Limited Investigation Report
Plat 14 Lots 2 and 4, Plat 15 Lot 1
Berkeley Commons/River Run Development
Cumberland, Rhode Island

Prepared for

Berkeley Commons/River Run Development
573 Mendon Road
Cumberland, Rhode Island 02864

Prepared by

EA Engineering, Science, and Technology, Inc.
2350 Post Road
Warwick, Rhode Island 02886
(401) 736-3440

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LIST OF ACRONYMS

EPA	(U.S.) Environmental Protection Agency
ILM	Inorganic Low Concentration Method
MTBE	Methyl tert-Butyl Ether
NPL	National Priority List
OLM	Organic Low Concentration Method
OU	Operable Unit
PAL	Project Action Limit
PCOPC	Preliminary Chemical of Potential Concern
PID	Photoionization Detector
PRG	Preliminary Remediation Goals
QAPP	Quality Assurance Project Plan
RIDEM	Rhode Island Department of Environmental Management
SVOC	Semivolatile organic compound
TAL	Target Analyte List
TIC	Tentatively Identified Compound
VOC	Volatile organic compound

EXECUTIVE SUMMARY

EA Engineering, Science, and Technology, Inc. (EA) has prepared this Limited Site Report for the Berkeley Commons and River Run Development Project in Cumberland, Rhode Island. The purpose of this investigation was to evaluate groundwater quality at the development property and investigate the hydraulic relationship of the property with known sources of groundwater contamination to the south and northwest. Also included in this investigation was an evaluation of surface water and sediment within two streams receiving runoff from roadways and residences and draining into the Rhode Island Department of Environmental Management (RIDEM) designated 100-foot riverbank wetland buffer zone.

The Berkeley Commons and River Run Development property encompasses approximately 80 acres, of which approximately 25 acres along the western edge of the property is included with Operable Unit-2 (OU-2) of the Peterson Puritan Superfund Site. The Peterson Puritan Superfund Site has been designated on the Environmental Protection Agency (EPA) National Priority List (NPL) based upon a solvent release occurring at the property in 1974 and the resulting contamination of groundwater. In order to guarantee access to all potential sources and receptors of contamination in the area, the EPA included an area south of the Peterson Puritan Superfund Site along the Blackstone River to the Pratt Dam.

The development property itself has been used as a sand and gravel pit since the 1930's. During interviews with the property owners (who have owned the property since 1934) conducted as part of the Phase I Environmental Site Assessment conducted by EA, no present or historic use of hazardous materials at the property were reported. No evidence of hazardous material use, storage, or disposal was found during the inspection for this investigation. According to the owners, residential development was always the long-term goal of the property purchase. Adjacent land use includes residential development to the north, commercial and residential development to the east along Mendon Road, industrial development to the north and northwest, and the inactive J.M. Mills Landfill to the southwest.

To assess groundwater quality in the portion of the development property included within OU-2, EA installed 4 groundwater monitoring wells along the southern and western edges of the property. These wells were installed at depths ranging from 25 to 52 feet below ground surface, with three wells installed in bedrock and one installed in the overburden. These wells were sampled using low-flow protocol to collect representative groundwater samples for laboratory analysis of volatile organic compounds (VOCs) by Organic Low Concentration Method 3.2 (OLM03.2) and total metals by Inorganic Low Concentration Method 4.1 (ILM04.1) and 1632.

Results of the groundwater analysis revealed no evidence of VOC contamination associated with the known contamination from the Peterson Puritan Superfund Site. At

one monitoring well location, low concentrations of petroleum-related VOCs were detected at levels in compliance with both the EPA Project Action Limits (PALs) and the RIDEM GA Groundwater Objectives. The VOC levels present do not present any risk to future residents of the development or to the adjacent wetland wildlife. These results indicate the development property is not a contributor or receptor of the groundwater contamination recognized in the Peterson Puritan Superfund Site.

A total of 15 metals were detected among the 4 groundwater samples. Three of these metals (aluminum, iron, and manganese) exceeded the EPA PALs. However, these PALs were based upon National Secondary Drinking Water Standards for nuisance chemicals. The groundwater is in compliance with the RIDEM GA Groundwater Objectives for all metals detected, indicating the groundwater suitable for public consumption without treatment.

Surface water and sediment samples were collected from two locations on the western edge of the property, an intermittent stream draining from the adjacent residential development to the north and Monastery Brook. The source of this intermittent stream is runoff from Mendon Road, properties east of Mendon Road, and a residential development abutting the property to the north. Monastery Brook has a source approximately 1.5 miles north of the property and its drainage area includes several residential areas and paved roads, including Mendon and Diamond Hill Roads. The surface water samples were analyzed for VOCs by OLC03.2, SVOCs by OLC03.2 and 8270SIM, and total metals by ILM04.1. Of the VOCs, only methylene chloride was detected. This common laboratory contaminant was found to be present in both samples and the trip blank, indicating contamination during collection, transport, or analysis. The levels of methylene chloride detected were below the PAL for that analyte and cause no risk to future development residents. Although 8 SVOCs were detected between the surface water samples, the only analyte detected above the PAL was bis(2-Ethylhexyl)phthalate in the intermittent stream. Bis(2-Ethylhexyl)phthalate is recognized as a common laboratory contaminant and is used commercially as a plasticizer. The levels detected do not pose a significant risk to future development residents. Of the 14 metals detected in the surface water samples, 6 metals were detected at levels exceeding the PALs. The results of the surface water analysis are typical for water bodies receiving runoff from roadways, and the streams present no risk to future residents of the development.

The sediment samples from the two streams were also analyzed for VOCs, SVOCs, and metals. No VOCs were detected in the sediment samples. No SVOCs were detected above the PALs. Arsenic, copper, iron, lead, and manganese exceeded the PALs in the sediment samples. These metals are typical in sediments impacted by roadway runoff. The sediment analytical results reveal no risk to future residents of the development.

In conclusion, the Berkeley Commons and River Run Development property is not a contributor or receptor of groundwater contamination associated with the Peterson

Puritan Superfund Site. The groundwater does not pose any risk to the health of future residents of the development. Surface water and sediment analytical results suggest the development is a receptor of metals and SVOCs from the two streams draining into the RIDEM 100-foot riverbank wetland buffer zone, but this contamination does not have the potential to affect residents.

1.0 INTRODUCTION

This Limited Investigation Report has been prepared by EA Engineering, Science, and Technology, Inc. (EA) on behalf of the Berkeley Commons and River Run Development in Cumberland, Rhode Island. The purpose of this investigation was to evaluate groundwater quality and the hydraulic relationship of the property to known sources of groundwater contamination to the south and northwest. This report covers site activities including the installation, surveying, gauging, development, and sampling of monitoring wells and the subsequent analysis of the groundwater data. Also included in this report is the sampling and analysis of surface water and hydric soils from two streams located within the Rhode Island Department of Environmental Management (RIDEM) 100-foot riverbank wetland buffer on the Berkeley Commons and River Run Development property.

Figure 1 depicts the location of the subject property. Figure 2 details the current condition of the property and surrounding properties and contains monitoring well and surface water and sediment sampling locations.

2.0 PROPERTY DESCRIPTION AND HISTORY

The proposed Berkeley Commons/River Run Residential Developments is located southwest of Mendon Road (RI Route 122) in the Town of Cumberland, Rhode Island. The development project encompasses approximately 80 acres. The study area for this investigation is designated on the Town of Cumberland Tax Assessor's Map as Plat 14, Lots 2 and 4 and Plat 15, Lot 1. This investigation is focused on the approximately 25 acres along the southern and western edge of the development that have been included in the Operable Unit-2 (OU-2) of the Peterson Puritan Superfund Site. There are freshwater wetlands associated with New River bordering the study area to the southwest. Further to the west are active Providence and Worcester Railroad tracks, the inactive J.M. Mills Landfill, and the Blackstone River. An area consisting of single-family residential development and the Monastery Brook are located between the two development projects. Adjacent land use along Mendon Road consists of a mixture of residential and commercial development, including single and multi-family homes and retail operations such as a hair salon and insurance office. There is a high concentration of industrial land use to the north and west of the property. There are currently no structures on the River Run Development (Plat 15, Lot 1) portion of the development. Former structures include a scale house and a structure supporting a large material crusher. At the time of this evaluation, construction has begun on the Berkeley Commons Development.

Groundwater within the development is characterized as GAA by the Rhode Island Department of Environmental Management (RIDEM), meaning groundwater is suitable for public consumption without treatment. Areas within a 0.5-mi radius of the study area, most notably the inactive J.M. Mills Landfill south of New River and the Peterson Puritan Site to the north, are classified as non-attainment with this GAA designation. Soils within the study area are characterized in the Soil Survey of Rhode Island (1981) as "Pits, gravel." The sand and gravel deposits are associated with the floodplains and terraces of the Blackstone River and extend to a depth of approximately 90 feet below the undisturbed ground surface. This is underlain by a 10-15 foot thick layer of glacial till, followed by Blackstone Metamorphic bedrock. The aquifer is described as highly transmissive due to the permeable nature of the sand and gravel deposits. However, the historic removal of overburden material by the sand and gravel operation has significantly altered the topography of the development property.

The current owner, Berkeley Commons and River Run Development, has owned the development property since 1934. Prior to the purchase of this land, it was open space. The property owners subdivided the parcel into two development projects in the late 1930's. The property has been used as a sand and gravel mining operation since that time. Improvements over the course of sand and gravel mining operations included the installation of haul roads, a reinforced concrete base for the material crusher, and a scale

house. In 1993, the development owners also purchased the former Admiral Inn property along Mendon Road at the eastern boundary of the study area, now included in the Berkeley Commons Development. In 2000, seven new residential lots were developed by the family as part of the existing residential development between the River Run and Berkeley Commons Developments. The two development projects have been planned for 7 years and extensive RIDEM coordination and permitting has been completed.

A Phase I Environmental Site Assessment conducted by EA and interviews with the property owners do not indicate the generation or disposal of hazardous materials or waste on the property at any time during its developed history. According to the property owners, residential development was always the intended use of the property following the termination of sand and gravel mining operations. No evidence was found during the Phase I investigation to indicate site practices had impacted site soil or groundwater.

3.0 POTENTIAL ENVIRONMENTAL CONCERNS

Currently, a portion of the development property is included within the boundary of OU-2 of the Peterson Puritan Superfund Site by the US Environmental Protection Agency (EPA). To the northwest of the property, on Martin Street, a significant solvent spill occurred in 1974. Approximately 6,000 gallons of solvent were released from a rail car and product tank at the former Peterson Puritan facility (currently in operation as CCL Custom Manufacturing, Inc.). Operable Unit-1 (OU-1) is comprised of this source area roughly south and downstream to just north of the subject property's western boundary. The area downstream of OU-1, including the former J.M. Mills Landfill, the western portion of the subject residential development project and the adjoining wetlands, is designated as OU-2. OU-2 extends south to the Pratt Dam on the Blackstone River and also includes the Lenox Street Well, an inactive public water source closed in 1979 following the discovery of significant volatile organic compound (VOC) contamination. In order to have access to all potential sources and receptors, the EPA has included over a mile of land downstream of OU-1 as OU-2, including approximately 35% of the area of the development property (approximately 25 acres).

4.0 GROUNDWATER EVALUATION

The locations of the EA-installed monitoring wells are detailed on Figure 2.

4.1 MONITORING WELL INSTALLATION

To fully investigate any potential groundwater contamination existing on the OU-2 portions of the Berkeley Commons/River Run Developments, EA installed a total of 4 monitoring wells along the southern and western edges of the properties and adjacent to the wetlands on 2 and 3 June 2003. Due to the gravelly nature of the overburden in the area as well as the shallow overburden/bedrock interface, these wells were installed using the air rotary method. Boring logs for these 4 monitoring wells are included as Appendix A. Three monitoring wells were installed into bedrock (MW-2, 3, and 4), and one was installed in the overburden (MW-1). During casing advancement into the overburden, split-spoon samples were collected in the standard interval (5-7', 10-12', etc.), logged and screened using a photoionization detector (PID) with a 10.6 eV lamp.

MW-1, screened in the overburden, was completed with 15 feet of 0.010-inch screen (25-40 feet below ground surface). The other three wells were completed with 10 feet of 0.010-inch screen, with depths ranging from 25 to 52 feet below ground surface. All wells were completed with steel, locking guard pipes approximately 2 feet above ground surface and cemented in place. Monitoring well diagrams are included as Appendix B.

4.2 GROUNDWATER SAMPLING

On 9 June 2003, the monitoring wells were developed to restore natural hydraulic conductivity and remove silt from the well screens to ensure that representative groundwater samples can be collected. Monitoring wells were gauged using a water level indicator and developed by peristaltic pump. Water quality parameters were monitored and recorded every 5 minutes until five times the standing well volume had been purged.

On 15 June 2003, EA conducted a low-flow sampling event for the newly installed monitoring wells. Groundwater samples were collected using low-flow sampling methods and procedures, in accordance with EPA protocols. Low-flow well purging was accomplished using a variable-speed peristaltic pump and dedicated polypropylene discharge lines. Field measurements of water quality indicator parameters, including temperature, pH, conductivity, turbidity, Eh, and dissolved oxygen were monitored and recorded to document stabilization of water quality prior to sample collection. The sampling forms associated with this groundwater monitoring event are included as Appendix C.

All samples were analyzed in accordance with the April 2003 EPA-New England QAPP #9b for the Peterson/Puritan Operable Unit 2. Samples were analyzed for volatile organic compounds by Organic Low Concentration Method 3.2 (OLM03.2) and total metals by EPA Methods Inorganic Low Concentration Method 4.1 (ILM04.1) and 1632 modified in accordance with the EPA's Contract Laboratory Program. Additionally, 1 duplicate sample set and 1 trip blank were collected for the sample delivery group. Detection limits and laboratory methods are detailed in QAPP Worksheet #9b (Appendix D).

4.3 ANALYTICAL RESULTS

Complete Certificates of Analysis for the groundwater samples are included as Appendix E. Table 1 presents a more detailed summary of the groundwater analysis.

4.3.1 Volatile Organic Compounds

The groundwater sample from MW-EA-3 was the only one in which VOCs were detected. The three VOCs detected at MW-EA-3, acetone, methyl tert-butyl ether (MTBE), and toluene, are all associated with petroleum products. However, none of these compounds were detected at levels exceeding the RIDEM GA Groundwater Objectives or the EPA Project Action Limits (PALs), as indicated in the table below.

Volatile Organic Compounds Detected in Groundwater

Analyte Detected (µg/L)	MW-EA-3	EPA PAL	RIDEM GA Groundwater Objectives
Acetone	10	61	--
MTBE	0.79	1.3	40
Toluene	0.52	72	1000

Note: "—" indicates no RIDEM GA Groundwater Objective promulgated for this analyte.
The EPA Project Action Limit (PAL) (QAPP Worksheet #9b, Peterson/Puritan Superfund Site OU-2 April 2003) is the lowest of the risk value criteria. For these analytes, the EPA Region 09 Preliminary Remediation Goals (PRGs) for Tap Water were used.

Of the VOCs detected at MW-EA-3, only toluene was designated as a Project-specific Preliminary Chemical of Potential Concern (PCOPC) for the Peterson/Puritan OU-2. MW-EA-3 was installed downgradient from the material crusher on the western portion of the property. However, low levels of petroleum constituents, such as those detected at MW-EA-3, present no risk to wildlife in the adjacent wetland area or to future development residents.

The analytical results for these wells, installed on the downgradient edge of the subject area, indicate the development property is not a contributor to the known VOC contamination associated with the Peterson/Puritan OU-2, nor is it a receptor of VOC contamination from either operable unit.

4.3.2 Total Metals

A total of 15 metals were detected in the groundwater samples submitted for analysis. None of the samples exceeded RIDEM GA Groundwater Objectives for any metal. Results for all detected analytes are presented in the table below.

Metals Detected in Groundwater

Analyte Detected (µg/L)	MW-EA-1	MW-EA-2	MW-EA-3	MW-EA-4	DUP-01 (MW-EA-4)	EPA PAL	RIDEM GA Groundwater Objectives
Aluminum	47.7	**143**	**100**	34.6	46.0	50 *	--
Barium	80.7	79.6	54.6	59.3	61.8	260	2000
Cadmium	ND	0.85	ND	ND	ND	1.8	5
Calcium	36,400	48,800	103,000	56,700	59,500	--	--
Chromium	ND	0.64	1.1	ND	ND	11	100
Cobalt	ND	ND	1.5	8.5	8.2	220	--
Copper	1.6	3.6	ND	1.5	1.9	140	--
Iron	ND	184	**369**	ND	ND	300 *	--
Magnesium	7110	4100	14,000	9590	10,000	--	--
Manganese	7.9	**66.7**	**422**	**603**	**632**	50 *	--
Nickel	ND	1.9	8.5	9.2	10.0	73	100
Potassium	3690	7680	10,900	6520	6950	--	--
Selenium	3.5	ND	5.8	3.8	4.0	18	50
Sodium	40,200	2490	11,300	21,000	21,700	--	--
Zinc	30.8	39.4	32.1	33.6	16.6	1100	--

Note: "--" indicates no applicable standards promulgated for this analyte.
Bold indicates an exceedance of the applicable standard.
The EPA PAL is the lowest of the risk criteria values. Unless noted with a "*" the PAL is from the EPA Region 09 PRGs for Tap Water.
"*" indicates comparison to the EPA National Secondary Drinking Water Standards.

The only metals that exceeded applicable standards were compared to the National Secondary Drinking Water Standards, for nuisance chemicals. Groundwater is not intended for consumption at the development property. Groundwater at the development property is in compliance with RIDEM GA/GAA Groundwater Objectives, indicating the groundwater is suitable for public consumption without treatment. Therefore, the metals detected in groundwater pose no health risks to the adjacent wetlands or to future residents of the development. The metals designated as PCOPCs for the Peterson/Puritan OU-2, arsenic, cyanide, cadmium, and chromium, were not detected at levels exceeding RIDEM GA Groundwater Objectives or EPA PALs.

4.4 HYDRAULIC ANALYSIS

Following the completion of well installation, a licensed surveyor was contracted to establish the northing and easting coordinates of the wells (on the 1983 Rhode Island State Plane), along with their elevation relative to the National Geodetic Vertical Datum. This data has allowed EA to establish the hydraulic gradient at the property and determine the direction, laterally and vertically, of groundwater flow.

The following table details the GPS coordinates and elevations for the four EA-installed groundwater monitoring wells.

Elevations and GPS Coordinates of Monitoring Wells

	MW-EA-1	MW-EA-2	MW-EA-3	MW-EA-4
Northing (m)	92888.268	92989.904	93176.013	93297.648
Easting (m)	107494.302	107202.507	106703.774	106595.934
Elevation (Top of Casing)	92.24	78.32	78.76	79.75
Elevation (Top of WT)	64.14	61.47	60.20	62.16

Note: WT = water table
The WT elevations are based upon gauging results from 9 June 2003.

Based upon these measurements, the estimated groundwater flow direction is towards the site wetlands and the New River. From the northern wells (MW-EA-3 and 4), groundwater flow is to the south/southwest, and from the southern wells (MW-EA-1 and 2), groundwater flow is to the north/northwest.

5.0 SURFACE WATER/SEDIMENT EVALUATION

The surface water/sediment sample locations are included on Figure 2.

5.1 SAMPLE COLLECTION

On 9 June 2003, surface water and sediment samples were collected from two streams located on the Berkeley Commons and River Run Development properties, within the RIDEM 100-foot riverbank wetland buffer zone. Surface water/sediment sample location WT-01 is an intermittent stream and was located in the presence of an EPA representative prior to sample collection. Coordinates for this sample location in the Rhode Island State Plane, 1983 in meters are 93133.218 north and 107001.815 east. The source of this intermittent stream is runoff from Mendon Road, properties east of Mendon Road, and a residential development abutting the property to the north. This runoff is temporarily contained in a basin before the water crosses the paved access road and empties into the New River. The surface water sample was analyzed for VOCs by EPA Method OLC03.2, SVOCs by EPA Methods OLC03.2 and 8270 SIM, and TAL Metals by EPA Method ILC04.1. A duplicate surface water sample (WT-DUP01) was collected at this location for surface water. The sediment sample from this location was analyzed for VOCs by EPA Method OLM04.2, SVOCs by EPA Method ILM04.2 and 8270SIM, and TAL Metals by EPA Method ILM04.1. Detection limits and analytical methods are detailed in the April 2003 EPA-New England QAPP Worksheet #9b for the Peterson/Puritan Superfund Site OU-2 (Appendix D).

Sample location WT-02, from Monastery Brook, was also located in the presence of an EPA representative prior to sample collection. Coordinates for this sample location are 93147.371 north and 107108.920 east. This stream has a source approximately 1.5 miles north of the property and its drainage area includes several residential areas and paved roads. The surface water sample was analyzed for VOCs, SVOCs, and TAL Metals. The sediment sample was analyzed for VOCs, SVOCs, and TAL Metals. A trip blank was also submitted for VOC analysis.

5.2 SURFACE WATER ANALYTICAL RESULTS

The complete Certificates of Analysis for the surface water evaluation are included as Appendix F. Table 2 presents a detailed summary of the surface water analytical results.

5.2.1 Volatile Organic Compounds

The only VOC detected in the surface water samples was methylene chloride, a common laboratory contaminant. This analyte was also present in the trip blank, at a higher concentration than in WT-01, WT-02, or WT-DUP01. Therefore, it is assumed that the presence of methylene chloride in the surface water samples is a byproduct of

contamination during collection, transport, or cross-contamination at the laboratory. For comparison, the levels of methylene chloride detected in the four samples analyzed for VOC-TCL (ranging from 1.1 to 1.4 µg/L) are lower than the RIDEM GA Groundwater Objective (suitable for public consumption without treatment) for methylene chloride of 5 µg/L. The PAL for methylene chloride is 4.7 µg/L based upon the EPA Water Quality Criteria, a level much higher than those detected in these surface water samples. Also, methylene chloride is not identified as a PCOPC for OU-2. This detected VOC does not cause concern about surface water quality at the property.

5.2.2 Semi-Volatile Organic Compounds

A total of 8 SVOCs were detected in the surface water samples. Due to low detection limits, 6 of the detected SVOCs are Tentatively Identified Compounds (TICs). Also, in WT-02, two compounds were identified tentatively as aldol-condensation products (ACP). The table below summarizes the identified SVOCs in the surface water samples.

Semi-Volatile Organic Compounds Detected in Surface Water

Analyte Detected (µg/L)	WT-01	WT-02	WT-DUP01 (WT-01)	EPA PAL
ACP	ND	4.0 *B	ND	--
bis(2-Ethylhexyl)phthalate	**8.0**	ND	ND	1.8
Butyl hexadecanoate	120 *	ND	ND	--
Butylbenzylphthalate	ND	ND	0.930 J	1.9
Caprolactam	ND	1.3 J	1.1 J	1800
Hexadecanoic acid	ND	ND	26 *	--
Octadecanoic acid, butyl ester	20 *	ND	ND	--
2-Pentene, 2,3-dimethyl-	ND	12 *	ND	--
Propanoic acid	ND	2.2 *	ND	--

Note: The EPA PAL is the lowest of the risk value criteria.
"—" indicates no standard promulgated for this analyte.
Bold indicates an exceedance of the applicable standard.
"*" indicates a TIC.
B = Present in blank.
J = Analyte not detected above Method Detection Limit; Estimated value.

The PAL for bis(2-Ethylhexyl)phthalate is based upon the EPA Water Quality Criteria for water and organisms. This SVOC is ubiquitious, also recognized as a common laboratory contaminant, and is used commercially as a plasticizer and a replacement for PCBs in electric capacitors. Levels of bis(2-Ethylhexyl)phthalate present in the environment are not suspected to cause health affects in humans.

5.2.3 Total Metals

A total of 14 metals were detected between the 3 surface water samples submitted for SW-846 analysis. The table below summarizes the metals identified in the surface water samples.

Metals Detected in Surface Water

Analyte Detected (µg/L)	WT-01	WT-02	WT-DUP01 (WT-01)	EPA PAL
Aluminum	**245**	**156**	**303**	87
Barium	**46.2**	**30.7**	**46.2**	3.9
Beryllium	ND	0.11	0.12	0.17
Calcium	34600	13200	33700	--
Chromium	0.74	0.74	0.96	11
Copper	**6.0**	**6.1**	**5.7**	2.87
Iron	683	752	655	1000
Lead	**2.1**	**2.3**	**2.5**	0.32
Magnesium	4020	2270	3820	--
Manganese	**153**	47.8	**129**	80
Nickel	1.9	2.0	2.4	40.28
Potassium	5510	1370	5490	--
Sodium	20100	18100	19100	--
Zinc	**32.2**	**33.6**	**70.2**	26.72

Note: "—" indicates no standard promulgated for this analyte.
Bold indicates an exceedance of the appropriate standard.
The EPA PAL is the lowest of the risk value criteria.

The PALs were exceeded for six metals in surface water. These PALs were based upon the RIDEM Ambient Water Quality Criteria for freshwater aquatic life and the Freshwater Ecotox Thresholds established by EPA. Of these six metals, copper and lead were designated as PCOPCs on the QAPP for OU-2.

5.3 SEDIMENT ANALYTICAL RESULTS

Complete Certificates of Analysis for sediment sampling are included as Appendix G. Table 3 presents a more detailed summary of sediment analytical results.

5.3.1 Volatile Organic Compounds

No volatile organic compounds were detected in the sediment samples submitted for VOC-TCL analysis.

5.3.2 Semi-Volatile Organic Compounds

A total of 4 SVOCs were positively identified and 5 SVOCs were tentatively identified in the sediment samples collected during this investigation. The table below summarizes the SVOCs detected in these sediment samples.

Semi-Volatile Organic Compounds Detected in Sediment

Analyte Detected (µg/L)	WT-01	WT-02	EPA PAL
ACP	290 *	1000 *	--
Benzo(b)fluoranthene	ND	100	620
Butane 2,3-dimethyl-2-nitro	200 *	ND	--
Fluoranthene	ND	150	423
Hexadecanoic acid	170 *	650 *	--
Methylacrylamide	140 *	200 *	--
3-Pentene-2-one	99 *	ND	--
Phenanthrene	ND	75	204
Pyrene	ND	100	195

Note: "—" indicates no standard promulgated for this analyte.
"*" indicates a Tentatively Identified Compound (TIC).
The EPA PAL is the lowest of the risk value criteria.

There were no exceedances of the PALs for any of the SVOCs detected in sediment. Therefore, the sediment is not contributing to any risks to the flora and fauna in the adjacent wetlands.

5.3.3 Total Metals

A total of 17 metals were detected in the sediment samples, and the results are also compared to the EPA PAL in the following table.

Metals Detected in Sediment

Analyte Detected (mg/kg)	WT-01	WT-02	EPA PAL
Aluminum	5030	3900	7600
Arsenic	**3.1**	**3.3**	0.39
Barium	48.2	62.1	540
Beryllium	0.25	0.97	15
Cadmium	ND	0.35	6
Calcium	2430	3590	--
Chromium	11.5	9.1	30
Cobalt	5.8	6.1	470
Copper	15.1	**19.7**	16
Iron	**9690**	**8960**	2300
Lead	13.7	**43.9**	31
Magnesium	3020	1520	--
Manganese	**329**	**365**	180
Nickel	9.9	8.6	16
Potassium	1670	382	--
Vanadium	12.0	14.7	55
Zinc	39.9	78.5	120

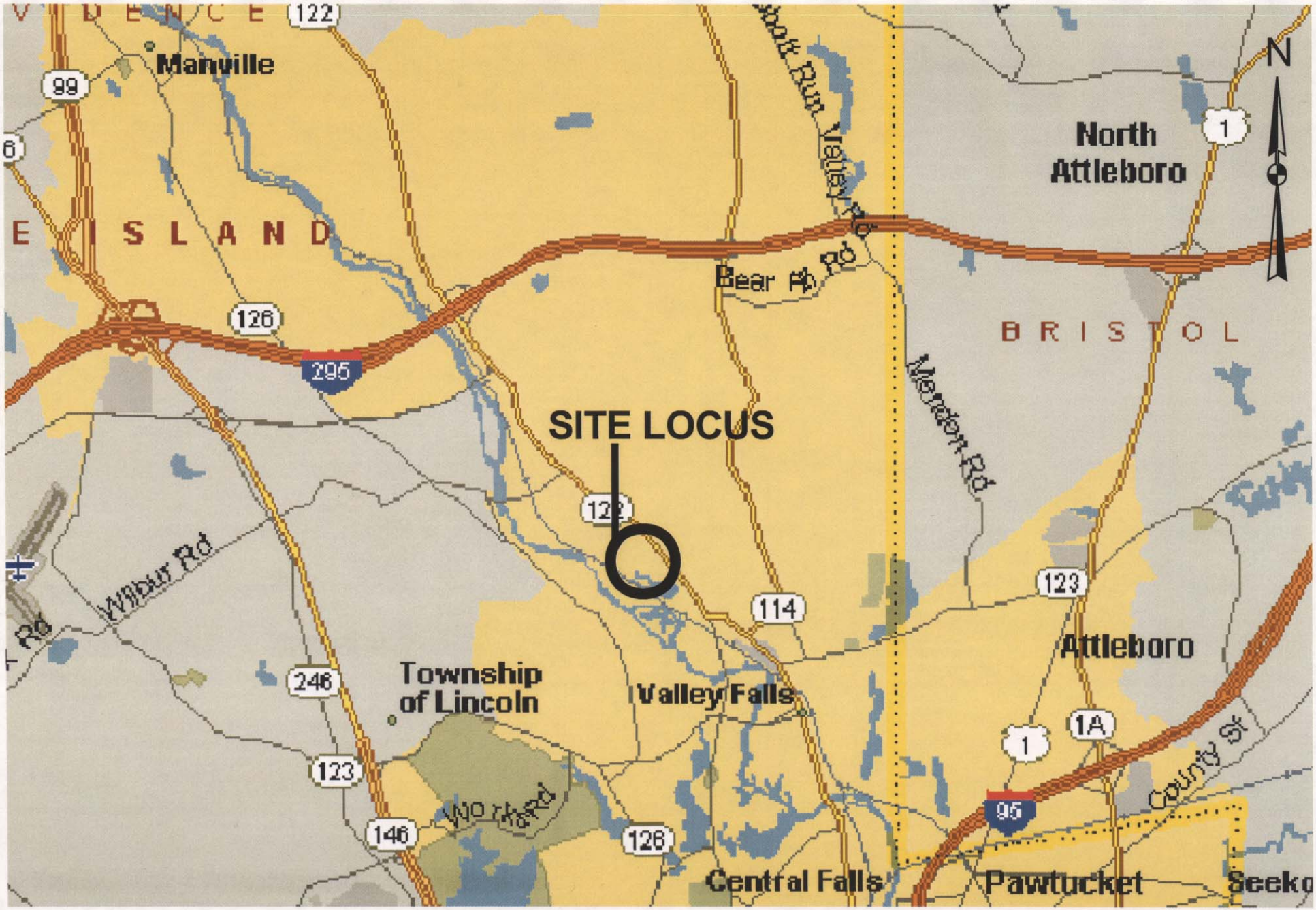
Note: **Bold** indicates an exceedance of the EPA PAL.
"—" indicates no standard promulgated for the given analyte.
The EPA PAL is the lowest of the risk value criteria.

Five metals exceeded the EPA PALs in the sediment samples collected from the site wetlands. For lead and copper, the PALs were based upon the Sediment Quality Criteria Lowest Effect Levels by the Ontario Ministry of the Environment. For arsenic, iron, and manganese, the PALs were based upon the EPA Region 09 Residential Soils PRGs. The levels of metals detected in these sediments are not expected to adversely affect humans.

6.0 CONCLUSIONS

EA has concluded that the Berkeley Commons and River Run Development property is not contributing to the VOC contamination of groundwater associated with the Peterson/Puritan Superfund Site. Also, analytical results of groundwater sampling do not indicate that the property is being affected by the VOC contamination.

Although there were indications of the elevated presence of SVOCs and metals in surface water and sediment within the two streams within the RIDEM 100-foot riverbank wetland buffer zone, the levels detected are not considered environmentally significant. These SVOCs and metals in surface water and sediment have no apparent source within the development property. Groundwater data does not support the assumption that the Berkeley Commons/River Run Development is contributing to this contamination. The property represents the mouths of the two water bodies sampled, and both have the potential to be affected by numerous upstream sources of contamination, due to the receiving of significant volumes of stormwater runoff from roadways, particularly Mendon and Diamond Hill Roads, prior to reaching the New River and associated wetlands on the development property.



EA ENGINEERING, SCIENCE, AND TECHNOLOGY	2350 POST ROAD WARWICK, RI 02886	FIGURE 1 SITE LOCUS	EA-MCNULTY CUMBERLAND, RHODE ISLAND			
PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	
TR	SW	SW	JP	--	06/11/03	

SCALE: 1" = 200'

0 100' 200' 400' 600'

GRAPHIC SCALE

LEGEND:

- MONITORING WELL LOCATIONS
- SEDIMENT SAMPLING LOCATIONS
- SITE BOUNDARY
- ROADS
- PROPOSED DEVELOPMENT
- BUILDINGS

FILE I:\TEMP\MCNULTY\07-16-03_AERIAL....DWG

FIGURE 2
GROUNDWATER MONITORING WELLS AND SURFACE WATER/ SEDIMENT SAMPLING LOCATIONS
LIMITED INVESTIGATION REPORT
E.A. McNULTY REAL ESTATE GROUP
CUMBERLAND, RHODE ISLAND

DATE: 30 JULY 2003	PROJECT NUMBER: 6177601
DESIGNED BY: DC	SCALE: As Shown
DRAWN BY: DC	FILE NAME: 07-16-03_AERIAL.dwg
CHECKED BY: JP	DRAWING NUMBER: 1
PROJECT MANAGER: TR	SHEET NUMBER: 1 OF 1

Table 1 PCOPCs and Detected Analytes in Groundwater Samples

Project-specific Preliminary Chemical of Potential Concern	MW-EA-1	MW-EA-2	MW-EA-3	MW-EA-4	DUP-01 (MW-EA-4)	Project Action Limits
VOCs						
Vinyl Chloride	ND	ND	ND	ND	ND	0.41
Trichlorofluoromethane	ND	ND	ND	ND	ND	130
Acetone*	ND	ND	ND	ND	ND	61
1,1-Dichloroethene	ND	ND	ND	ND	ND	0.46
Methyl tert-Butyl Ether *	ND	ND	0.79	ND	ND	2
Chloroform	ND	ND	ND	ND	ND	1.6
1,2-Dichloroethane	ND	ND	ND	ND	ND	1.2
Carbon Tetrachloride	ND	ND	ND	ND	ND	1.7
1,2-Dichloropropane	ND	ND	ND	ND	ND	1.6
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	4
Trichloroethene	ND	ND	ND	ND	ND	1.6
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	2
Benzene	ND	ND	ND	ND	ND	3.5
Trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	4
Tetrachloroethene	ND	ND	ND	ND	ND	1.1
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	0.55
Toluene	ND	ND	0.52	ND	ND	72
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	0.5
etals						
Aluminum*	47.7	**143**	**100**	34.6	46.0	50
Arsenic	ND	ND	ND	ND	ND	0.45
Barium*	80.7	79.6	54.6	59.3	61.8	260
Cadmium	ND	0.85	ND	ND	ND	1.8
Calcium*	36,400	48,800	103,000	56,700	59,500	NA
Chromium	ND	0.64	1.1	ND	ND	11
Cobalt*	ND	ND	1.5	8.5	8.2	220
Copper	1.6	3.6	ND	1.5	1.9	140
Iron*	ND	184	**369**	ND	ND	300
Lead	ND	ND	ND	ND	ND	15
Magnesium*	7110	4100	14,000	9590	10,000	NA
Manganese*	7.9	**66.7**	**422**	**603**	**632**	50
Nickel*	ND	1.9	8.5	9.2	10.0	73
Potassium*	3690	7680	10,900	6520	6950	NA
Selenium*	3.5	ND	5.8	3.8	4.0	18
Sodium*	40,200	2490	11,300	21,700	21,700	NA
Zinc*	30.8	39.4	32.1	33.6	16.6	1100

te: "*" denotes a detected analyte but not a PCOPC.
Bold denotes an exceedance of the PAL.
ND = Not detected.
NA = No PAL established for this analyte.

Table 2 PCOPCs and Detected Analytes in Surface Water Samples

Project-specific Preliminary Chemical of Potential Concern (µg/L)	WT-01	WT-DUP01 (WT-01)	WT-02	Project Action Limits (µg/L)
VOCs				
Vinyl Chloride	ND	ND	ND	0.41
Trichlorofluoromethane	ND	ND	ND	130
Methylene Chloride	1.2	1.2	1.1	4.7
1,1-Dichloroethene	ND	ND	ND	0.057
Chloroform	ND	ND	ND	1.6
1,2-Dichloroethane	ND	ND	ND	0.38
Carbon Tetrachloride	ND	ND	ND	0.25
1,2-Dichloropropane	ND	ND	ND	0.52
cis-1,3-Dichloropropene	ND	ND	ND	0.055
Trichloroethene	ND	ND	ND	2.7
1,1,2-Trichloroethane	ND	ND	ND	0.6
Benzene	ND	ND	ND	1.2
trans-1,3-Dichloropropene	ND	ND	ND	0.055
Tetrachloroethene	ND	ND	ND	0.8
1,1,2,2-Tetrachloroethane	ND	ND	ND	0.17
Toluene	ND	ND	ND	9.8
1,4-Dichlorobenzene	ND	ND	ND	1.2
SVOCs				
Naphthalene	ND	ND	ND	2.6
Caprolactum	ND	1.1 J	1.3 J	1800
2-Methylnaphthalene	ND	ND	ND	2.6
Acenaphthylene	ND	ND	ND	2.6
Acenaphthlene	ND	ND	ND	1.9
Fluorene	ND	ND	ND	3.9
Pentachlorophenol	ND	ND	ND	0.28
Phenanthrene	ND	ND	ND	6.3
Anthracene	ND	ND	ND	0.73
Di-n-butylphthalate	ND	ND	ND	33
Fluoranthene	ND	ND	ND	4.4
Pyrene	ND	ND	ND	18
Butylbenzylphthalate	ND	0.930 J	ND	1.9
Benzo(a)anthracene	ND	ND	ND	0.0044
Chrysene	ND	ND	ND	0.0044
bis(2-Ethylhexyl)phthalate	**8.0**	ND	ND	1.8
Benzo(b)fluoranthene	ND	ND	ND	0.0044
Benzo(k)fluoranthene	ND	ND	ND	0.0044
Benzo(a)pyrene	ND	ND	ND	0.0044
Indeno(1,2,3-cd)pyrene	ND	ND	ND	0.0044
Dibenzo(a,h)anthracene	ND	ND	ND	0.0044
Benzo(g,h,i)perylene	ND	ND	ND	2.6
Metals				
Aluminum*	**245**	**303**	**156**	87
Arsenic	ND	ND	ND	0.05
Barium*	**46.2**	**46.2**	**30.7**	200
Cadmium	ND	ND	ND	0.3
Calcium*	34,600	33,700	13,200	NA
Chromium	0.74	0.74	0.96	11
Copper	**6.0**	**5.7**	**6.1**	2.87
Iron*	683	655	752	1000
Lead	**2.1**	**2.5**	**2.3**	0.32
Magnesium*	4020	3820	2270	NA
Manganese*	**153**	**129**	47.8	80
Nickel*	1.9	2.4	2.0	40.28
Potassium*	5510	5490	1370	NA
Sodium*	20,100	19,100	18,100	NA
Zinc*	**32.2**	**70.2**	**33.6**	26.72

Note: "*" indicates the analyte detected is not a PCOPC.
Bold indicates an exceedance of the PAL.
J = Not detected above the Method Detection Limit; Estimated value. ND = Not detected.

Table 3 PCOPCs and Detected Analytes in Sediment Samples

Project-specific Preliminary Chemical of Potential Concern (µg/kg)	WT-01	WT-02	Project Action Limits (µg/kg)
VOCs			
Vinyl Chloride	ND	ND	150
Trichlorofluoromethane	ND	ND	39,000
1,1-Dichloroethane	ND	ND	27
Chloroform	ND	ND	22
1,2-Dichloroethane	ND	ND	250
Carbon Tetrachloride	ND	ND	47
1,2-Dichloropropane	ND	ND	350
Cis-1,3-Dichloropropene	ND	ND	0.051
Trichloroethene	ND	ND	1600
1,1,2-Trichloroethane	ND	ND	840
Benzene	ND	ND	57
Trans-1,3-Dichloropropene	ND	ND	0.051
Tetrachloroethene	ND	ND	410
1,1,2,2-Tetrachloroethane	ND	ND	380
Toluene	ND	ND	50
1,4-Dichlorobenzene	ND	ND	340
SVOCs			
Napththalene	ND	ND	160
2-Methylnaphthalene	ND	ND	160
Acenaphthylene	ND	ND	160
Acenaphthlene	ND	ND	16
Fluorene	ND	ND	77.4
Pentachlorophenol	ND	ND	3000
Phenanthrene	ND	75	204
Anthracene	ND	ND	27
Di-n-butylphthalate	ND	ND	11,000
Fluoranthene	ND	150	423
Pyrene	ND	100	195
Benzo(a)anthracene	ND	ND	108
Chrysene	ND	ND	166
bis(2-Ethylhexyl)phthalate	ND	ND	35,000
Benzo(b)fluoranthene	ND	100	620
Benzo(k)fluoranthene	ND	ND	240
Benzo(a)pyrene	ND	ND	62
Indeno(1,2,3-cd)pyrene	ND	ND	200
Dibenzo(a,h)anthracene	ND	ND	33
Benzo(g,h,i)perylene	ND	ND	170
Metals			
Aluminum*	5,030,000	3,900,000	7,600,000
Arsenic	**3100**	**3300**	390
Barium*	48,200	62,100	540,000
Beryllium*	250	970	15,000
Cadmium	ND	350	600
Calcium*	2,430,000	3,590,000	NA
Chromium	11,500	9100	30,000
Cobalt*	5800	6100	47,000
Copper	15,100	**19,700**	16,000
Iron*	**9,690,000**	**8,960,000**	2,300,000
Lead	13,700	**43,900**	31,000
Magnesium*	3,020,000	1,520,000	NA
Manganese*	**329,000**	**365,000**	180,000
Nickel*	9900	8600	16,000
Potassium*	1,670,000	382,000	NA
Vanadium*	12,000	14,700	55,000
Zinc*	39,900	78,500	120,000

Note: "*" indicates the analyte detected is not a PCOPC.
Bold indicates an exceedance of the PAL.
J = Not detected above the Method Detection Limit; Estimated value. ND = Not detected.