Site Investigation Report Addendum
Town of Tiverton
Tiverton, Rhode Island

Prepared for

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1. INTRODUCTION

This Site Investigation Report (SIR) Addendum has been prepared in accordance with Section 7.0 of the Rhode Island Department of Environmental Management (RIDEM) "Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases," or "Remediation Regulations" (March 1993, amended August 1996). EA Engineering, Science, and Technology, Inc. (EA) has prepared this addendum on behalf of the Town of Tiverton, Rhode Island to supplement the SIR prepared by EA in March 2003. The purpose of the addendum is to finish the characterization of fill material located beneath the Town-owned roadways between and including Bay Street, Bottom Street, Judson Street, and State Avenue. This addendum also includes an investigation of the Town-owned Bay View Recreation Area located on Hooper Street (Plat 8-6, Block 3, Lot 2).

Figure 1 is a site locus for the study area. Figure 2 is a site plan showing all boring locations in the Bay View Recreation Area. Figure 3 is a detailed site plan including all roadway soil boring locations. Appendix A includes the soil boring logs for the Bay View Recreation Area. Appendix B contains the Certificates of Analysis from the soil samples submitted from these Bay View Recreation Area soil borings. Appendix C is the letter from the Rhode Island Department of Health regarding the analytical results of the Bay View Recreation Area subsurface investigation. Appendix D includes the boring logs from the roadway investigation of State Avenue, A. Connell Street, Chace Avenue, Canonicus Street, Hooper Street, and Bottom Street. Appendix E contains the Certificates of Analysis from these roadway soil samples. Appendix F is the Soil Management Plan established for potential roadway excavations in the study area.

2. DESCRIPTION OF RELEASE, SITE CONDITIONS, AND RECEPTORS

A description of the release, site conditions, and surrounding receptors is provided below.

2.1 SITE DESCRIPTION

The study area is an approximately 46-acre parcel located within 0.25 mi of the Sakonnet River/ Mount Hope Bay in Tiverton, Rhode Island. Topography is characterized by a slight slope to the west. The study area is located at the foot of a steep hill to the east. There are no significant surface water bodies located within the study area, although there is a stream draining to Hooper Street from the east. Locations of subsurface investigation included the Bay View Recreation Area and the following Town of Tiverton public roadways: Hooper Street, Canonicus Street, Chace Avenue, Bottom Street, A. Connell Street, and State Avenue.

Surrounding land usage is predominantly residential, with commercial/residential usage to the north at Bay Street and State Avenue. Commercial businesses in this area include an auto repair facility and a fuel terminal. The Fall River Wastewater Treatment Facility is located less than 0.25 mi to the north on Bay Street. Inactive, former Conrail tracks run north-south along the entire length of the study area, approximately 50 ft to the west of Bay Street.

The depth to groundwater was found to be variable over the site. The direction of groundwater is assumed to be west by northwest based upon surface topography. No barriers to groundwater flow are known at the site. Soil at the site is characterized as urban fill overlying coastal sand deposits. Merrimac-Urban land complex and Udorthents-Urban land complex cover the site area, but the study area was expected to contain more urban fill, as all boring locations, with the exception of the Bay View Recreation Area, were on paved roadways. Bedrock at the site is characterized as Sachuest Arkose, a sandstone and conglomerate interbedded with phyllite.

2.2 SITE HISTORY

Information was gathered regarding the site history during a review of historical aerial photographs from 1939 to 1995 at the Rhode Island Statewide Planning Office. Land use in the area of Bay Street in North Tiverton was primarily agricultural in 1939, and residential development was already in place along Bay Street and its side streets, including those investigated during this site investigation phase. Hooper Street does not appear to be a formal, paved road in aerial photographs until the 1972 aerial photograph. By 1972, the land use had switched to predominantly agricultural, with the exception of land along Judson Street that remained open space, developed only with paths at this time. These lots were not developed until the 1992 aerial photograph, when the Bay View Recreation Area was also present.

According to the aerial photographs, the Inland Fuel Terminal has been present at 25 State Avenue since at least 1939. The two largest and southernmost tanks were constructed between 1951 and 1965, increasing the facility to its present capacity of 25 million gallons. The Conrail tracks were present in all of the historical aerial photographs reviewed, with significant

revegetation beginning prior to 1981. The Fall River Wastewater Treatment Facility was constructed between 1939 and 1951, with major tank additions occurring in 1981.

2.3 SURROUNDING RECEPTORS

The study area is bounded to the north by residential/commercial development, including the Fall River Wastewater Treatment Facility, to the east by residential development, to the south by an area of undeveloped land followed by residential development, and to the west by the Rhode Island Department of Transportation Rail right-of-way, followed by undeveloped land and the Mount Hope Bay. Although area groundwater is zoned as GA/GAA, defined as suitable for use as drinking water without treatment, all residences in the immediate vicinity of the site are served by Town water. There are no Wellhead Protection Areas located within 500 ft of the site.

2.4 DESCRIPTION OF RELEASE

During excavation of soils along Bay Street in August 2002 for the Mount Hope Bay Sewer Interceptor Project, contamination was discovered in the form of petroleum-impacted soils. The odor of petroleum and a sheen on groundwater were observed. Soils from this area were designated as unsuitable for backfill due to structural concerns and were transported to two temporary staging areas on Kaufman and Last Streets. A Notification of Release for these locations was filed with RIDEM on 2 October 2002, and an Emergency and Short-Term Response Action was completed to address these releases from September through November 2002.

A site investigation was conducted by EA between October 2002 and February 2003. The first stage of this investigation, in October 2002, was to install soil borings along the proposed path of the Mount Hope Bay Sewer Interceptor Project along Bay Street and Foote Street. Borings were also installed at 100 and 200 ft from the Bay Street intersection and Judson, Hooper, Canonicus, Hilton, and Chace Streets. This round of subsurface investigation discovered semi-volatile organic compounds (SVOCs), particularly polycyclic aromatic hydrocarbons (PAHs), and cyanide at levels exceeding both the RIDEM Residential and Industrial/Commercial Direct Exposure Criteria (RDEC and I/CDEC) at Judson-2, Bay-5, and Hilton-1 for several analytes. Figure 3 identifies all the subsurface investigation locations on the roadways.

A follow-up phase of the Site Investigation was conducted in November 2002 to try to locate the eastern extent of the subsurface contamination on Judson and Hilton Streets, as well as to investigate Chace Avenue, for which utilities were not marked for the first phase of the investigation. Three borings were advanced on Chace Avenue at 100-ft intervals from the Bay Street intersection. The first two indicated the presence of contamination through screening results, and the third was sent for laboratory analysis. No exceedances of the RIDEM RDEC were detected at Chace-3. Although no visual or olfactory evidence of contamination was observed at Hilton-2 (100 ft east of Hilton-1 from the previous phase), the RDEC was exceeded in soils at this location for benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene, all PAHs. Judson-8, advanced a total of 600 ft east of Judson-2, contained concentrations of benzo(a)pyrene and chrysene exceeding the RIDEM RDEC.

In December 2002, the site investigation was expanded to include the areas east of Hilton-2 and Judson-8 to find the extent of the contaminated material. Judson-9, 100 ft east of Judson-8, did not contain any analytes at concentrations exceeding the RIDEM RDEC. Borings were advanced east on Hilton Street and the soil screening results indicated the presence of the fill material extending to the intersection of Bottom Street. A soil sample collected from Hilton-7 contained benzo(a)pyrene at a concentration just exceeding the RIDEM RDEC, at 0.405 parts per million (ppm). However, visual evidence suggested a thinning of this layer as the investigation continued in an easterly direction.

Based on a review of RIDEM records, historical aerial photographs, and state and federal databases, no information exists regarding the origin of this contamination. Records reviewed for Whitney's Auto Repair (110 Bay Street) and Inland Fuel Terminals, Inc. (25 State Avenue) indicated their status as Small Quantity Generators of Hazardous Waste under the Resource Conservation and Recovery Act (RCRA), but did not reveal any spill records. The Fall River Wastewater Treatment Facility reported an oil spill in April 2001, but this type of spill is not expected to have caused the widespread contamination along Bay Street.

Since the submittal of the SIR in March 2003, anecdotal evidence has been found to link this contamination to the former town dump located between Hooper and Canonicus Streets, as well as historic dumping of manufactured gas plant (MGP) material by the former Fall River Gas Company. Chemical profiles of the contaminated soil and organic material are consistent with this suspected source.

3. INVESTIGATION GOALS

This investigation was conducted to establish the limits of the soil contamination previously uncovered along Bay Street. In these soils, SVOCs exceeded the RIDEM RDEC, a concern in a residentially-zoned neighborhood. Concerns about historic filling operations along Bay Street by the Fall River Gas Co. also required the addition of total cyanide, volatile organic compounds (VOCs), and metals analyses. The investigation was conducted on Town of Tiverton property and assessed the impacts to their property as well as potential impact to private property. At the conclusion of this site investigation phase, all Town-owned property located between State Avenue and Judson Street and between Bay Street and Bottom Street will have been investigated through the installation of soil borings and subsequent soil sampling. It is expected that this investigation will assist the Town in the preparation of an Environmental Land Usage Restriction (ELUR) which will address future intrusive activities conducted in the areas on and around Bay Street, as well as potentially suggest additional privately-owned lots in the ongoing investigation being conducted on behalf of the Southern Union Gas Co.

4. SUBSURFACE INVESTIGATION

4.1 BAY VIEW RECREATION AREA – 29 AND 30 APRIL 2003

4.1.1 Soil Sampling

Prior to the beginning of intrusive activities, the Bay View Recreation Area lot was cleared for utilities by calling DigSafe. Two days of subsurface investigation were undertaken to completely investigate the lot in a grid pattern (29 and 30 April 2003). Soil borings were advanced using a truck-mounted Geoprobe 5400. Soils were logged and screened in 4-ft long, 2-in. diameter acetate sleeves. Soil borings were advanced to 12 ft bgs. Boring logs for this Bay View Recreation Area phase of this investigation are included as Appendix A. Figure 2 is a plan of the lot and the location of all 18 soil borings.

Samples were collected from a total of 10 locations. Seven soil samples were collected from the surface interval (0–2 ft bgs) in order to characterize potential exposure risks to site visitors. These 7 locations were chosen to establish the most spatial coverage of the site. Three samples were collected from subsurface depths based upon visual observations indicating a potential presence of contamination in the soil. No elevated flame ionization detector (FID) readings were recorded for any of the 18 soil boring locations.

Soil samples were collected in clean 8-oz glass jars and clean 40-mL vials preserved with methanol, and all samples were kept under 4°C pending submittal to a certified analytical laboratory. The 10 soil samples were analyzed for SVOCs analysis by U.S. Environmental Protection Agency (EPA) Method 8270, Total Cyanide analysis by EPA Method 9010, Priority Pollutant (PP13) Metals by EPA Methods 6010 and 7471, and VOCs by EPA Method 8260B/5035. A trip blank was also submitted for laboratory analysis of VOCs to assess any contamination introduced during transport. Complete Certificates of Analysis for the Bay View Recreation Area samples are included as Appendix B.

4.1.2 Soil Analytical Results

No VOCs were detected in any of the 10 soil samples submitted for analysis by EPA Method 8260B/5035. Cyanide was detected in 2 samples (BVRC-6 and BVRC-11) at levels well below the RIDEM RDEC. Arsenic exceeded the RIDEM RDEC at all 10 locations sampled. However, its presence at the deeper samples (BVRC-5, BVRC-6, and BVRC-9), as well as the 7 surficial soil sampling locations, suggests arsenic may be present in the soils naturally and does not appear to constitute a release. Although the arsenic levels at all locations and beryllium levels at 4 locations exceed the RIDEM RDEC, it does not present a health risk due to the surface layers of grasses or gravel around the entire site preventing this direct exposure.

The only boring location with exceedances of the RIDEM RDEC besides arsenic and beryllium is BVRC-6 (2–4 ft). This interval was chosen for sampling at this boring location based upon the suspicious nature of the soils, which were black and “sparkly” with a slight asphaltic odor.

Although the levels of arsenic, beryllium, lead, and 6 PAHs exceed the RIDEM RDEC, the sample was collected at a depth of 2–4 ft bgs, with 2 ft of fill and vegetation overlying the contaminated layer. Therefore, these soils at BVRC-6 do not present a direct exposure risk to site visitors. Analytical results for the soil sampling activities at Bay View Recreation Area are presented in the table below.

ANALYTICAL RESULTS FOR 29 AND 30 APRIL 2003 SOIL SAMPLING ACTIVITIES

Analyte Detected (ppm)	BVRC1 (0-2 ft)	BVRC3 (0-2 ft)	BVRC5 (10-12 ft)	BVRC6 (2-4 ft)	BVRC7 (0-2 ft)	BVRC9 (5-7 ft)	BVRC11 (0-2 ft)	BVRC14 (0-2 ft)	BVRC16 (0-2 ft)	BVRC18 (0-2 ft)	RIDEM RDEC
Cyanide	ND	ND	ND	8.9	ND	ND	9.2	ND	ND	ND	200
Arsenic	**2.92**	**4.64**	**2.25**	**4.88**	**3.41**	**2.27**	**6.36**	**4.96**	**10.3**	**3.88**	1.7
Beryllium	0.197	0.304	0.261	**0.827**	**0.420**	0.307	**0.439**	0.321	**0.460**	0.301	0.4
Chromium	6.1	6.96	2.22	4.18	7.57	3.65	9.06	8.45	8.92	9.91	1,790
Copper	10.3	16.9	6.66	27.4	4.73	9.19	17.8	2.02	11.9	11.7	3,100
Lead	ND	84.1	11.6	**257**	ND	8.53	99	12.8	65.6	12.8	150
Mercury	ND	0.115	ND	0.343	ND	ND	1.01	0.124	0.292	0.037	23
Nickel	11.5	6.56	3.44	8.6	4.89	4.57	7.06	5.33	7.55	11.3	1,000
Zinc	23.2	190	10.2	28.1	18.9	12.4	51.4	21.6	43.7	42	6,000
2-Methylnaphthalene	ND	ND	ND	0.189J	ND	ND	ND	ND	0.069J	ND	123
Acenaphthene	ND	ND	ND	0.046J	ND	ND	ND	ND	0.025J	ND	43
Acenaphthylene	ND	ND	ND	0.179J	ND	ND	0.146J	ND	ND	0.040J	23
Anthracene	ND	ND	ND	0.385J	ND	ND	0.069J	ND	ND	ND	35
Benzo(a)anthracene	ND	0.110J	ND	**1.310**	ND	ND	0.255J	ND	0.106J	0.097J	0.9
Benzo(a)pyrene	ND	0.142J	ND	**1.610**	ND	ND	0.279J	ND	0.114J	0.131J	0.4
Benzo(b)fluoranthene	ND	0.129J	ND	**1.870**	ND	ND	0.273J	ND	0.103J	0.112J	0.9
Benzo(g,h,I)perylene	ND	0.109J	ND	**1.000**	ND	ND	0.199J	ND	0.070J	0.176J	0.8
Benzo(k)fluoranthene	ND	0.136J	ND	**1.200**	ND	ND	0.269J	ND	0.119J	ND	0.9
Chrysene	ND	0.136J	ND	**1.440**	ND	ND	0.305J	ND	0.160J	0.113J	0.4
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND	0.056J	ND	ND	0.031J	0.4
Fluoranthene	ND	0.203J	ND	1.390	ND	ND	0.332J	ND	0.243J	0.275J	20
Fluorene	ND	ND	ND	0.097J	ND	ND	ND	ND	ND	ND	28
Indeno(1,2,3-cd)pyrene	ND	0.093J	ND	0.885	ND	ND	0.155J	ND	0.057J	0.088J	0.9
Naphthalene	ND	ND	ND	0.256J	ND	ND	0.044J	ND	0.186J	ND	54
Phenanthrene	ND	0.069J	ND	1.360	ND	ND	0.206J	ND	0.125J	0.101J	40
Pyrene	ND	0.183J	ND	4.900	ND	ND	0.427	ND	0.217J	0.306J	12

NOTE: **Bold** indicates an exceedance of the Rhode Island Department of Environmental Management (RIDEM) Residential Direct Exposure Criteria (RDEC).
J = Detected below the Method Detection Limit; estimated value.
ND = Not detected.

A letter to the Town of Tiverton from the Rhode Island Department of Health (RIDOH) dated 19 June 2003 concluded that the "Bay View Recreation Area is safe for both children and adults to use for sports and other play activities" based upon these soil analytical results. This letter is included as Appendix C.

4.2 ROADWAYS – 28 AND 29 JULY 2003

4.2.1 Soil Sampling

On 28 and 29 July 2003, another phase of the roadway investigation occurred on the following streets: State Avenue, A. Connell Street, Chace Avenue, Canonicus Street, Hooper Street, and Bottom Street. Prior to the subsurface investigation, all locations were cleared for utilities by calling DigSafe. Chace Avenue, Canonicus Street, and Hooper Street had previously been investigated with soil borings at the Bay Street (western) ends during the prior phase of this site investigation, and this phase continued boring installation east to the streets' intersections with Bottom Street. Soil borings had also been previously installed at the corners of State Avenue and Foote Street (State-1) and State Avenue and Bay Street (Bay-19), so this investigation also continued the installation of soil borings east along State Avenue to the intersection of Bottom Street.

Soil borings were advanced in the center of the roadways to 8 ft bgs using a truck-mounted Geoprobe 5400. Locations were established every 200 ft in order to provide a consistent means of coverage throughout the area. Soils were logged and screened in 4-ft long, 2-in. diameter acetate sleeves using visual/olfactory observations and a photoionization detector (PID). Boring logs are included as Appendix D.

A total of 20 soil samples were submitted for SVOC analysis by EPA Method 8270C and total cyanide by EPA Method 9010. If screening results revealed headspace readings above 10 ppm on the PID, the impacted soil interval was also submitted for VOC analysis by EPA Method 8260B. During this investigation, a total of 3 soil samples were submitted for VOC analysis (State-2, State-3, and A Connell-3). If field observations noted the blue color in the soils characteristic of the previously identified contaminated soils, the soils were also submitted for PP13 Metals analysis by EPA Method 6010/7471. Two soil samples were submitted for PP13 analysis during this investigation (A Connell-3 and Chace-5). The interval of all samples submitted for laboratory analysis was the 1-2 ft directly beneath the asphalt.

Soil samples were collected in clean 8-ounce glass jars and clean 40-mL vials preserved with methanol for VOC analysis, and all samples were kept under 4°C pending submittal to a certified analytical laboratory. A trip blank was also submitted for laboratory analysis of VOCs to assess any contamination introduced during transport. Complete Certificates of Analysis for the roadway soils are included as Appendix E.

4.2.2 Soil Analytical Results

4.2.2.1 Volatile Organic Compounds

Three soil samples were submitted for VOC analysis by EPA Method 8260B based upon the presence of PID screening results above 10 ppm. No VOCs were detected at levels exceeding the RIDEM RDEC at any of the three locations: State-2, State-3, and A Connell-3. At State-2, where the headspace reading for the 0- to 4-ft interval was 571 ppm, 7 VOCs were detected in

the soil sample. No VOCs were detected at State-3, where the PID headspace reading was 24.5 ppm. At A Connell-3, 2 VOCs were detected and the PID headspace reading was 158 ppm. The table below details the VOCs detected among these 3 soil samples.

VOC ANALYTICAL RESULTS FOR 28 AND 29 JULY 2003 SOIL SAMPLING ACTIVITIES

VOC Detected (ppm)	State-2	State-3	A Connell-3	RIDEM RDEC
1,2,4-Trimethylbenzene	0.060J	ND	ND	--
4-Isopropyltoluene	0.054J	ND	ND	--
Ethylbenzene	1.670	ND	ND	71
Isopropylbenzene	0.122	ND	ND	27
Naphthalene	0.436	ND	0.245	54
Tetrahydrofuran	0.091JB	ND	0.067JB	--
Toluene	0.039J	ND	ND	190
PID Headspace	571	24.5	158	--
NOTE: J = Detected below the Method Reporting Limit; estimated value. B = Analyte present in blank.				

The nature of VOCs detected in the soil samples is consistent with historic hydrocarbon material under the asphalt. However, these levels beneath the roadway present no risk to nearby residents and are isolated from direct exposure and from volatilization to the ambient air by approximately 4-6 in. of asphalt.

4.2.2.2 Priority Pollutant Metals

Based upon the presence of the previously observed "blue soil" in two roadway borings, soil samples from these 2 borings (A Connell-3 and Chace-5) were submitted for Priority Pollutant Metals (PP13) analysis by EPA Method 6010/7741. Both these soils exhibited arsenic exceedances of the RIDEM RDEC. In addition, the A Connell-3 soil sample also had RIDEM RDEC exceedances for lead and mercury. The table below summarizes the concentrations of all metals detected in these 2 samples.

PP13 ANALYTICAL RESULTS FOR 28 AND 29 JULY 2003 SOIL SAMPLING ACTIVITIES

Metal Detected (ppm)	A Connell-3	Chace-5	RIDEM RDEC	RIDEM I/CDEC
Arsenic	***12.9***	**3.4**	1.7	3.8
Beryllium	0.334	0.075	0.4	1.3
Chromium	39.8	8.15	1,790	20,000
Copper	101	8.77	3,100	10,000
Lead	**327**	19.5	150	500
Mercury	**73.4**	1.55	23	610
Nickel	8.7	4.06	1,000	10,000
Zinc	231	16.6	6,000	10,000
NOTE: **Bold** indicates an exceedance of the RIDEM RDEC. *Italics* indicate an exceedance of the RIDEM I/CDEC.				

4.2.2.3 Total Cyanide

All 20 soil samples were submitted for total cyanide analysis. High cyanide levels had been noted at borings installed during the previous phase of this site investigation, and cyanide is known to be a characteristic chemical of MGP material. In all samples, the levels of cyanide were below the RIDEM RDEC (200 ppm). Cyanide was detected in four soil samples: State-2 (108 ppm), State/Bottom (2.7 ppm), A Connell-3 (36.9 ppm), and Bottom-4 (4.1 ppm). These levels are not expected to pose risks to nearby residents, as the soils are isolated from direct exposure and volatilization beneath 4-6 in. of asphalt.

4.2.2.4 Semi-Volatile Organic Compounds

All 20 soil samples were also submitted for laboratory analysis for SVOCs, including PAHs, the primary chemicals of concern in the area. Seven samples had PAH levels exceeding the RIDEM RDEC: State-2, Bottom-1, Bottom-2, Bottom-3, A Connell-3, Chace-5, and Canonicus-3. Of these 7 samples, 4 also had exceedances of the RIDEM I/CDEC: Bottom-1, Bottom-2, Bottom-3, and A Connell-3. The table below summarizes the concentrations of all SVOCs detected at levels exceeding the applicable standards from these 7 boring locations. Full analytical results for all SVOCs detected are included as Table 1.

SVOC ANALYTICAL RESULTS FOR 28 AND 29 JULY 2003 SAMPLING ACTIVITIES

SVOC Detected (ppm)	State-2	Bottom-1	AConnell-3	Bottom-2	Chace-5	Bottom-3	Canonicus-3	RIDEM RDEC	RIDEM I/CDEC
Benzo(a)anthracene	0.448J	***17.50***	***19.10***	**3.790**	0.328J	**1.100**	0.698J	0.9	7.8
Benzo(a)pyrene	0.260J	***14.60***	***17.40***	***3.260***	0.300J	***1.230***	**0.563J**	0.4	0.8
Benzo(b)fluoranthene	0.257J	***13.60***	***19.30***	**3.410**	**1.050**	1.570	ND	0.9	7.8
Benzo(g,h,I)perylene	ND	**6.600**	**8.490**	**1.410J**	ND	ND	ND	0.8	10,000
Benzo(k)fluoranthene	0.435J	**14.30**	**14.90**	**3.260**	0.632J	**1.870**	ND	0.9	78
Chrysene	**0.427J**	**17.80**	**19.90**	**4.290**	**0.576**	**1.420**	**0.753**	0.4	780
Dibenzo(a,h)anthracene	ND	***2.910J***	ND	**0.553J**	ND	ND	ND	0.4	0.8
Fluoranthene	1.110	**38.90**	**36.80**	9.230	0.640	1.800	0.869	20	10,000
Indeno(1,2,3-cd)pyrene	ND	**6.600**	***8.570***	**1.260J**	0.136J	ND	ND	0.9	7.8

NOTE: **Bold** indicates an exceedance of the RIDEM RDEC.
Italics indicate an exceedance of the RIDEM I/CDEC.
J = Detected below the Method Reporting Limit; estimated value.
B = Analyte present in blank.
ND = Not detected.

The levels of SVOCs detected in the 3 Bottom Street borings and the boring on A. Connell Street reveal the inconsistent nature of the contamination under the roadways. For example, A Connell-3 exceeds the RIDEM I/CDEC for 4 PAHs, but the borings located 200 ft east and west of this location did not exceed even the RDEC. Analytical results for A Connell-4, located 200 ft east of A Connell-3 and between Bottom-2 and Bottom-3, did not reveal the presence of any SVOCs at this location.

5. REMEDIAL ALTERNATIVES

To address the contamination identified on Town of Tiverton-owned land, EA is proposing two remedial alternatives. Based on the results of the previously conducted Site Investigation and this Site Investigation Addendum, two remedial alternatives are presented for further consideration for the Town of Tiverton property in and around Bay Street:

1. Excavation and disposal of impacted soil.

2. An Environmental Land Usage Restriction. Further discussion is presented to better define the requirements and effectiveness of the proposed remedial alternatives.

The following criteria were incorporated into the evaluation of remedial alternatives for the site:

- Ability to prevent the exposure of residents and site workers to contaminated soil
- Ability to remediate soil to RIDEM RDEC standards
- Cost effectiveness
- Time efficiency (schedule concerns related to the everyday use of the property as public roadways and the concentration of nearby residences).

Remedial Alternative #1: Removal Action

One alternative to address this contamination would be to establish clearly defined extents of contamination and initiate a removal action to excavate all soils contaminated above the applicable RIDEM direct exposure criteria. Soil would be screened and submitted to a certified analytical laboratory for confirmatory analysis to ensure that all contaminated material had been removed. This would eliminate all possibility of risk to residents or workers in the area. Following removal, soil would be transported to a licensed facility for disposal. The timeframe of this action alternative would be the several months necessary to remove all of the contaminated material. However, this option would require no further action following the removal.

It is important to note that the contamination beneath the Town-owned roadyways has posed no risk to residents or workers prior to the start of sewer excavations. Although the soil exceeds RIDEM direct exposure criteria for several analytes, the presence of 0.3–1.0 ft of asphalt over these soils has prevented the possibility of exposure. No residents in the immediate vicinity of or downgradient from this contaminated soil are served by private drinking water wells. All potable water to residents in the area is supplied by the Town of Tiverton. A removal action would, in fact, increase exposure by residents and workers to the material through working conditions and potential wind-borne contaminants.

Remedial Alternative #2: Environmental Land Usage Restriction

Another alternative to address the contamination found beneath the Town-owned roadways would be to establish an ELUR for the entire area between Judson Street and State Avenue, and between Bay Street and Bottom Street. This would involve establishing guidelines on any future invasive activities within the range of contaminated material, such as those found in the attached Soil Management Plan (Appendix F). Such guidelines would include a requirement for air monitoring during excavations and the segregation of any contaminated soil from clean material in cases where the material cannot be used as backfill. Guidelines would also require replacement of the asphalt over the roadway that is acting as a cap to prevent exposure to the soil. This ELUR would be recorded in the land evidence records of the Town of Tiverton.

TABLE 1 ALL DETECTED ANALYTES FOR ROADWAY SOIL SAMPLING 29 AND 30 JULY 2003

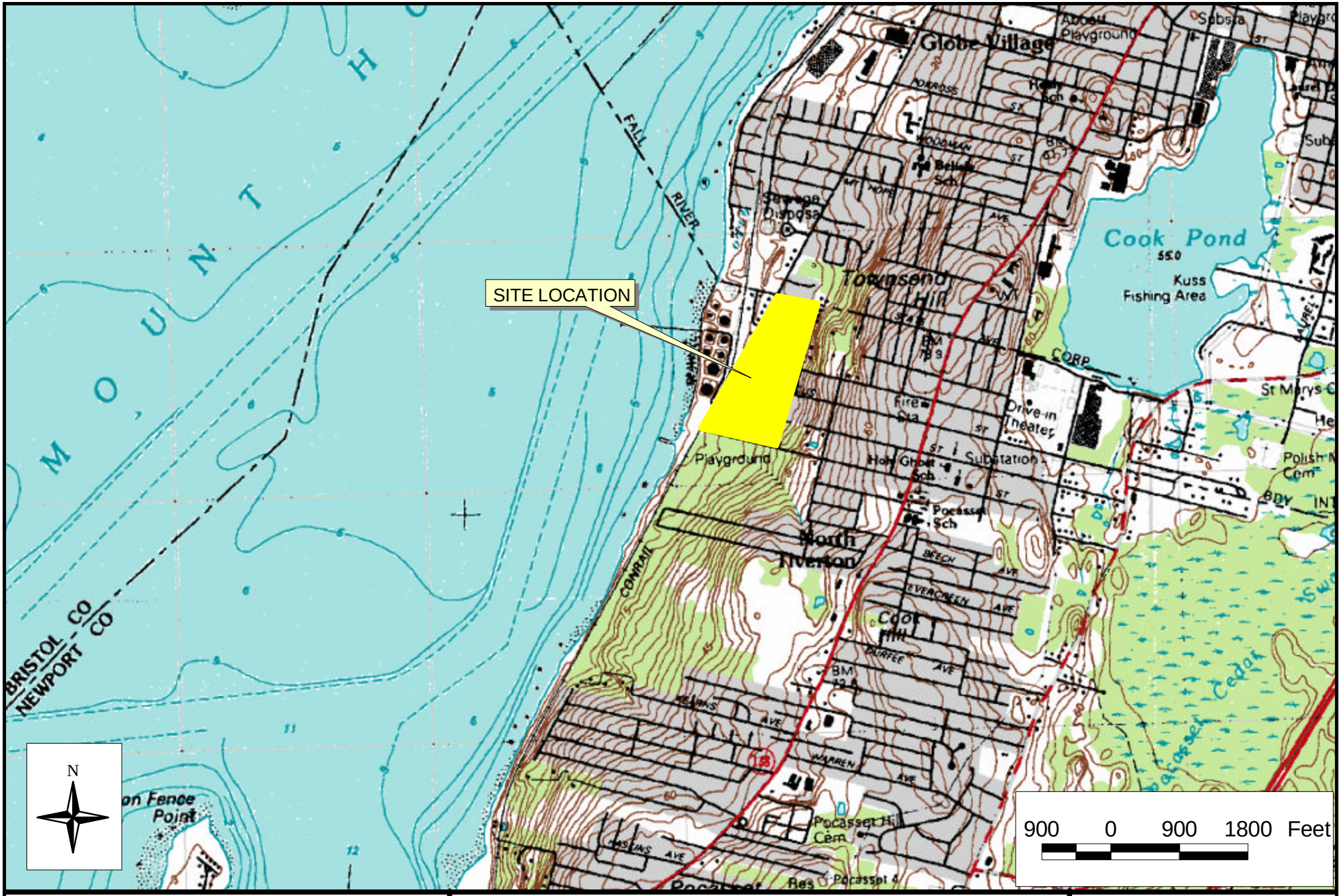
Analyte Detected (ppm)	RIDEM RDEC	RIDEM I/CDEC	State-2	State-3	State/ Bottom	Bottom-1	AConnell-1	AConnell-2	AConnell-3	AConnell-4	Bottom-2
Cyanide	200	10,000	108	ND	2.7	ND	ND	ND	36.9	ND	ND
Metals											
Arsenic	3.0	7.0	NA	NA	NA	NA	NA	NA	***12.9***	NA	NA
Beryllium	0.4	1.3	NA	NA	NA	NA	NA	NA	0.334	NA	NA
Chromium	1,790	20,000	NA	NA	NA	NA	NA	NA	39.8	NA	NA
Copper	3,100	10,000	NA	NA	NA	NA	NA	NA	101	NA	NA
Lead	150	500	NA	NA	NA	NA	NA	NA	**327**	NA	NA
Mercury	23	610	NA	NA	NA	NA	NA	NA	**73.4**	NA	NA
Nickel	1,000	10,000	NA	NA	NA	NA	NA	NA	8.7	NA	NA
Zinc	6,000	10,000	NA	NA	NA	NA	NA	NA	231	NA	NA
VOCs											
1,2,4-Trimethylbenzene	--	--	0.060 J	ND	NA	NA	NA	NA	ND	NA	NA
4-Isopropyltoluene	--	--	0.054 J	ND	NA	NA	NA	NA	ND	NA	NA
Ethylbenzene	71	10,000	1.670	ND	NA	NA	NA	NA	ND	NA	NA
Isopropylbenzene	27	10,000	0.122	ND	NA	NA	NA	NA	ND	NA	NA
Naphthalene	54	10,000	0.436	ND	NA	NA	NA	NA	0.245	NA	NA
Tetrahydrofuran	--	--	0.091 J B	ND	NA	NA	NA	NA	0.067 J B	NA	NA
Toluene	190	10,000	0.039 J	ND	NA	NA	NA	NA	ND	NA	NA
SVOCs											
1,1-Biphenyl	0.8	10,000	0.028 J	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	123	10,000	ND	ND	ND	1.220 J	0.391 J	ND	0.396 J	ND	0.161 J
2-Methylphenol	--	--	ND	ND	ND	ND	0.026 J	ND	ND	ND	ND
3+4-Methylphenol	--	--	ND	ND	ND	ND	0.038 J	ND	ND	ND	ND
Acenaphthene	43	10,000	0.098 J	ND	ND	4.140 J	ND	0.030 J	3.280 J	ND	0.828 J
Acenaphthylene	23	10,000	0.042 J	ND	ND	0.623 J	0.390	ND	0.767 J	ND	ND
Anthracene	35	10,000	0.246 J	ND	ND	10.10	0.032 J	0.079 J	7.170	ND	1.700 J

Note: Bold indicates an exceedance of the RIDEM RDEC.
Italics indicate an exceedance of the RIDEM I/CDEC.
ppm = Parts per million.
J = Detected below the Method Reporting Limit; Estimated value.
B = Present in blank.

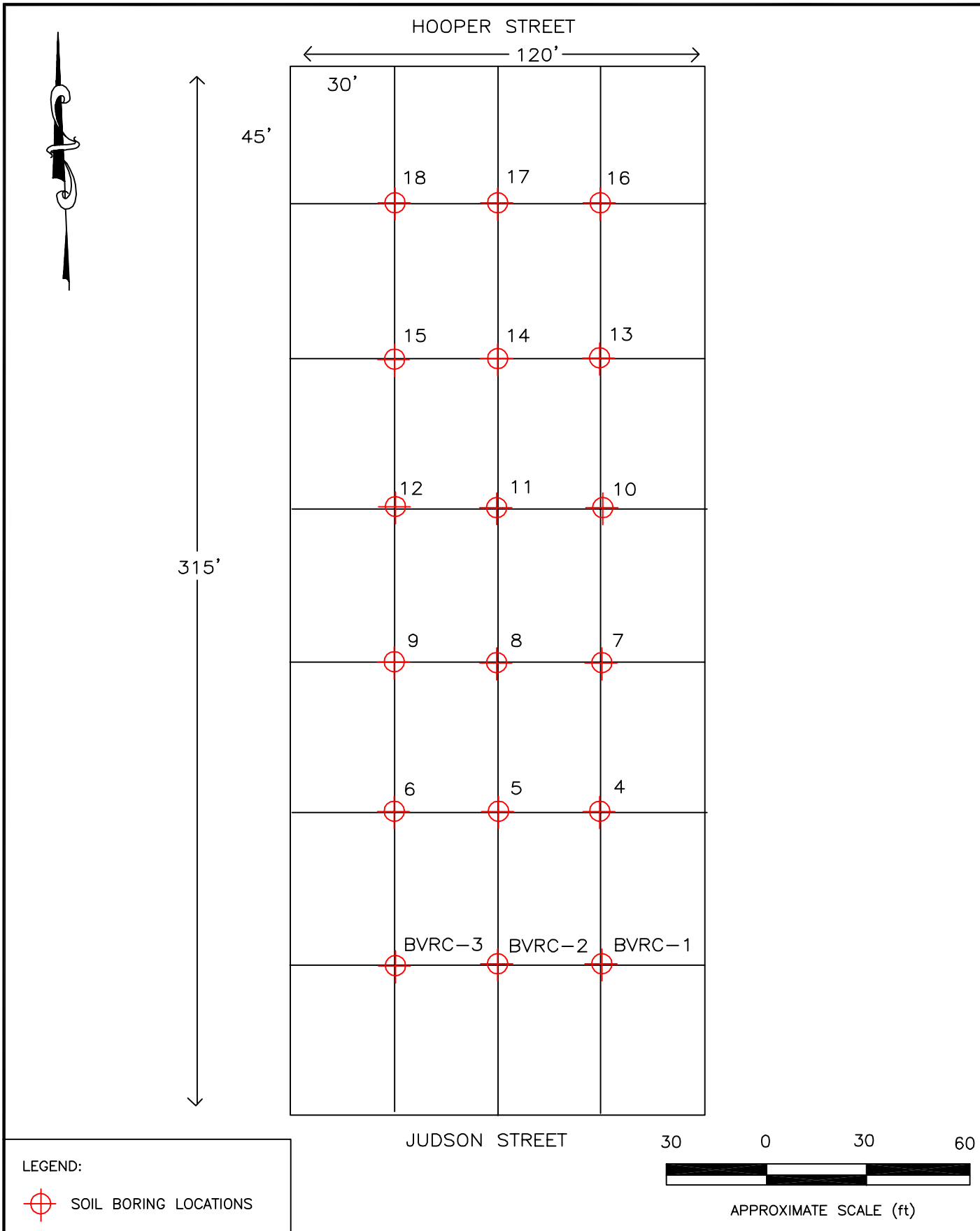
Analyte Detected (ppm)	RIDEM RDEC	RIDEM I/CDEC	State-2	State-3	State/ Bottom	Bottom-1	AConnell-1	AConnell-2	AConnell-3	AConnell-4	Bottom-2
SVOCs (continued)											
Benzo(a)anthracene	0.9	7.8	0.448 J	ND	ND	***17.50***	ND	0.244 J	***19.10***	ND	**3.790**
Benzo(a)pyrene	0.4	0.8	0.260 J	ND	ND	***14.60***	0.333 J	0.277 J	***17.40***	ND	***3.260***
Benzo(b)fluoranthene	0.9	7.8	0.257 J	ND	ND	***13.60***	0.191 J	0.198 J	***19.30***	ND	**3.410**
Benzo(ghi)perylene	0.8	10,000	ND	ND	ND	**6.600**	0.115 J	0.226 J	**8.490**	ND	**1.410 J**
Benzo(k)fluoranthene	0.9	78	0.435 J	ND	ND	**14.30**	ND	0.240 J	**14.90**	ND	**3.260**
Carbazole	--	--	0.034 J	ND	ND	3.380 J	ND	0.022 J	3.170 J	ND	0.718 J
Chrysene	0.4	780	**0.427 J**	ND	ND	**17.80**	0.205 J	0.291 J	**19.90**	ND	**4.290**
Dibenzofuran	--	--	0.065 J	ND	ND	3.210 J	ND	ND	1.400 J	ND	0.474 J
Dibenzo(ah)anthracene	0.4	0.8	ND	ND	ND	***2.910 J***	0.051 J	ND	ND	ND	**0.553 J**
Fluoranthene	20	10,000	1.110	ND	ND	**38.90**	ND	0.291 J	**36.80**	ND	9.230
Fluorene	28	10,000	0.156 J	ND	ND	4.260	ND	0.030 J	2.230 J	ND	0.531 J
Indeno(123cd)pyrene	0.9	7.8	ND	ND	ND	**6.600**	0.112 J	ND	**8.570**	ND	**1.260 J**
Naphthalene	54	10,000	0.255 J	ND	ND	2.000 J	0.417	ND	1.080 J	ND	0.389 J
Phenanthrene	40	10,000	0.533 J	ND	0.024 J	39.10	ND	0.310 J	27.00	ND	7.720
Pyrene	6000	10,000	0.960	ND	0.069 J	35.90	ND	1.250	36.00	ND	8.260

Analyte Detected (ppm)	RIDEM RDEC	RIDEM I/CDEC	Chace-4	Chace-5	Bottom-3	Bottom-4	Canonicus-3	Canonicus-4	Bottom-5	Hooper-3	Hooper-4	Hooper-5
Cyanide	200	10,000	ND	ND	ND	4.1	ND	ND	ND	ND	ND	ND
Metals												
Arsenic	3.0	7.0	NA	**3.4**	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.4	1.3	NA	0.075	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	1,790	20,000	NA	8.15	NA	NA	NA	NA	NA	NA	NA	NA
Copper	3,100	10,000	NA	8.77	NA	NA	NA	NA	NA	NA	NA	NA
Lead	150	500	NA	19.5	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	23	610	NA	1.55	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	1,000	10,000	NA	4.06	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	6,000	10,000	NA	16.6	NA	NA	NA	NA	NA	NA	NA	NA
VOCs												
1,2,4-Trimethylbenzene	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Isopropyltoluene	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	71	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	27	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	54	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrahydrofuran	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	190	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SVOCs												
1,1-Biphenyl	0.8	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	123	10,000	ND	0.025 J	0.042 J	ND	ND	ND	ND	ND	ND	ND
2-Methylphenol	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3+4-Methylphenol	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	43	10,000	ND	ND	0.122 J	ND	ND	ND	ND	0.024 J	ND	ND
Acenaphthylene	23	10,000	0.082 J	0.244 J	0.104 J	ND	ND	0.071 J	ND	0.025 J	0.037 J	0.054 J
Anthracene	35	10,000	0.035 J	0.110 J	0.292 J	ND	0.111 J	ND	ND	0.052 J	ND	ND
Benzo(a)anthracene	0.9	7.8	0.070 J	0.328 J	**1.100**	0.165 J	0.698 J	0.176 J	0.036 J	0.201 J	0.075 J	0.062 J
Benzo(a)pyrene	0.4	0.8	0.053 J	0.300 J	***1.230***	0.222 J	**0.563 J**	0.206 J	ND	0.200 J	0.096 J	ND
Benzo(b)fluoranthene	0.9	7.8	0.133 J	**1.050**	1.570	0.273 J	ND	0.376	0.078 J	0.330 J	0.115 J	0.137 J
Benzo(ghi)perylene	0.8	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	0.9	78	0.089 J	0.632 J	**1.870**	0.187 J	ND	0.174 J	ND	0.158 J	ND	ND
Carbazole	--	--	ND	0.084 J	0.144 J	ND	ND	ND	ND	ND	ND	ND
Chrysene	0.4	780	0.105 J	**0.576**	1.420	0.218 J	**0.753**	0.208 J	0.053 J	0.250 J	0.109 J	0.115 J

Analyte Detected (ppm)	RIDEM RDEC	RIDEM I/CDEC	Chace-4	Chace-5	Bottom-3	Bottom-4	Canonicus-3	Canonicus-4	Bottom-5	Hooper-3	Hooper-4	Hooper-5
SVOCs (continued)												
Dibenzofuran	--	--	ND	ND	0.065 J	ND	ND	ND	ND	ND	ND	ND
Dibenzo(ah)anthracene	0.4	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	20	10,000	0.133 J	0.640	1.800	0.210 J	0.869	0.243 J	0.073 J	0.453	0.172 J	0.125 J
Fluorene	28	10,000	ND	0.019 J	0.073 J	ND	ND	ND	ND	ND	ND	ND
Indeno(123cd)pyrene	0.9	7.8	ND	0.136 J	ND	ND	ND	ND	ND	0.050 J	ND	ND
Naphthalene	54	10,000	ND	ND	0.049 J	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	40	10,000	0.096 J	0.429	1.370	0.081 J	0.347 J	0.080 J	0.113 J	0.232 J	0.118 J	0.079 J
Pyrene	6000	10,000	0.194 J	1.230	5.720	0.612 J	3.410	0.713	ND	0.736	0.267 J	ND



EA	TOWN OF TIVERTON SITE INVESTIGATION REPORT TIVERTON, RHODE ISLAND					FIGURE 1 SITE LOCATION MAP	
PROJECT MGR TR	DESIGNED BY DC	DRAWN BY DC	CHECKED BY JP	SCALE AS SHOWN	DATE OCT 2003	PROJECT NO. 1407001	FILE NO. I:\TIV.APR



EA ENGINEERING, SCIENCE, AND TECHNOLOGY	TOWN OF TIVERTON SITE INVESTIGATION REPORT BAY VIEW RECREATION CENTER TIVERTON, RHODE ISLAND	FIGURE 2 SOIL BORING LOCATIONS

PROJECT MGR:	DESIGNED BY:	DRAWN BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
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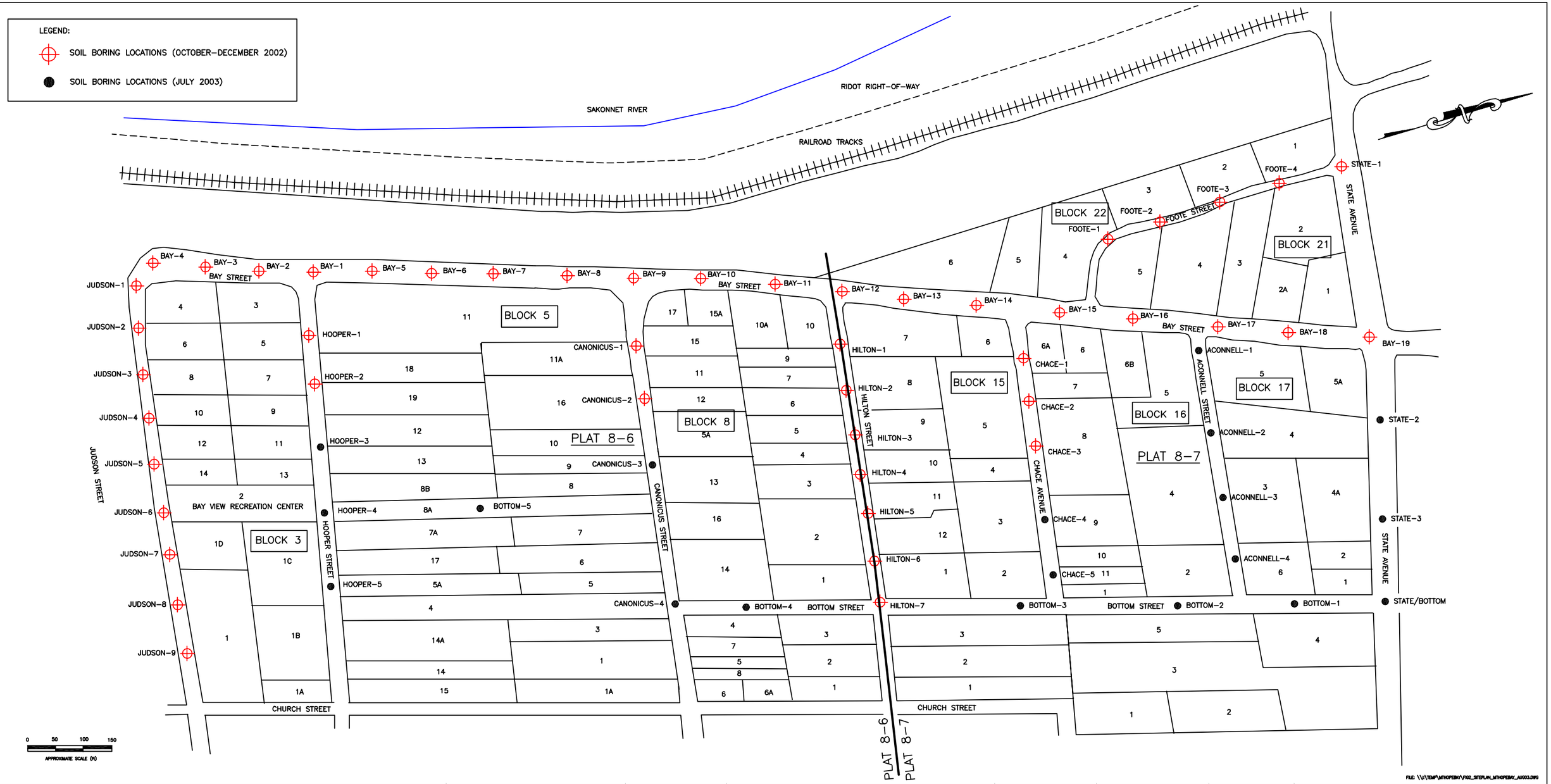

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	TOWN OF TIVERTON SITE INVESTIGATION REPORT	SITE PLAN AND SOIL BORING LOCATIONS	FIGURE 3	PROJECT MANAGER: TR	CREATED BY: DC	DESIGNED BY: DC	CHECKED BY: JP	SCALE: AS SHOWN	DATE: OCTOBER 2003	PROJECT NO: 1407001

SOIL MANAGEMENT PLAN
Tiverton, Rhode Island

During trench excavation activities at the Mount Hope Bay Sewer Interceptor Project Site on Bay Street in August 2002, workers encountered soil contaminated with cyanide and semi-volatile organic compounds (SVOCs). This soil had an organic odor and open trenches exhibited a sheen on groundwater. This soil was separated from other excavated materials and has been removed from the site following RIDEM Emergency and Short-Term Response Procedures. Subsequent site investigation activities revealed the presence of the polycyclic aromatic hydrocarbons (PAH) group of SVOCs, arsenic, lead, and cyanide in soils under public roadways around Bay Street, including Judson, Hooper, Canonicus, Hilton, A. Connell, and Bottom Streets and State and Chace Avenues (east of Church Street).

Any excavation that may expose residents or workers to contaminated material will require a formal notification of all abutting residents at least 72 hours prior to the start of excavation. Persons conducting excavations in potentially contaminated areas must also submit notification to the Rhode Island Department of Environmental Management (RID EM), including plans for the proposed work.

In the areas where contaminated soil is expected in the area on and around Bay Street, the soil will be screened using field equipment and visual/olfactory signals. Suitable material will be reused as backfill in the excavation. RIDEM has required that one foot of clean material be placed above the backfilled material prior to installing the final paved surface. In the event that excavation is necessary in unpaved areas, a minimum of two feet of clean material must be placed above the backfilled material. Unsuitable material will be segregated and stored properly to await the appropriate waste disposal alternative. Proper storage will consist of a polyethylene containment area with runoff control measures, such as hay bales. If laboratory analysis of soils is required for disposal purposes, results will be forwarded to RIDEM. All excavations must be properly secured during non-working periods with safety markings, including snow fence, and a cover.

1.0 EXCAVATION

During any excavation through areas of soil contamination in the area of Bay Street, all actions will be conducted in compliance with the Site Safety, Health, and Emergency Response Plan (SHERP) prepared by EA. This environmental SHERP will be followed in conjunction with the plan used by the excavation subcontractor during normal excavation and installation activities. EA-recommended health and safety procedures include: conducting excavations downwind of work area, periodic air monitoring for toxic, combustible, and explosive gases, using combustion machinery upwind of work area, and appropriate personal protective equipment (PPE). All personnel conducting excavations must be properly trained, and oversight must be conducted by properly trained individuals to ensure the health and safety of workers and the public. Temporary security

fencing must be installed around all excavations prior to beginning the project and maintained throughout the project in order to prevent potential access by the public to contaminated materials.

2.0 SOIL SCREENING

During the excavation of suspect soils, the material will be screened using visual and olfactory methods. In the event that visual/olfactory methods are inconclusive, a photo-ionization detector (PID) will be used to screen soils utilizing the jar headspace method. Soils will be collected in clean, glass 8-ounce jars and covered with tin foil. The lid will be screwed on tightly and the jar will be shaken vigorously for at least 15 seconds. The temperature will be allowed to equilibrate for at least 15 minutes, then the lid will be unscrewed and the PID probe will be inserted through the tin foil.

Excavated materials meeting the definition of suitable fill based on visual/olfactory and Pill screening will be used as backfill for the pipeline according to the protocols established by the excavation subcontractor. According to RIDEM requirements, one foot of clean material must be used above backfill in areas that will be paved. Two feet of clean material must be used above backfill in unpaved areas.

As contact with contaminated soil is expected during this phase of excavation activities, only EA personnel will perform the soil screening and assist in the determination of suitability for use as backfill. Proper PPE will be worn in accordance with the SHERP.

3.0 SOIL STAGING AND SAMPLING

Polyethylene sheeting will be used to stage all unsuitable soils excavated during invasive activities. This method will serve to prevent infiltration of contamination to surface soils. These soil piles will be further isolated using hay bales to prevent contaminated runoff from spreading to the rest of the site. At the end of each workday, any soil stockpiles will be covered with polyethylene sheeting weighed down by sandbags. Waste characterization sampling will be completed at the frequency required by the ultimate disposal facility, with results forwarded to RIDEM. Soils will not be stored on site in excess of 60 days.

4.0 WASTE DISPOSAL

The loading and transport of any contaminated soils generated through the duration of the project should be conducted in accordance with the SHERP and under EA supervision. Care will be taken to ensure that the integrity of any soil piles is maintained to prevent the spread of contamination. If dust becomes a health and safety issue, water will be used as the method of dust suppression. Breathing zone monitoring will be done every 30 minutes to ensure worker safety. All copies of the bills of lading and waste manifests will be maintained by EA personnel and will be submitted to RIDEM. All loads will be covered in the transporting dump trucks en route to the ultimate disposal facility.