7		ug/L	10.00		107	70-130	0.6	25	
Trichloroethene	10.0		ug/L	10.00		100	70-130	1	25	
Vinyl Chloride	11.2		ug/L	10.00		112	70-130	1	25	
Xylene O	10.4		ug/L	10.00		104	70-130	3	25	
Xylene P,M	21.0		ug/L	20.00		105	70-130	2	25	
Surrogate: 1,2-Dichloroethane-d4	***25.0***		ug/L	***25.00***		***100***	***70-130***			
Surrogate: 4-Bromofluorobenzene	***22.6***		ug/L	***25.00***		***91***	***70-130***			
Surrogate: Dibromofluoromethane	***25.8***		ug/L	***25.00***		***103***	***70-130***			
Surrogate: Toluene-d8	***24.6***		ug/L	***25.00***		***98***	***70-130***			
8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution										
Batch CJ41006 - 3520C										
Blank										
1,4-Dioxane	ND	0.2	ug/L							
Surrogate: 1,4-Dioxane-d8	***3.24***		ug/L	***5.000***		***65***	***15-115***			
LCS										
1,4-Dioxane	6.8	0.2	ug/L	10.00		68	40-140			
Surrogate: 1,4-Dioxane-d8	***4.29***		ug/L	***5.000***		***86***	***15-115***			
LCS Dup										

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application ESS Laboratory Work Order: 1410211

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270D(SIM) Semi-Volatile Organic Compounds w/ Isotope Dilution										
Batch CJ41006 - 3520C										
1,4-Dioxane	6.2	0.2	ug/L	10.00		62	40-140	9	20	
Surrogate: 1,4-Dioxane-d8	***4.39***		ug/L	***5.000***		***88***	***15-115***			
8270C(SIM) Polynuclear Aromatic Hydrocarbons										
Batch CJ40911 - 3510C										
Blank										
Acenaphthene	ND	0.20	ug/L							
Acenaphthylene	ND	0.20	ug/L							
Anthracene	ND	0.20	ug/L							
Benzo(a)anthracene	ND	0.05	ug/L							
Benzo(a)pyrene	ND	0.05	ug/L							
Benzo(b)fluoranthene	ND	0.05	ug/L							
Benzo(g,h,i)perylene	ND	0.20	ug/L							
Benzo(k)fluoranthene	ND	0.05	ug/L							
bis(2-Ethylhexyl)phthalate	ND	2.50	ug/L							
Butylbenzylphthalate	ND	2.50	ug/L							
Chrysene	ND	0.05	ug/L							
Dibenzo(a,h)Anthracene	ND	0.05	ug/L							
Diethylphthalate	ND	2.50	ug/L							
Dimethylphthalate	ND	2.50	ug/L							
Di-n-butylphthalate	ND	2.50	ug/L							
Di-n-octylphthalate	ND	2.50	ug/L							
Fluoranthene	ND	0.20	ug/L							
Fluorene	ND	0.20	ug/L							
Indeno(1,2,3-cd)Pyrene	ND	0.05	ug/L							
Naphthalene	ND	0.20	ug/L							
Pentachlorophenol	ND	0.90	ug/L							
Phenanthrene	ND	0.20	ug/L							
Pyrene	ND	0.20	ug/L							
Surrogate: 1,2-Dichlorobenzene-d4	***1.04***		ug/L	***2.500***		***42***	***30-130***			
Surrogate: 2,4,6-Tribromophenol	***1.66***		ug/L	***3.750***		***44***	***15-110***			
Surrogate: 2-Fluorobiphenyl	***1.29***		ug/L	***2.500***		***52***	***30-130***			
Surrogate: Nitrobenzene-d5	***1.88***		ug/L	***2.500***		***75***	***30-130***			
Surrogate: p-Terphenyl-d14	***1.65***		ug/L	***2.500***		***66***	***30-130***			
LCS										
Acenaphthene	2.28	0.20	ug/L	4.000		57	40-140			
Acenaphthylene	2.36	0.20	ug/L	4.000		59	40-140			
Anthracene	2.67	0.20	ug/L	4.000		67	40-140			
Benzo(a)anthracene	2.50	0.05	ug/L	4.000		63	40-140			
Benzo(a)pyrene	2.75	0.05	ug/L	4.000		69	40-140			
Benzo(b)fluoranthene	2.74	0.05	ug/L	4.000		68	40-140			
Benzo(g,h,i)perylene	2.76	0.20	ug/L	4.000		69	40-140			
Benzo(k)fluoranthene	2.42	0.05	ug/L	4.000		61	40-140			
bis(2-Ethylhexyl)phthalate	4.00	2.50	ug/L	4.000		100	40-140			
Butylbenzylphthalate	3.23	2.50	ug/L	4.000		81	40-140			

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application

ESS Laboratory Work Order: 1410211

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270C(SIM) Polynuclear Aromatic Hydrocarbons										
Batch CJ40911 - 3510C										
Chrysene	2.72	0.05	ug/L	4.000		68	40-140			
Dibenzo(a,h)Anthracene	2.85	0.05	ug/L	4.000		71	40-140			
Diethylphthalate	2.75	2.50	ug/L	4.000		69	40-140			
Dimethylphthalate	2.62	2.50	ug/L	4.000		66	40-140			
Di-n-butylphthalate	2.70	2.50	ug/L	4.000		67	40-140			
Di-n-octylphthalate	3.21	2.50	ug/L	4.000		80	40-140			
Fluoranthene	2.63	0.20	ug/L	4.000		66	40-140			
Fluorene	2.55	0.20	ug/L	4.000		64	40-140			
Indeno(1,2,3-cd)Pyrene	2.89	0.05	ug/L	4.000		72	40-140			
Naphthalene	2.02	0.20	ug/L	4.000		50	40-140			
Pentachlorophenol	2.26	0.90	ug/L	4.000		56	30-130			
Phenanthrene	2.63	0.20	ug/L	4.000		66	40-140			
Pyrene	2.60	0.20	ug/L	4.000		65	40-140			
Surrogate: 1,2-Dichlorobenzene-d4	***1.28***		ug/L	***2.500***		***51***	***30-130***			
Surrogate: 2,4,6-Tribromophenol	***1.94***		ug/L	***3.750***		***52***	***15-110***			
Surrogate: 2-Fluorobiphenyl	***1.49***		ug/L	***2.500***		***59***	***30-130***			
Surrogate: Nitrobenzene-d5	***1.99***		ug/L	***2.500***		***80***	***30-130***			
Surrogate: p-Terphenyl-d14	***1.73***		ug/L	***2.500***		***69***	***30-130***			
LCS Dup										
Acenaphthene	2.31	0.20	ug/L	4.000		58	40-140	1	20	
Acenaphthylene	2.41	0.20	ug/L	4.000		60	40-140	2	20	
Anthracene	2.69	0.20	ug/L	4.000		67	40-140	0.7	20	
Benzo(a)anthracene	2.54	0.05	ug/L	4.000		64	40-140	2	20	
Benzo(a)pyrene	2.76	0.05	ug/L	4.000		69	40-140	0.6	20	
Benzo(b)fluoranthene	2.73	0.05	ug/L	4.000		68	40-140	0.02	20	
Benzo(g,h,i)perylene	2.82	0.20	ug/L	4.000		70	40-140	2	20	
Benzo(k)fluoranthene	2.41	0.05	ug/L	4.000		60	40-140	0.6	20	
bis(2-Ethylhexyl)phthalate	4.54	2.50	ug/L	4.000		113	40-140	12	20	
Butylbenzylphthalate	3.23	2.50	ug/L	4.000		81	40-140	0.001	20	
Chrysene	2.66	0.05	ug/L	4.000		67	40-140	2	20	
Dibenzo(a,h)Anthracene	2.91	0.05	ug/L	4.000		73	40-140	2	20	
Diethylphthalate	2.76	2.50	ug/L	4.000		69	40-140	0.4	20	
Dimethylphthalate	2.63	2.50	ug/L	4.000		66	40-140	0.3	20	
Di-n-butylphthalate	2.77	2.50	ug/L	4.000		69	40-140	3	20	
Di-n-octylphthalate	3.13	2.50	ug/L	4.000		78	40-140	2	20	
Fluoranthene	2.61	0.20	ug/L	4.000		65	40-140	0.7	20	
Fluorene	2.57	0.20	ug/L	4.000		64	40-140	0.7	20	
Indeno(1,2,3-cd)Pyrene	2.92	0.05	ug/L	4.000		73	40-140	0.9	20	
Naphthalene	1.93	0.20	ug/L	4.000		48	40-140	5	20	
Pentachlorophenol	2.22	0.90	ug/L	4.000		56	30-130	2	20	
Phenanthrene	2.60	0.20	ug/L	4.000		65	40-140	1	20	
Pyrene	2.62	0.20	ug/L	4.000		65	40-140	0.8	20	
Surrogate: 1,2-Dichlorobenzene-d4	***1.12***		ug/L	***2.500***		***45***	***30-130***			
Surrogate: 2,4,6-Tribromophenol	***1.89***		ug/L	***3.750***		***50***	***15-110***			
Surrogate: 2-Fluorobiphenyl	***1.52***		ug/L	***2.500***		***61***	***30-130***			

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application ESS Laboratory Work Order: 1410211

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8270C(SIM) Polynuclear Aromatic Hydrocarbons										
Batch CJ40911 - 3510C										
Surrogate: Nitrobenzene-d5	*1.83*		ug/L	*2.500*		*73*	*30-130*			
Surrogate: p-Terphenyl-d14	*1.84*		ug/L	*2.500*		*74*	*30-130*			
Classical Chemistry										
Batch CJ40840 - General Preparation										
Blank										
Total Residual Chlorine	ND	10	ug/L							
LCS										
Total Residual Chlorine	2		mg/L	2.250		100	85-115			
Batch CJ40841 - General Preparation										
Blank										
Hexavalent Chromium	ND	10	ug/L							
LCS										
Hexavalent Chromium	0.5		mg/L	0.4998		99	90-110			
LCS Dup										
Hexavalent Chromium	0.5		mg/L	0.4998		100	90-110	0.3	20	
Batch CJ41011 - General Preparation										
Blank										
Total Suspended Solids	ND	5	mg/L							
LCS										
Total Suspended Solids	68		mg/L	68.80		99	80-120			
Batch CJ41417 - TCN Prep										
Blank										
Total Cyanide (LL)	ND	5.0	ug/L							
LCS										
Total Cyanide (LL)	20.0	5.0	ug/L	20.06		100	90-110			
LCS										
Total Cyanide (LL)	148	5.0	ug/L	150.4		99	90-110			
LCS Dup										
Total Cyanide (LL)	149	5.0	ug/L	150.4		99	90-110	0.6	20	
Batch CJ41431 - General Preparation										
Blank										
Total Petroleum Hydrocarbon	ND	5	mg/L							
LCS										
Total Petroleum Hydrocarbon	13	5	mg/L	19.38		69	66-114			
Batch CJ41514 - General Preparation										
Blank										
Phenols	ND	100	ug/L							
LCS										

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application

ESS Laboratory Work Order: 1410211

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch CJ41514 - General Preparation										
Phenols	98	100	ug/L	100.0		98	80-120			
LCS										
Phenols	995	100	ug/L	1000		100	80-120			
Batch CJ41517 - General Preparation										
Blank										
Chloride	ND	0.5	mg/L							
LCS										
Chloride	2.6		mg/L	2.500		106	90-110			
Batch CJ41623 - General Preparation										
Blank										
Chloride	ND	0.5	mg/L							
LCS										
Chloride	2.6		mg/L	2.500		104	90-110			
8011 1,2-Dibromoethane / 1,2-Dibromo-3-chloropropane										
Batch CJ41101 - 504/8011										
Blank										
1,2-Dibromoethane	ND	0.015	ug/L							
Surrogate: Pentachloroethane	*0.198*		ug/L	*0.2000*		*99*	*30-150*			
LCS										
1,2-Dibromoethane	0.170	0.015	ug/L	0.2000		85	60-140			
Surrogate: Pentachloroethane	*0.179*		ug/L	*0.2000*		*90*	*30-150*			
LCS										
1,2-Dibromoethane	0.069	0.015	ug/L	0.08000		86	60-140			
Surrogate: Pentachloroethane	*0.0621*		ug/L	*0.08000*		*78*	*30-150*			
Batch CJ41608 - 504/8011										
Blank										
1,2-Dibromoethane	ND	0.015	ug/L							
Surrogate: Pentachloroethane	*0.187*		ug/L	*0.2000*		*94*	*30-150*			
LCS										
1,2-Dibromoethane	0.252	0.015	ug/L	0.2000		126	60-140			
Surrogate: Pentachloroethane	*0.208*		ug/L	*0.2000*		*104*	*30-150*			
LCS										
1,2-Dibromoethane	0.091	0.015	ug/L	0.08000		113	60-140			
Surrogate: Pentachloroethane	*0.0920*		ug/L	*0.08000*		*115*	*30-150*			

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application ESS Laboratory Work Order: 1410211

Notes and Definitions

U	Analyte included in the analysis, but not detected
HT	The maximum holding time listed in 40 CFR Part 136 Table II for pH, Dissolved Oxygen, Sulfite and Residual Chlorine is fifteen minutes.
EL	Elevated Method Reporting Limits due to sample matrix (EL).
D	Diluted.
C+	Continuing Calibration recovery is above upper control limit (C+).
B-	Blank Spike recovery is below lower control limit (B-).
B	Present in Method Blank (B).
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: UMASS - Boston NOI Application

ESS Laboratory Work Order: 1410211

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP)
A2LA Accredited: Testing Cert# 2864.01
http://www.a2la.org/scopepdf/2864-01.pdf

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI0002
http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/documents/AllLabs.xls

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.depweb.state.pa.us/portal/server.pt/community/labs/13780/laboratory_accreditation_program/590095

CHEMISTRY

A2LA Accredited: Testing Cert # 2864.01
Lead in Paint, Phthalates, Lead in Children's Metals Products (Including Jewelry)
http://www.A2LA.org/dirsearchnew/newsearch.cfm

CPSC ID# 1141
Lead Paint, Lead in Children's Metals Jewelry
http://www.cpsc.gov/cgi-bin/labapplist.aspx

Sample and Cooler Receipt Checklist

Client: GZA GeoEnvironmental, Inc.
Client Project ID: _____
Shipped/Delivered Via: Client

ESS Project ID: 14100211
Date Project Due: ~~10/15/2014~~ 10/16/14 MB 10/8/14
Days For Project: 5 Day

Items to be checked upon receipt:

1. Air Bill Manifest Present?	* No	10. Are the samples properly preserved?	Yes
Air No.:		11. Proper sample containers used?	Yes
2. Were Custody Seals Present?	No	12. Any air bubbles in the VOA vials?	* Yes MB 10/8/14
3. Were Custody Seals Intact?	N/A	13. Holding times exceeded?	No
4. Is Radiation count < 100 CPM?	Yes	14. Sufficient sample volumes?	Yes
5. Is a cooler present?	Yes	15. Any Subcontracting needed?	No
Cooler Temp: **13.1** 5.9, 3, 6 MB 10/8/14		16. Are ESS labels on correct containers?	Yes No
Iced With: **Ice**		17. Were samples received intact?	Yes No
6. Was COC included with samples?	Yes	ESS Sample IDs: _____	
7. Was COC signed and dated by client?	Yes	Sub Lab: _____	
8. Does the COC match the sample	Yes	Analysis: _____	
9. Is COC complete and correct?	Yes	TAT: _____	

WC 10/8/14

18. Was there need to call project manager to discuss status? If yes, please explain Trip Blank has An bubble
Sample #1 came from cooler w/ 13.1°, Sample 2 came from cooler w/ 5.9°
Sample #3 came from cooler w/ 3.6°. Hexachrome samples split off and MB 10/8/14
Presented in lab @ 1537 MB 10/8/14

Who was called?: _____ By whom? _____

Sample Number	Properly Preserved	Container Type	# of Containers	Preservative
1	Yes	1 L Glass	3	H2SO4
1	Yes	1 L Glass	6	NP
1	Yes	1 L Plastic	1	NP
1	Yes	250 ml Plastic	1	HNO3
1	Yes	250 ml Plastic	1	NaOH pH=11 @ 1530 MB 10/8/14
1	Yes	250 ml Plastic	1	NP
1	Yes	40 ml - VOA	6	HCL
1	Yes	500 ml Plastic	1	HNO3
2	Yes	1 L Glass	4	H2SO4
2	Yes	1 L Glass	5	NP
2	Yes	1 L Plastic	1	NP
2	Yes	250 ml Plastic	1	HNO3
2	Yes	250 ml Plastic	1	NaOH pH=12 @ 1530 MB 10/8/14
2	Yes	250 ml Plastic	1	NP
2	Yes	40 ml - VOA	6	HCL
2	Yes	500 ml Plastic	1	HNO3
3	Yes	1 L Glass	3	H2SO4
3	Yes	1 L Glass	6	NP
3	Yes	1 L Plastic	1	NP
3	Yes	250 ml Plastic	1	HNO3
3	Yes	250 ml Plastic	1	NaOH pH=10 @ 1530 MB 10/8/14
3	Yes	250 ml Plastic	1	NP
3	Yes	40 ml - VOA	6	HCL
3	Yes	500 ml Plastic	1	HNO3
4	Yes	40 ml - VOA	2	HCL

Sample and Cooler Receipt Checklist

Client: GZA GeoEnvironmental, Inc.

ESS Project ID: 14100211

Completed By: _____ Date/Time: 10/8/14 1545

Reviewed By: _____ Date/Time: 10/8/14 1550

ESS Laboratory

Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston, RI 02910-2211
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS LAB PROJECT ID: 1410211

Turn Time: ✓ Standard Rush ____ Approved By: ____

Reporting Limits -

State where samples were collected: (MA) NH RI

Is this project for: **RGP**

Electonic Deliverable: Yes ✓ No ____
Format: Excel ✓ Access ____ PDF ✓ Other ____

GZA Project Manager: Jason Ressler
GZA GeoEnvironmental, Inc.
Address: 530 Broadway, Providence, RI

Project # 33930.02
Project Name: U-Mass Boston
Contract Pricing ____
Special Pricing WO#: ____

ESS Lab Sample ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample Identification	# of Containers	RGP Metals	Chloride 300.0	Total Cyanide 4500 LL	TPH 1664	TSS 2540D	TRC 4500-CL E	Total Phenols 420.1	Tri Cr (Calc. MUST run T. Cr)	Hex Cr 7196A	RGP VOC Long List 8260	1,4-Dioxane 8270	EDB 8011	RGP SVOC Log List 8270-SIM	PCB 8082 LL	Comment #
1	10/8/14	8:30	G	GW	U-6	18/9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	1,2
2	↓	9:25	G	GW	U-108	18/9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	↓	11:10	G	GW	U-9B	18/9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4					Trip Blank MW 10/8/14																
							4	1	5	3	1	1	3	-	1	2	1	2	1	1	
							P	P	P	AG	P	P	AG	-	P	V	AG	V	AG	AG	

PAH SIM

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-____

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present: X Yes ____ No

Seals Intact: ____ Yes ____ No NA: X

Cooler Temperature: 3.6° 5.9° 13.1° RUR MS 10/8/14

Sampled by: Ryan DaPonte

Comments: 1) RGP Metals include Sb, As, Cd, Cu, Fe, Pb, Ni, Se, Ag and Zn by 6010/6020/7010 and Hg by 7470A
2) Parameters in **BOLD** have Short hold-time
PERMIT ATTACHED

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	10/8/14 1320	10/8/14 1320			

Please E-mail all changes to Chain of Custody in writing.

Page ____ of ____