EPA NEW ENGLAND
REGION 1

RECORD OF DECISION

WEST KINGSTON TOWN DUMP/URI DISPOSAL AREA SUPERFUND SITE,
SOUTH KINGSTOWN, RHODE ISLAND

SEPTEMBER 2006

PART 1: THE DECLARATION

PART 2: THE DECISION SUMMARY

DECLARATION FOR THE RECORD OF DECISION

A. SITE NAME AND LOCATION

West Kingston Town Dump / URI Disposal Area Superfund Site
South Kingstown, Rhode Island
RID981063993

B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the West Kingston Town Dump/URI Disposal Area Superfund Site (the Site), in South Kingstown, Rhode Island. This remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 USC § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, as amended. The Deputy Director of the Office of Site Remediation and Restoration (OSRR) has been delegated the authority to approve this Record of Decision (ROD).

This decision was based on the Administrative Record, which has been developed in accordance with Section 113(k) of CERCLA, and which is available for review at the South Kingstown Public Library in Peace Dale, Rhode Island, at the Rhode Island Department of Environmental Management (RIDEM) in Providence, Rhode Island, and at the United States Environmental Protection Agency (EPA) Region 1 OSRR Records Center in Boston, Massachusetts. The Administrative Record Index (Appendix E to the ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

RIDEM has reviewed the various alternatives and has indicated its support for the selected remedy. RIDEM has also reviewed the Remedial Investigation, Risk Assessment, and the Feasibility Study. RIDEM concurs in the selected remedy for the Site.

C. ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

D. DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for the West Kingston Town Dump/URI Disposal Area Site. This remedy is a comprehensive approach to the Site. It involves treatment of source area soils and source area groundwater using in situ chemical oxidation processes and monitored natural attenuation (MNA) to achieve restoration of the groundwater aquifer to drinking water standards. Contamination in downgradient groundwater will be subjected to MNA. MNA is also part of the remedy for source area groundwater, inasmuch as chemical oxidation is expected to greatly reduce contaminant mass but will not by itself achieve the required cleanup levels for groundwater. The remedy also includes institutional controls in the form of an Environmental Land Use Restriction (ELUR), to prevent the disturbance of the remedy components and to restrict the use of contaminated groundwater for drinking water purposes until restoration to drinking water standards is achieved. This remedy will allow for the restoration of the Site for potential future use.[1]

Two former landfills at the Site, the former Town Dump and URI Disposal Area, have been capped under RIDEM oversight pursuant to state law. Although these caps are separate from the selected remedy, the selected remedy assumes that the caps will prevent any future leaching of contaminants into the groundwater from the landfill areas. These RCRA cover systems will be inspected and maintained by the potentially responsible parties acting under state oversight. The state-regulated landfill closure will also include institutional controls that will be used to protect the landfill caps from being disturbed. In addition to state oversight of the landfill closure, reports on the status of these caps will be included in environmental monitoring reports submitted as part of this remedy, as described more below.

The major components of this selected remedy are:

1. Treatment Technologies – To clean up contaminated source area soils, a top layer of clean soil will be removed and an oxidant (such as potassium permanganate) will be mechanically mixed into the contaminated soils below, oxidizing contaminants until soil cleanup levels are achieved. Confirmation samples will be taken to document pre- and post-treatment soil conditions; the clean soil will be backfilled. The source area groundwater plume will be treated with sodium permanganate (or similar oxidant) via several injection wells to be constructed in the source area. The injection wells will carry a solution of oxidant into the bedrock of the Former Drum Storage Area, where the source area groundwater plume exists. The oxidant solution is expected to be injected into the subsurface area until 90% of the VOC mass in the source area groundwater is eliminated.

2. Monitored Natural Attenuation – Naturally occurring processes will reduce

[1] It is also expected that an exceedance of Rhode Island ambient water quality criteria in URI Pond will be eliminated as the groundwater that discharges into the Pond is cleaned up.

contaminant concentrations that remain in the source area groundwater following the in-situ oxidation treatment. In addition, MNA will be the primary means of reducing contaminant concentrations in the portion of the groundwater plume that is downgradient of the source area. It is also expected that an exceedance of Rhode Island ambient water quality criteria in the URI Pond will be eliminated as the groundwater discharging into the Pond is cleaned up. URI Pond will be monitored as a means of measuring the performance of the groundwater remediation.

3. Institutional Controls – Institutional controls in the form of deed restrictions, otherwise known as ELURs, will restrict the use of contaminated groundwater until restoration to drinking water standards is achieved, and will prohibit activities that would disturb remedy components.

4. Long-Term Monitoring – Long-term environmental monitoring will be conducted throughout the Site to monitor MNA and the effectiveness of the selected remedy.

The principal threat waste at the Site is the source area soil, which is leaching contaminants into groundwater. The selected response action addresses this threat by oxidizing and destroying contaminants in the source area soil. There are no other principal or low-level threat wastes, inasmuch as the source area groundwater, the downgradient groundwater, and surface waters are not source materials.

E. STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of materials comprising principal threats through treatment).

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure (and groundwater restrictions and/or land use restrictions are necessary), a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

F. ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

- Chemicals of concern (COCs) and their respective concentrations
- Baseline risk represented by the COCs
- Cleanup levels established for COCs and the basis for the levels
- Current and future land and groundwater use assumptions used in the baseline risk assessment and ROD
- Land and groundwater use that will be available at the Site as a result of the selected remedy
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected
- Decisive factor(s) that led to selecting the remedy

G. AUTHORIZING SIGNATURES

This ROD documents the selected remedy for soil, groundwater and surface water remediation at the West Kingston Town Dump / URI Disposal Area Superfund Site. This remedy was selected by EPA with the concurrence of the Rhode Island Department of Environmental Management.

Concur and recommended for immediate implementation:

U.S. Environmental Protection Agency

By: ______________________ Date: 9-28-06

Richard Cavagnero
Deputy Director
Office of Site Remediation and Restoration
Region 1

A. SITE NAME, LOCATION AND BRIEF DESCRIPTION

The West Kingston Town Dump/University of Rhode Island (URI) Disposal Area Superfund Site (the Site) is located primarily on the eastern side of Plains Road in South Kingstown, Washington County, Rhode Island. To the south of the Site is the University of Rhode Island Main Campus. To the west of the Site is Hundred Acre Pond. The National Superfund Database (CERCLIS) Identification Number for the Site is RID981063993.

The Site contains three main disposal areas, each with separate solid waste disposal histories. The first area is the West Kingston Town Dump, also known as the South Kingstown Landfill #2 (hereinafter referred to as the Town Dump). It is on the southern part of the Site and is privately owned; the ownership is in the process of being transferred to the Town of South Kingstown. It is approximately 0.4 miles north of the URI campus. In the early 1950s, the Town of Narragansett, the Town of South Kingstown and URI began disposing of solid waste in this landfill. Disposal continued in at least some form until 1987, as described more below. A pond called Tibbits Pond is located just upgradient from that disposal area.

The second area is the URI Disposal Area, also known as the URI Gravel Bank or Sherman Farm. It is north of the West Kingston Town Dump and is owned by URI. Waste was dumped here from approximately 1945 to 1987, particularly by the University of Rhode Island after the Town Dump closed in 1978. A small pond called URI Pond is located in this area, just south of the main disposal areas.

In addition to the two main landfill areas, a Former Drum Storage Area was discovered in 1989 on the URI property during Site investigations, uphill and east of the Town Dump and the URI Disposal Area. During a 1989 inspection, 12 rusted drums were observed lying on the ground, some with their contents visible. The drums appeared to have contained a brown, caked material, or a hardened tar-like substance, possibly roofing tar. Two additional drums containing roofing tar were discovered in 2004 and 2005. The Remedial Investigation (RI) determined that this area has been and continues to be the primary source of a groundwater plume of tetrachloroethene (PCE) and trichloroethene (TCE) that extends approximately 2,500 feet from the Former Drum Storage Area west to Hundred Acre Pond.

Groundwater at the Site is federally classified as a drinking water aquifer or a potential drinking water aquifer. Under State groundwater regulations, this aquifer is also classified as GAA (suitable for drinking water use without treatment) and areas directly below the closed landfills are classified as GB (not suitable for drinking water use without prior treatment). But because the State has not obtained EPA approval of a Comprehensive State Ground Water Protection Program (CSGWPP), it is necessary to default to the federal classification. Groundwater from areas surrounding the Site is used for public and private water supplies as well as for irrigation; however no groundwater is currently drawn from the Site itself.

The remedy selected in this Record of Decision has been developed to clean up the contamination at and resulting from the Former Drum Storage Area only, and to restore the groundwater aquifer to drinking water standards. The Town Dump and the URI Disposal Area have each been capped with a RCRA impermeable cover system as part of a landfill closure administered by RIDEM. The remedy selected in this ROD is separate from these caps, although the protectiveness of this remedy assumes proper maintenance of these caps. This maintenance will be done by the PRPs under state oversight as part of the separate landfill closure, although maintenance reports on the caps will also be part of the environmental monitoring required by this remedy. As described further below, the investigation leading to the selected remedy has been carried out by the potentially responsible parties at the Site, including the University of Rhode Island, the Town of South Kingstown, and the Town of Narragansett. See **Figure 1**, Site Locus Plan, for location of the Site. A more complete description of the Site can be found in sections 1 through 3 of the RI Report.

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

The Site history presented in this section is based primarily on findings in the Hazard Ranking System package for the Site, the Final Listing Site Inspection Report, and the USEPA Environmental Photographic Interpretation Center (EPIC) aerial photographic interpretation, all of which are referred to in the RI.

The Site was listed on the National Priorities List (NPL) on October 14, 1992. Below is a summary of waste disposal activities for the West Kingston Town Dump, the URI Disposal Area, and the Former Drum Storage Area. See **Figure 2**, Site Plan, for the Site layout. Although all three areas are part of the Site, the remedy selected in this ROD addresses contamination at and resulting from the Former Drum Storage Area exclusively; as discussed above, the selected remedy assumes that a separate remedy administered by the State (landfill closure, including impermeable caps, maintenance and institutional controls) will remain protective with respect to contamination from the West Kingston Town Dump and the URI Disposal Area. These caps are discussed more fully in "Landfill Caps," below.

<u>West Kingston Town Dump</u>

This area comprises two discrete disposal areas, designated FA2 and FA3. Gravel was mined from what would become the West Kingston Town Dump beginning in the 1930s and continuing until the early 1960s. Excavation likely continued until the water table was encountered. In 1951, URI and the Towns of South Kingstown and Narragansett began disposing of wastes on the property. Gravel extraction and waste disposal continued through the 1950s. By 1962, a pond existed in the excavation to the east of the disposal area. An additional disposal area was identified to the south of the pond.

The Town Dump operated unregulated until the Rhode Island Department of Health (RIDOH) began inspections in 1967. At that time, RIDOH noted that wastes from industrial, residential, commercial, and institutional sources were being disposed of at the Town Dump. The landfill was closed in 1978 by covering it with soil from the Site and grading; however, RIDEM did not issue a certificate of closure. Disposal at the dump was noted at least until 1987.

<u>URI Disposal Area</u>

This area comprises three discrete disposal areas, designated FA1, FA4, and FA5. Gravel mining occurred in what would become the URI Disposal Area beginning in the late 1940s. FA1, an area slightly over one acre in the northern part of the Site, was used between 1945 and 1951 for disposal of solid waste, including building and landscape debris and furniture. Waste began to be dumped in FA4 between 1962 and 1972 and ended by 1975. Between 1972 and 1975, waste and debris were dumped in FA5, to the south of FA1 and north of the access road.

<u>Former Drum Storage Area</u>

A 1989 site inspection by an EPA contractor discovered an area of drum disposal (an area now referred to as the Former Drum Storage Area) uphill and east of the above-described waste areas and west of the access road, just south of a radio tower located on the Site. Twelve rusted drums were observed lying on the ground, some with contents visible. The drum contents were described as brown, caked material, or as a hardened tar-like substance. Stained soil was noted around one drum. No sampling of the drums or the surrounding soil was conducted at that time. Two additional drums containing roofing tar were discovered in 2004 and 2005. Sampling activities during the Remedial Investigation (RI) determined that subsurface soil and groundwater in this area is the primary source of a groundwater plume of tetrachloroethene (PCE) and trichloroethene (TCE) that extends approximately 2,500 feet from the Former Drum Storage Area west toward Hundred Acre Pond.

Landfill Caps

Waste from the West Kingston Town Dump and the URI Disposal Area was recently consolidated and placed underneath impermeable RCRA caps (with the closed landfills generally located in the FA2, FA4, and FA5 areas). Although these RCRA caps were designed using EPA guidance on presumptive remedies for landfills, this action was carried out by certain PRPs under state supervision and pursuant to state law. The goal of this landfill closure system has been to contain and consolidate the contaminant mass to significantly reduce possible direct exposure, leachate production, and contaminant migration through groundwater to surface waters and sediments.

Although separate from the selected remedy, the selected remedy assumes that the landfill cap system currently in place will be maintained, will prevent any future exposure to soils or materials beneath the cap, and will prevent leaching of contaminants into the groundwater from the landfill areas. The RCRA cap system will be inspected and maintained by the PRPs under state oversight as part of the landfill closure (although additional reports on cap maintenance will be included in the environmental monitoring required as part of this remedy). The state-regulated landfill closure will also include institutional controls that will be used to protect the landfill caps from being disturbed.

A more complete description of the Site history can be found in Section 1.3 of the RI report.

2. History of Federal and State Investigations and Removal and Remedial Actions

Several environmental investigations have been conducted at the Site since 1975. Environmental investigations have been lead by the RIDOH, RIDEM, USEPA, and URI. Tables B-1 and B-2 present a summary of the work conducted during previous investigations and previous/current response actions, respectively, including the dates and the agency/party that performed the work.

Table B-1: Summary of Previous Investigations

Date	Investigation Conducted By	Work Conducted and Results
1975	Rhode Island Water Resources Board/ Department of Civil and Environmental Engineering at URI	Monitoring wells were sampled for inorganics to characterize the water quality conditions below the landfills. This investigation concluded that a leachate plume approximately 1,200 ft wide existed below the Site, flowing west.
1977	Solid and Hazardous Waste Research Division of EPA	Following this groundwater investigation, USEPA concluded that the dump did not meet criteria requiring "conclusive evidence that the study area is polluting." The exact locations of the wells sampled and the analytical methods used during this study are not known.
June – November 1987	Rhode Island Department of Health (RIDOH)	Five private wells on Plains Road were sampled by RIDOH as part of a regional sampling study. Three private wells contained five VOCs that were detected during the initial testing, including: 1,1,1-TCA, TCE, PCE, 1,2-DCE, and 1,1-DCA. These three private wells were connected to the URI water supply in 1988. No VOCs were detected in the two additional private wells on Plains Road.
November 1987	RIDOH	Ten surface water samples were collected from Hundred Acre Pond and analyzed for the same parameters as the private well samples. All surface water samples were non-detect for VOCs.
November 1987	Rhode Island Department of Environmental Management (RIDEM)	A monitoring well and surface water sampling effort was initiated. Groundwater samples were collected from eight pre-existing monitoring wells, all located west of Plains Road, bis(2-ethylhexyl) phthalate was the only compound detected. Sediment and surface water samples were collected from two on-site ponds. Analytical results indicated the presence of VOCs in one surface water sample collected on the URI property immediately east of FA4. Detected VOCs included 1,1,1-TCA, TCE, PCE, 1,2-DCE, and 1,1-DCA. All metals detected were below federal Maximum Contaminant Levels (MCLs). In addition, the two sediment samples from the ponds contained phthalates.
1989	Environmental Protection Agency (EPA)	Through its contractor, EPA installed and sampled four on-site groundwater monitoring wells, identified as GW-01 through GW-04. Groundwater samples collected from these monitoring wells were analyzed for VOCs, SVOCs,

Table B-1: Summary of Previous Investigations

Date	Investigation Conducted By	Work Conducted and Results
		metals, pesticides, and PCBs. Detected VOCs in these samples included acetone, 1,2-DCE, 4-methyl-2-pentanone, TCE, and PCE. Detected SVOCs included bis(2-ethyhexyl)phthalate, which was detected in all of the wells. PCE, TCE, 1,2-DCE, and lead were detected at concentrations at or exceeding three times the background concentration or exceeding the sample quantitation limit (SQL) for that compound.
2002-2005	University of Rhode Island, Town of South Kingstown, and Town of Narragansett	These PRPs completed a Remedial Investigation to evaluate the nature and extent of contamination and potential impacts from the Former Drum Storage Area. This RI determined that the groundwater contamination was attributable to PCE and TCE from the subsurface soils and groundwater in the Former Drum Storage Area, not the landfills.
2006	University of Rhode Island, Town of South Kingstown, and Town of Narragansett	These PRPs completed a Feasibility Study to assess response actions to address contamination at and from the Former Drum Storage Area.

Notes:
VOC = volatile organic compounds
SVOC = semivolatile organic compound
TCE = trichloroethene
TCA = trichloroethane
DCA = dichloroethane
DCE = dichloroethene
PCE = tetrachloroethene

Table B-2: Summary of Previous/Current Response Actions		
Date	**Action Completed By**	**Action Conducted and Results**
1987	University of Rhode Island	URI removed 159 tons of exposed debris and transported it to a federally-approved waste disposal facility.
1988	University of Rhode Island and the Town of South Kingstown	Three private wells along Plains Road were connected to the URI water supply system.
2000	University of Rhode Island and the Town of South Kingstown	An additional private well along Plains Road was connected to the URI water supply system.
2004	University of Rhode Island, Town of South Kingstown, and Town of Narragansett	A partially full 55-gallon drum near the Former Drum Storage Area was identified. Drum contents were sampled and it was determined to be roofing tar. Drum disposed of by Lincoln Environmental.
2005	University of Rhode Island, Town of South Kingstown, and Town of Narragansett	An additional, partially full 55-gallon drum near the Former Drum Storage Area was identified. Drum contents were sampled and it was determined to be roofing tar. Drum disposed of by Lincoln Environmental.
2005 – June 2006	University of Rhode Island, Town of South Kingstown, and Town of Narragansett	Using EPA's presumptive remedy guidance for municipal landfills, and pursuant to a state-regulated landfill closure, the solid waste areas (FA1, FA2, FA3, FA4, and FA5) at the West Kingston Town Dump and the URI Disposal Area were consolidated and placed beneath a RCRA impermeable cap system.

3. History of CERCLA Enforcement Activities

In November 1997, EPA sent Information Request letters to potential generators and transporters at the Site. In June 2000, EPA issued general notice letters to four Potentially Responsible Parties (PRPs), identifying them as potentially responsible for investigating and cleaning up the Site. These parties were owners or operators of a facility at the Site at the time hazardous substances were disposed of at the Site, and/or were current owners of part of the Site.

In August 2001, EPA and RIDEM entered into an Enforcement Agreement to implement a presumptive remedy (landfill caps) and a Remedial Investigation/Feasibility Study (RI/FS) for the Site. In October 2001 RIDEM issued a Letter of Responsibility to the four PRPs who had previously received EPA's general notice letter. This Letter of Responsibility included a proposed Scope of Work under which the PRPs would carry out the landfill closures and complete an RI/FS to address contamination at the Site. The parties eventually agreed to undertake this work, and performed the RI/FS in 2002-2006 and implemented the presumptive remedy in 2005-2006. As noted above, data collected for the RI/FS shows that the groundwater contamination was attributable to PCE and TCE present in the subsurface soil and groundwater at the Former Drum Storage Area rather than the landfills subjected to the presumptive remedy.

To date, the PRPs have implemented the landfill closures by constructing the RCRA impermeable cap system under RIDEM oversight, and have completed the RI/FS that is the basis for the remedy in this ROD.

C. COMMUNITY PARTICIPATION

Throughout the Site's history, community concern and involvement has been low to moderate. The PRPs, EPA, and RIDEM have kept the community and other interested parties apprised of Site activities through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of public outreach efforts.

On July 29, 2002, RIDEM issued a press release announcing the beginning of the remedial investigation activities by the PRPs.

On December 7, 2004, RIDEM, EPA, and the PRPs hosted an informational meeting in the Town of South Kingstown Council Chambers to discuss the results of the Remedial Investigation and to present the landfill cap design.

On October 26, 2005, PRPs, RIDEM, and EPA held an open house meeting at URI to describe the plans for selecting the Remedial Action for the Site and to answer questions.

On June 16, 2006, RIDEM and EPA issued the Proposed Plan for the Site, with cleanup alternatives evaluated by the agencies and a remedy proposal (i.e., the remedy selected in this ROD).

On June 21, 2006, RIDEM published a notice and brief analysis of the Proposed Plan in the Narragansett Times and made the plan available to the public at EPA's Records Center, 1 Congress Street, Boston, MA (617) 918-1440; at the South Kingstown Public Library, 1057 Kingstown Road, Peace Dale, RI 02879 (401)-783-4085; and at RIDEM's office at 235 Promenade Street, Providence, RI 02908.

On June 23, 2006, RIDEM and EPA made the administrative record available for public review at the Peace Dale library, at EPA, and at RIDEM.

On June 28, 2006, RIDEM and EPA held an informational meeting to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Feasibility Study and to present the Proposed Plan for cleaning up the Site. At this meeting, representatives from EPA, RIDEM, and the PRPs answered questions from the public.

From June 29, 2006 to July 31, 2006, the Agency held a 30-day public comment period to accept public comments on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public.

On July 26, 2006, the Agency held a public hearing to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting and the comments and the Agency's response to comments are included in the Responsiveness Summary, which is part of this Record of Decision.

D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The selected remedy was developed by combining components of source control and management of migration alternatives to obtain a comprehensive Site remediation. Clean topsoil will be removed and contaminated subsurface soils will be excavated within the Former Drum Storage Area to the depth of contamination. Contaminated soils will then be treated via in-situ mixing of a chemical oxidant (such as potassium permanganate) to reduce the mass and concentration of VOCs in source area soil, until soil cleanup levels are achieved. Following treatment, the excavation area will be backfilled with the clean soil and re-vegetated. Source area groundwater will be addressed through a similar process. Chemical oxidants (such as sodium permanganate) will be injected into source area groundwater through injection wells to reduce the mass of VOCs present in groundwater, with the goal of achieving 90% mass reductions. Additional mass reductions necessary to achieve cleanup levels in the source area groundwater will be accomplished through monitored natural attenuation (MNA) – i.e., dissolved constituents in the source area groundwater will be monitored to show the ability of natural attenuation processes to reduce the concentration and mass of dissolved site-related VOCs in groundwater over time. The same process of MNA will be the exclusive means of achieving cleanup levels in the downgradient groundwater. Surface water in the URI Pond (where some groundwater discharges) will also be monitored to measure the performance of the groundwater remediation; the pond is expected to become cleaner as a result of cleaning up the groundwater. Institutional controls will be implemented as part of this alternative to restrict future groundwater use at the Site. An environmental monitoring plan will be developed to evaluate the continued effectiveness of the remedy, including an evaluation of the effectiveness of natural degradation processes. An annual review of the landfill caps' maintenance (in addition to the operation & maintenance oversight performed by the State as part of the landfill closure) and of the institutional controls for the landfill and former drum storage area will be included as a component of this environmental monitoring plan. Finally, as long as waste remains in place so as to prevent unrestricted use of the Site, a Site review will be performed at least every five years to ensure that the remedy remains protective of human health and the environment.

The principal threat waste at the Site is the source area soil, which is leaching contaminants into groundwater. The selected response action addresses this threat by oxidizing and destroying contaminants in the source area soil. There are no other principal or low-level threat wastes, inasmuch as the source area groundwater, the downgradient groundwater, and surface waters are not source materials. Contamination in the groundwater and surface water is also being addressed by oxidation and destruction of VOCs in the source area groundwater and by MNA.

E. SITE CHARACTERISTICS

Chapter 2 of the Feasibility Study contains an overview of the Remedial Investigation. The significant findings of the RI Report dated April 12, 2006 are summarized below.

The Site is located primarily on the eastern side of Plains Road in South Kingstown, Rhode Island as shown on the Site Location Map in **Figure 1**. The Site includes two landfills that have recently been capped: the West Kingston Town Dump and the URI Disposal Area. In addition to the landfills, the Site also includes the Former Drum Storage Area, the groundwater plume associated with this area, and all the areas where contamination from the Site has come to be located. The plume of contamination encompassed by the Site currently extends west from the Former Drum Storage Area to Hundred Acre Pond, roughly 2,500 feet away.

The closed West Kingston Town Dump is comprised of the western 8.1 acres of a 117-acre mixed forest parcel, and the closed URI Disposal Area consists of two discrete areas, 1.7 acres and 2.4 acres, within a 17-acre sand and gravel excavation area. The Former Drum Storage Area (located on the URI property) and the groundwater plume comprise approximately 45 acres. The total acreage of the Site, including the closed landfills and the groundwater plume, is approximately 55 acres, as shown in the Site plan on **Figure 2**.

The former landfills at the Site, the former West Kingston Town Dump and URI Disposal Area, were capped in 2005-2006 (consistent with EPA's presumptive remedy guidance for landfills) under RIDEM oversight and pursuant to state law. Although the landfill caps are separate from the selected remedy, the selected remedy assumes that the capping systems will prevent any future leaching of contaminants into the groundwater from the landfill areas, that the caps will be maintained by the PRPs and will prevent exposures to soils beneath the caps, that institutional controls will be implemented, monitored and enforced if necessary, and that the closed landfills will pose no unacceptable risks to human health or the environment.

The Former Drum Storage Area subsurface soil and groundwater are identified as the primary source of the PCE and TCE groundwater plume at the Site. Elevated levels of PCE and/or TCE were found in the source area subsurface soils, overburden and bedrock groundwater, and in the URI Pond, which is a discharge area located in the path of the groundwater plume. More specifically, PCE in the subsurface soils was found to exceed the RIDEM soil leachability criteria. PCE and TCE in groundwater exceed the maximum contaminant levels (MCLs) set under the federal Safe Drinking Water Act. Surface water samples in the URI Pond indicate a PCE exceedance of Rhode Island's Ambient Water Quality Criteria for aquatic life.

Potential future human health risks for carcinogens and non-carcinogens were above EPA's target risk range and hazard index due to the presence of PCE and TCE in the groundwater, should potable water supply wells be installed in the future at the Site and groundwater be used as a drinking water source for residential or commercial use. No elevated risks to humans were found under all other current and future exposure scenarios, including recreational uses of the

Site. In addition, no unacceptable risk was found based on use of the URI Pond, notwithstanding the exceedance of the state ambient water quality criteria for chronic exposures to aquatic life. Based on modeled exposures and comparison of levels of contaminants in soil, surface water and sediment to reference benchmarks, the screening level ecological risk assessment conducted as part of the RI concluded that there are no significant ecological risks to organisms and wildlife in the Former Drum Storage Area, URI Pond and Hundred Acre Pond.

1. Site Overview

Section A of this ROD described the West Kingston Town Dump/URI Disposal Area Site.

The Site is located in the Chipuxet River Basin. This basin is considered a major groundwater aquifer and consists of glacial outwash deposits. These outwash deposits are discontinuous layers of silt, sand, gravel, and cobbles with a thickness of as much as 150 feet. Bedrock in the area is mapped as the Ten Rod Granite Gneiss. Regional groundwater flow is generally toward the south, although, as explained below, Site groundwater flow is toward the west. Hydraulic conductivity in the glacial outwash aquifer decreases with depth. Groundwater flow in bedrock is believed to be confined to bedrock fractures.

The land in the vicinity of the Site is used primarily for agriculture and forestry. The Site itself includes open overgrown areas associated with former waste disposal activities and recently capped landfills with stormwater management systems. The Site is surrounded by forested areas and turf fields. The URI campus (with an estimated 15,000 students and staff) and a few residential areas are located within one-mile from the Site. Three public water supply wells serving a population of about 40,000 people are located within 1.5 miles from the Site.

The primary surface water feature is Hundred Acre Pond, which lies approximately 2,500 feet west and downgradient from the Former Drum Storage Area. It is approximately 84 acres in size, and is surrounded by woods and waterfront residential developments. The Hundred Acre Pond eastern shoreline area consists of a thick scrub-shrub wetland with woody vegetation. This wetland likely provides habitat to a variety of songbirds such as the red-winged blackbird, swamp sparrow, and American bittern. A variety of other wetland species, such as raccoon, shrews, and muskrat may be expected in this area. Hundred Acre Pond is used for recreational boating, swimming, and fishing for species such as largemouth bass, pickerel, northern pike, and yellow perch.

The primary surface water features located entirely on-site are the URI and Tibbits ponds, which abut the now-closed landfill areas. Both ponds are 0.5 – 1.0 acre in size, with a maximum depth of 10-15 feet. Both ponds have no inflow or outflow, and are fed entirely by groundwater and local surface water runoff. Both ponds now serve as part of the stormwater management system associated with the final landfill closures.

Three small wetland areas (under 0.25 acre in size) previously identified at the Site were within the construction zone of the landfill cover system, and were filled during landfill closure in 2005. However, restoration of these impacted wetlands adjacent to the URI Pond has been incorporated into the landfill closure construction, as approved by the RIDEM Wetlands Section.

Site geology

The Site is situated on the eastern side of the Chipuxet River basin, which slopes gently toward the southwest. The overburden at the Site ranges in thickness from 10 to 150 feet in the east-west direction, increasing sharply downgradient from the landfills, toward Hundred Acre Pond.

Overburden at the Site consists of approximately 5 feet of fine sand and silt lying on top of a gravel and cobble layer; below that is interbedded gravel and sand beds grading into fine to coarse sand. As with the overburden thickness, the depth to bedrock also varies sharply across the Site. The bedrock is exposed just northeast of the Site, and ranges from 20 feet below ground surface (bgs) in the vicinity of the Former Drum Storage Area, to 30 feet bgs at the center of the Site near URI pond, before dipping sharply in the direction of Hundred Acre Pond.

Site hydrogeology

The main features that dominate the flow regime within the Site are the recharge area in the eastern part of the Site, in the vicinity of the Former Drum Storage area, and the large sand and gravel valley fill zone extending from URI Pond and the landfill areas in the east to Hundred Acre Pond in the west. Groundwater flow at the Site is to the west and discharges into the Hundred Acre Pond. Groundwater also discharges to the URI Pond.

A MODFLOW three-dimensional groundwater flow model was prepared as part of the RI. The model, presented in Appendix C of the RI Report, depicts groundwater flow from the Former Drum Storage Area in the easternmost portion of the Site west toward Hundred Acre Pond. The model demonstrates flow originating from the till located above shallow bedrock, then continuing through a deep unconsolidated till at the center portion of the Site. In the lower valley fill/glacial outwash deposits, groundwater flows in a more northwesterly direction toward Hundred Acre Pond, where it turns abruptly to the west as it is influenced by a small, steeply sloped hill adjacent to Hundred Acre Pond.

The water table slopes quite steeply on the eastern side of the Site, starting at an elevation of 150 ft above mean sea level (msl) at the Former Drum Storage Area. The groundwater table drops 40 ft to the outwash plain, where the groundwater elevation is approximately 110 ft above msl at the toe of the slope (where monitoring wells MW-1S/1R and MW-2S/2R are located). From here, the water table is quite flat under the western side of the Site and across Plains Road, and again drops off to its discharge zone into Hundred Acre Pond, which has a surface water elevation of approximately 94 ft above msl. Based on the groundwater model, the travel time between the source area (Former Drum Storage Area) and Hundred Acre Pond is estimated at 6 to 10 years.

The groundwater recharge area in the Former Drum Storage Area (source area) is characterized by shallow bedrock overlaid by 10 to 20 feet of glacial till. The groundwater table in this area is at 15 to 20 feet bgs and seasonally fluctuates near the till/bedrock interface. From here, groundwater flows west primarily at the bedrock/till interface and within the fractured bedrock toward the URI Pond. A transition area from till to sand and gravel outwash soil units is located at the toe of the slope, above the URI Pond, about 700 feet downgradient from the source area. Groundwater in this area is characterized by a strong upward gradient, with groundwater moving from the bedrock into the overburden and discharging into URI Pond, while Tibbits Pond is shown to lie outside the path of the groundwater originating from the Former Drum Storage Area. Further downgradient, the bedrock surface sharply drops about 150 feet between URI Pond and Plains Road over a distance of about 900 feet. Depth to groundwater in this area is 30 to 40 feet bgs and the gradient is relatively flat. West of Plains Road, groundwater again exhibits a strong upward gradient, indicating that groundwater from bedrock is moving toward the overburden, and the overburden groundwater is also moving toward and discharging into Hundred Acre Pond.

2. Nature and Extent of Contamination

The Former Drum Storage Area is located over 800 feet east and upgradient from the now-closed landfill areas. During a 1989 investigation, 12 rusted drums were observed lying on the ground in that area, some with contents of a hardened tar-like substance visible. During the remedial investigation leading to the selection of this remedy, two additional drums were identified on the ground surface at the Former Drum Storage Area. Samples of the contents of the drums detected no VOCs and were disposed of off-site as non-hazardous waste. Field investigations have determined that the PCE/TCE plume present at the Site originated from the subsurface soil and groundwater in this area. Test pits and soil borings showed that the subsurface soil at the Former Drum Storage Area is a natural till, not fill, indicating that no excavation or burial activities occurred in this area.

a. Former Drum Storage Area Soil Investigations

During the remedial investigation, soil samples were collected and analyzed to characterize the contamination in the Former Drum Storage Area as well as to determine the nature and extent of waste material in the former waste disposal (landfill) areas. The latter data was used in the design and closure of the landfill areas. Discussion in this Section focuses on soil investigations of the Former Drum Storage Area, which was found to be the primary source of the groundwater PCE/TCE plume. For additional information see Section 4.2 of the RI Report. See **Figure 3** for the Former Drum Storage Area soil sampling locations.

Three test pits, and two rounds of six soil borings each, were completed between 2003 and 2005 to identify the source of the PCE/TCE plume and to aid in placement of the groundwater monitoring wells. Fifty-nine subsurface soil samples have been collected in and downgradient from the Former Drum Storage Area and analyzed for VOCs. Three VOCs (PCE, TCE and 1,1,1-trichloroethane (1,1,1-TCA)) were detected in several soil samples during the vertical profiling, generally at 10 to 18 feet bgs, indicating a source of VOCs in the overburden. None of the VOCs exceeded RIDEM Direct Exposure Criteria for soils. Three samples of PCE (SB-10 at 12-14 and 14-16 feet bgs; and VP-3A at 15-17 feet bgs) exceeded the RIDEM Leachability Criterion of 0.1 mg/kg, with a maximum concentration of PCE at 0.34 mg/kg. Selected samples were tested for SVOCs and metals. No SVOCs were detected. Eight detected metals did not exceed RIDEM Direct Exposure Criteria. In addition, six background surface soil samples were collected and analyzed for target analyte list (TAL) metals. The background metal concentrations were within the typical range for northeast soils.

Fourteen surface soil samples were collected from the Former Drum Storage Area in three phases of the investigation. The samples were analyzed for VOCs, and a subset was also tested for SVOCs, pesticides, PCBs, and TAL metals. PCE was the only VOC detected in surface soil samples; it was detected in only one sample, and at 0.0008 mg/kg, well below the RIDEM Direct Exposure Criteria for residential soils. Detected SVOCs included six polyaromatic hydrocarbons (PAHs), ranging in concentrations from 0.155mg/kg to 0.453 mg/kg -- all below the RIDEM Direct Exposure Criteria. Twenty-one metals were detected in these samples. None of the metals exceeded the RIDEM Direct Exposure Criteria. Beryllium was detected at an estimated 0.41 mg/kg, which (because of rounding) would not be considered an exceedance of the relevant Direct Exposure Criterion, which is set at 0.4 mg/kg. There were no PCBs or pesticides detected in these surface soil samples. This surface soil data was used to evaluate compliance with cleanup standards, and to characterize human health and ecological risk.

b. Groundwater Investigations

Several rounds of groundwater data were used to characterize and define the groundwater plume, and to perform the human health risk assessment. In particular, three rounds of groundwater monitoring well sampling were completed in November 2004, March 2005 and December 2005. See **Figure 4** for the groundwater exploration locations and delineation of the PCE/TCE plume.

Overburden Groundwater

Two Geoprobe sampling events were completed as part of the RI. The first event was a December 2002 site-wide investigation to identify potential source areas. Seven VOCs were detected at low concentrations in some of the groundwater samples from the 27 investigative locations. The VOC detected at highest levels was TCE, which was detected at the GP-20A (98 feet bgs) and GP-20A (68 feet bgs) borings located downgradient of FA4 and URI Pond, at a concentration of 8 ug/L at each location. The second focused Geoprobe investigation was conducted in May 2003 at 18 locations in the vicinity of the URI pond in order to investigate a suspected upgradient source area. PCE and TCE were the most frequently detected VOCs. Detected PCE concentrations ranged from 21 ug/L to 320 ug/L, at depths from 5 to 31 feet bgs. Detected TCE concentrations in these samples ranged from 18 ug/L to 96 ug/L. The highest PCE and TCE levels were found on the eastern side of the URI Pond at the toe of the embankment at GP-28, 14 feet bgs. Geoprobe results were used to select locations for installation of permanent monitoring wells.

Eleven overburden monitoring wells were installed throughout the plume in September 2004 as part of the RI field program. Vertical profiling was completed on eight of these 11 borehole locations by collecting samples every 5 feet and screening these for VOCs. The interval with the highest VOC analytical results was used to select the monitoring well screen placement. There were no VOCs detected in shallower sampling intervals, with higher levels of TCE and PCE generally found below 100 feet bgs. The overburden monitoring wells located within the limits of the plume boundary include: GW-03, MW-1S, MW-2S, MW-4D, MW-5D, MW-7S, MW-7D, and MW-11.

Groundwater samples from these wells were analyzed for VOCs, SVOCs, TAL metals, PCBs, pesticides, and cyanide. The VOCs detected in the highest concentrations in these wells were PCE and TCE. PCE concentrations were highest at MW-1S (352 ug/L) and MW-2S (92 ug/L), both about 650 feet west and downgradient from the Former Drum Storage Area. TCE concentrations were highest at MW-1S (100 ug/L). These levels exceed the MCLs for PCE and TCE, which are set at 5 ug/L each. The VOC 1,1,1-TCA was also detected in the samples from MW-1S, MW-2S, and MW-4D. Several other VOCs were also detected at low-level concentrations (below MCLs). Sixteen metals were detected in at least one monitoring well during the two sampling events. None of the detected metal concentrations exceeded the relevant maximum contaminant level (MCL) for drinking water. The metal concentrations are likely from naturally occurring conditions and could be associated with suspended particulates in the samples. Detections of SVOCs, PCBs, pesticides, and cyanide were not reported above the laboratory practical quantitation limit (PQL).

Monitoring wells located outside of the plume boundary include the following overburden wells: GW-02, MW-6D, MW-8D, MW-9S, and MW-10. Groundwater samples from these wells were analyzed for VOCs, SVOCs, TAL metals, PCBs, pesticides, and cyanide. Thirteen metals were detected in at least one monitoring well during the two sampling events. None of the detected metals concentrations exceeded MCLs. No other contaminants were detected in these wells. In addition, upgradient (e.g., background) groundwater conditions at the Site are monitored by well GW-01. This well is screened across the overburden/bedrock interface. The sample from this well was analyzed for VOCs, SVOCs, TAL metals, PCBs, pesticides, and cyanide. The sample from GW-01 was non-detect for all parameters, except for detections of five naturally occurring metals.

Bedrock Groundwater

Six bedrock monitoring wells were installed as part of the RI field work (MW-1R, MW-2R, MW-3R, MW-12R, MW-13, and MW-14). Results of the April 2003 seismic survey were used to determine the depth to bedrock and to develop locations and depths of groundwater monitoring wells. The depth to bedrock varies sharply across the Site. It ranges from 10-30 feet bgs from the Former Drum Storage Area to the URI Pond, then slopes sharply downward to the west of the URI Pond and levels out at 150 feet bgs toward the Hundred Acre Pond. Borehole geophysics was conducted on the bedrock borings after the drilling was completed to identify transmissive fractures. The fractures were packer sampled and the fracture with the highest VOC concentrations was selected for the screen interval. Two of the six bedrock monitoring wells used in the RI (MW-13 and MW-14) were unused bedrock residential water supply wells located at Plains Road (these residences were connected to public water in 1988) that were converted in December 2005 to long-term monitoring wells. These wells are located along the projection of the bedrock VOC plume.

Elevated levels of VOCs were detected in MW-1R and MW-2R, which are two wells located approximately 650 feet west and downgradient of the Former Drum Storage Area. Of the eight detected VOCs, only PCE and TCE exceeded MCLs. The PCE concentrations detected were 324 ug/L at MW-1R and 218 ug/L at MW-2R. TCE was detected at 317 ug/L and 87 ug/L at MW-1R and MW-2R, respectively. These levels exceed the MCLs for PCE and TCE, which are set at 5 ug/L each.[2]

Nine metals were detected in at least one monitoring well. The detected concentrations of these metals did not exceed MCLs. The samples from these bedrock wells were non-detect for the following compounds: SVOCs, PCBs, pesticides, and cyanide.

Hundred Acre Pond Road Residential Wells Testing

Twenty-seven residential wells along Hundred Acre Pond (all outside the plume, inasmuch as there are no houses in the area where the plume reaches the eastern shore of the pond) were sampled for VOCs in December 2005 and January 2006. The objective of this sampling was to confirm that Site contaminants are not impacting off-site residential wells. RIDOH had conducted residential wells sampling in the area from 1987 to 1996 and detected 5 VOCs, including PCE and TCE. However, subsequent testing conducted by RIDEM did not detect these VOCs in the residential wells. In the December 2005-January 2006 round of sampling, samples from four of the residential wells had detections of one VOC each. Methyl tertiary butyl ether (MTBE) was detected in two of the wells. MTBE is a gasoline additive, and is not a contaminant associated with the Site. Dichlorodifluoromethane and TCE were detected at trace concentrations in one well each. Because of the location of these residential wells relative to Hundred Acre Pond and the Site, these detections of VOCs are not believed to be associated with the Site (e.g., the TCE detection was in a well located west of the pond, where groundwater flows in from west rather than from the Site).

c. Surface Water Investigations

Surface water sampling was conducted to characterize the potential impact to surface water bodies from site-related contamination and to evaluate potential human health and ecological risks. See **Figure 5** for surface water sampling locations. One sample was initially collected in

[2] Another sampling round was conducted in December 2005, and in this round PCE and TCE concentrations were reported in MW-1R at 407 ug/L and 519 ug/L, respectively. These figures were not included in the RI evaluations because the December 2005 sampling round had not been validated at the time of the RI report. These results exceed previously detected maximum concentrations for the MW-1R well.

January 2003 from each of the small water bodies identified on-site. These five surface water samples were analyzed for VOCs, SVOCs, and TAL metals. No SVOCs were detected in any of the five water bodies. In sample SW-01, collected from the URI Pond, PCE, TCE and trichlorofluoromethane were detected at 19 ug/L, 6 ug/L, and 1 ug/l, respectively. In SW-04, a sample collected from a small water body northeast of FA-2, PCE and TCE were detected at 3 ug/L and 2 ug/L, respectively. Based on these results, two additional samples were collected from the URI Pond in May 2003. PCE was detected in both of these samples at 14 ug/L, confirming earlier results. These PCE detections exceed the Rhode Island Ambient Water Quality Criteria (RI AWQC) of 5.3 ug/L for chronic exposures to aquatic organisms (the TCE levels are below all relevant AWQCs). Overall, the surface water sampling results show that only the URI Pond has been impacted by site-related VOCs, primarily PCE, as a result of the groundwater plume discharging to the URI Pond. Twelve metals were detected in the on-site surface water samples, with four metals (aluminum, barium, iron, and lead) exceeding the aquatic benchmark criteria in at least one sample.

Five surface water samples were collected from Hundred Acre Pond. No VOCs were detected in the initial sample collected in October 2004. Four additional surface water samples were collected from the Hundred Acre Pond in October 2005 and analyzed for VOCs, and TAL metals. Consistent with the initial sampling, no VOCs were detected in these samples. The results show that the surface water in Hundred Acre Pond has not been affected by the site-related VOC plume. Twelve metals were detected in these surface water samples from Hundred Acre Pond with four metals (aluminum, barium, iron, and lead) exceeding the aquatic benchmark criteria in at least one sample. These metals were not considered to be site-related, because as the PCE/TCE groundwater plume does not contain elevated concentrations of metals and because overall, surface water at Hundred Acre Pond does not appear to be impacted by the VOC plume (see discussion on pore water sampling results in Hundred Acre Pond below).

In addition, 27 porewater (water between grains of sediment) samples were collected in the URI Pond in May 2003, following detection of elevated VOCs in the initial surface water sample. These samples were analyzed for VOCs. Four VOCs -- PCE, TCE, and their breakdown products, 1,2 DCA and cis-1,2-DCE -- were detected in 18 out of the 27 samples. The highest levels of PCE and TCE were detected at the eastern edge of the URI Pond, with maximum levels found at the PW-21 location, where PCE and TCE were detected at 360 ug/L and 56 ug/L, respectively. The results of porewater samples confirmed that the URI Pond is being impacted by the plume and helped to direct the groundwater investigation in the vicinity of the Pond.

Porewater was also collected at depths of 1-3 feet at 12 locations in Hundred Acre Pond and analyzed for VOCs in September-October 2004. TCE and PCE were the only VOCs detected in porewater. TCE was detected in three porewater sampling locations in Hundred Acre Pond at concentrations from 5 ug/L to 8 ug/L; PCE was detected at one location at 9 ug/L. These results indicate that the groundwater plume is discharging to Hundred Acre Pond. In the ecological risk assessment, it was assumed that concentrations of VOCs in Hundred Acre Pond porewater would be reflective of conditions in very shallow riparian surface water or wetland standing water where groundwater initially discharges, and that terrestrial mammals might consume water at these levels of contamination (even though in fact such surface waters would likely show lower levels of contamination due to biodegradation, dilution or volatilization).

d. Sediment Investigations

Similar to surface water, sediment sampling was conducted during the RI to characterize the potential impact to sediments from site-related contamination. Eight sediment samples were collected from the surface waters located entirely on-site, including five samples collected concurrently with the surface water samples and analyzed for VOCs, SVOCs, TAL metals, and Pesticides/PCBs. No SVOCs were detected in the sediment samples. VOCs were detected only at the SD-01 location at the URI Pond, where PCE and TCE were found at concentrations of 0.573 mg/kg and 0.13 mg/kg, respectively. The PCE detection of 0.573 mg/kg exceeded the aquatic benchmark (i.e., a benchmark based on a published toxicological study rather than any official criteria) of 0.410 mg/kg. Twenty metals were detected in the URI Pond sediments, with two, beryllium and selenium, exceeding ecological benchmarks (also based on published studies). Three additional samples were then collected from the URI Pond and analyzed for VOCs only. TCE and cis-1,2-DCE were detected at one of these additional samples at 0.032 mg/kg and 0.105 mg/kg, respectively. The results of the sediment sampling suggest that, similar to surface water, the URI Pond sediments have been impacted by site-related VOCs from the groundwater discharge into the Pond.

Six sediment samples were collected at Hundred Acre Pond. Initially two sediment samples were analyzed for VOCs in October 2004, followed by collection of four additional samples which were analyzed for VOCs and TAL metals in October 2005. No site-related VOCs were detected in any Hundred Acre Pond sediment samples. Sixteen metals were detected in the Hundred Acre Pond sediment samples; however, none of the metals exceeded the ecological benchmarks.

e. Air Investigations

Based upon the results of the landfill gas sampling, ambient air sampling was not conducted as part of the RI field investigations. The completed landfill closure includes a passive gas collection and venting system.[3]

The depth of the groundwater plume (at 80 to 120 ft bgs, with an approximately 40-foot layer of "clean" water above it) was found to preclude migration of volatiles from the Site into indoor air of the nearby residences.

[3] Landfill gas samples were collected from each of the three large landfill areas (FA2, FA4, and FA5) for VOC analysis in October 2003. The purpose of the sampling was to identify the presence of VOCs and landfill gases within each of the primary landfill areas and to identify whether VOCs from landfill gases were migrating off-site. Five VOCs were detected in the three landfill gas samples. Dichlorofluoromethane and trichlorofluoromethane were detected at the highest concentrations in sample collected from FA5, at concentrations of 74 ug/m^3 and 79 ug/m^3, respectively. The landfill gas results were compared to RIDEM Ambient Air Criteria and none of the VOCs detected in the landfill gas samples exceeded the applicable ambient air criterion.

3. Principal and Low-Level Threats

Principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied. Wastes generally considered to be principal threats are liquid, mobile and/or highly-toxic source material.

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that are generally considered to be low-level threat wastes include non-mobile contaminated source material of low to moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or ground water, low leachability contaminants or low toxicity source material. Principal threat wastes are listed in Table E-1 below. No low-threat wastes are identified at the site.

Table E-1: Principal Threats					
Source Media	**Affected Media**	**Contaminant**	**Reason(s)**	**Concentration**	**Receptors**
Subsurface soil	groundwater, surface water	PCE	Mobility, Toxicity	0.34 mg/kg	water supply

4. Fate and Transport

The Conceptual Site Model for soil, groundwater and surface water at the Site is provided in **Figure 6**. The CSM is a three-dimensional "picture" of site conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. It documents current and potential future site conditions and shows what is known about human and environmental exposure through contaminant release and migration to potential receptors. The risk assessment and response action for the soil, groundwater and surface water are based on this CSM.

Overburden and bedrock groundwater at the Site has been impacted by historical Site operations. VOCs, specifically PCE and TCE, are the primary contaminants detected in the groundwater at this Site. The source of the PCE/TCE plume has been identified as the subsurface soil and groundwater at the Former Drum Storage Area. Liquid-phase PCE and TCE released at the surface is thought to have migrated vertically through fractures in the till to the bedrock surface in the source area. The dissolved contaminants then traveled down slope along the bedrock/till interface, moving into the fractured bedrock aquifer. Further downgradient, prior to reaching URI Pond, the TCE/PCE groundwater plume moves from the bedrock aquifer into the overburden. Some of the VOC plume is then intercepted and discharges into the URI Pond located about 700 feet from the source area, while the remaining plume extends to Hundred Acre

Pond, approximately 2,500 feet west and downgradient of the source area.

Currently, relatively low concentrations of PCE and TCE are found in the source area subsurface soils, with maximum reported PCE concentrations of 0.34 mg/kg. The maximum groundwater TCE/PCE concentrations are in the 200-500 ug/L range. Since the maximum PCE and TCE groundwater concentrations are an order of magnitude lower than their 1 percent solubility levels (i.e., levels customarily accepted as indicators of non-aqueous phase liquid (NAPL) occurrence), and no other NAPL indicators were found in soil or groundwater, no NAPL is suspected to be present at the Site.

The mass of remaining VOCs in the Former Drum Storage Area is estimated at 0.12 – 0.14 lbs. The mass of dissolved VOCs in the overburden and bedrock groundwater plume emanating from the source area is estimated at 52-89 lbs and 1 lb, respectively, indicating that the majority of PCE and TCE mass no longer resides in overburden, but remains as a dissolved phase within the overburden aquifer. Concentrations of PCE and TCE degradation products in groundwater, primarily cis-1,2-DCE, are reported at low concentrations in only three monitoring wells, indicating that anaerobic de-chlorination is not occurring at high rates.

Contaminant migration pathways at the Site include infiltrating precipitation which dissolves and transports contaminants from the ground surface and unsaturated overburden by downward percolation toward the water table in the Former Drum Storage Area. Dissolved contaminants then migrate with natural groundwater flow. Natural processes expected to affect contaminant migration and concentrations over time in groundwater include adsorption, dispersion, dilution, sorption, volatilization, and biodegradation. Adsorption is often the dominant attenuation mechanism in the saturated zone. The PCE and TCE plume will migrate up to 2 times more slowly than the groundwater flow due to adsorption of dissolved contaminants by organic aquifer material. An EPA-developed screening process to evaluate PCE and TCE degradation has also been completed and is presented in Appendix G of the RI Report. The total score for biodegradation of the source area groundwater was classified as "inadequate evidence," meaning no evidence of degradation. The score for the downgradient plume was classified as "limited evidence," suggesting some active biodegradation of TCE and PCE is occurring in that area.

At the Site, the main migration pathway for PCE and TCE into the surface water and sediments is the groundwater plume discharge into URI Pond, where elevated levels of PCE and TCE are detected. The fate of PCE and TCE in surface water is to volatilize to the atmosphere. TCE will volatilize very quickly with its estimated half-life in surface water (i.e., the time required for half of the mass of the contaminants to decay) in minutes to a few hours, while the expected half-life of PCE is several days. Adsorption and biodegradation are also occurring within the sediment, as shown by the relatively high cis-1,2-DCE concentrations reported in porewater.

The data collected indicates that the historic waste areas (FA1, FA2, FA3, FA4, FA5, and Unnamed Area) are not significantly contributing to the groundwater VOC plume at the Site. It has been assumed for purposes of this Record of Decision that closure of the landfills and continued maintenance of caps along with institutional controls will prevent future exposures to and migration of contaminants from these areas.

5. Routes of Exposure

Several potential routes of human exposure were considered in the baseline human health risk assessment conducted as part of the RI as shown in **Table E-2**. The following summarizes the pathways evaluated for each human health exposure scenario:

- Current and future youth trespasser/passive recreational user:
  - Dermal contact and incidental ingestion of soil and inhalation of fugitive dust from uncapped on-site upland areas;[4] and
  - Dermal contact and incidental ingestion of surface water and sediment in URI Pond/on-site wetlands.
- Current and future child/adult local resident:
  - Dermal contact and incidental ingestion of surface water and sediment in Hundred Acre Pond; and
  - Inhalation of volatiles in indoor air of a residence.
- Future child/adult on-site resident:
  - Dermal contact and incidental ingestion of soil and inhalation of fugitive dust from uncapped on-site upland areas;
  - Ingestion of groundwater as drinking water source; and
  - Dermal contact with groundwater and inhalation of volatiles while showering.
- Future adult commercial/industrial facility worker[5]:
  - Dermal contact and incidental ingestion of soil and inhalation of fugitive dust from uncapped on-site upland areas; and
  - Dermal contact and ingestion of groundwater as drinking water source.
- Future adult construction worker:
  - Dermal contact and incidental ingestion of soil and inhalation of fugitive dust from uncapped on-site upland areas; and
  - Dermal contact with shallow (less than 10 feet) groundwater

Several potential routes of exposure were considered in the baseline screening-level ecological risk assessment (SLERA) conducted as part of the RI. The following summarizes the pathways evaluated for each ecological exposure scenario:

- Former Drum Storage Area:

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4 For current exposure scenarios, surface soil data (0 – 1 foot) was used; while for future receptors, soil data from subsurface soils up to depths of 10 feet was also used, under an assumption that under future land use scenarios currently subsurface soils may be brought to the surface/mixed with surface soil.

5 The risk to future adult commercial/industrial facility workers was calculated in the RI for comparative purposes only. Human health risks to future on-site residents are the basis for the remedial action, consistent with future land use scenarios; this approach is also more conservative.

  - Uptake of chemicals from soils by terrestrial plants; and
  - Dermal exposure and ingestion of chemicals from soils and vegetation by invertebrates, and through food chain by higher trophic level receptors (herbivores and carnivores).
- URI Pond and on-site wetlands:
  - Dermal exposure and ingestion of chemicals in surface water, sediment, by invertebrates and amphibians, and through food chain by waterfowl who may feed in the URI Pond.
- Hundred Acre Pond:
  - Ingestion of chemicals from riparian surface water (assumed to be contaminated to the same degree as deep pore water) at the edge of the pond by terrestrial mammals.

Human health and ecological risks associated with these pathways, if found significant, are presented in Section G of this ROD.

Table E-2: Conceptual Site Model - Potential Receptors

Primary Sources	Medium of Concern	Exposure Point	Potential Exposure Route	Potential Receptors				
				Current and Future Residents	**Current Site Trespassers**	**Future Site Worker**	**Future Trespasser/ Recreational User**	**Ecological Receptors**
Former Drum Storage Area	Soil	Upland and/or wetland areas proximate to the former drum storage area	Ingestion	•	•	•	•	•
			Inhalation (Dust)	•	•	•	•	
			Dermal Contact	•	•	•	•	•
	Groundwater	East and West of Plains Road	Ingestion	•		•		
			Inhalation	•				
			Dermal Contact	•		•		
	Indoor Air	Residences along Plains Road	Inhalation					
	Surface Water	URI Pond	Incidental Ingestion					•
			Dermal Contact		•		•	•
	Sediment	URI Pond	Incidental Ingestion		•		•	•
			Dermal Contact		•		•	•
	Surface Water	Hundred Acre Pond	Dermal Contact					
			Incidental Ingestion					•
	Sediment	Hundred Acre Pond	Dermal Contact					
			Incidental Ingestion					

Key
• Complete exposure pathway.
A blank indicates that the pathway is not relevant for that receptor.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCES USES

This section provides a general summary of the current demography and land use of the Site and its vicinity as well as future plans for the Site.

1. Land Uses

The part of the Site that is east of Plains Road, including the West Kingston Town Dump and the URI Disposal Area, is zoned "GI-Government and Institutional," i.e., zoning for land owned by governments, major semi-public institutions, and the like. Parcels in this part of the Site are owned by either URI or the Town of West Kingston, and are vacant except for the landfill caps. To the west, the narrow strip of land between Plains Road and the railroad tracks has two different zoning designations. The northern part is zoned "Rural Very Low Density," which is designed to protect sensitive areas by keeping residential density low enough to discourage conversion of lands and farmlands to more intensive uses (e.g., each lot must measure at least 200,000 square feet). This area is lightly developed consistent with this zoning and is owned in separate parcels by small private residential owners. The southern part of the strip between the road and the railroad tracks is zoned "GI-Government and Institutional," and is owned by URI, which has kept the land vacant. Further west still, the land between the railroad tracks and Hundred Acre Pond is zoned "Open Space, Conservation and Recreation." This zoning typically includes land where development rights have been conveyed or for which there is a reasonable expectation of long-term use for open space, conservation or recreation. In this case, the area is owned by the Audubon Society of Rhode Island, which has kept the area (much of it wetland) as open space. A map showing the zoning scheme for the Site is in **Figure 3-1** of the RI.

In the vicinity of the Site are the URI campus and other land used primarily for agriculture and forestry. Turf farming and hay production occur both south and west of the Site, while the areas to the north and east are primarily forested. Land used for potato farming is located about 1.5 miles to the north and west of the Site. The Site is used by local residents and URI students for passive recreation, such as walking and running.

According to discussions with the URI and Town officials, there is no re-use planned at this time for the central part of the Site that is owned by them. Reasonably anticipated near-term uses of the Site include passive recreational use by URI students and nearby residents. The area will remain open space as the remedy is implemented and until a re-use plan is developed.

2. Groundwater Uses

No groundwater is currently drawn from the Site, but there are public and private wells in surrounding areas, as well as irrigation wells. The majority of groundwater is drawn from the overburden portion of the aquifer. The five residences on Plains Road had private wells that were screened in bedrock. Four of these residential wells have not been in use since 1988, when they were connected to the Town of South Kingstown public water supply. The remaining fifth residential well was connected to public water in September 2000. The closest private well that is currently in use is approximately 1,000 feet north/northwest of the Site. **Table F-1** summarizes the municipal groundwater supplies located within four miles of the Site. As shown in the table, there are two public water supply sources within 1.5 miles of the Site, the URI water supply and the Town of South Kingstown water supply. The most recent analytical testing reports from these water supplies are provided in Appendix G-5 of the RI. No site-related VOCs were reported in tests for these wells.

Table F-1: Municipal Groundwater Supply Sources within 4 Miles of Site			
Distance and Direction from Site	**Source Name**	**Estimated Population Served**	**Source Type/ Screened Interval**
0.5 mile SW	URI/three supply wells	URI population (~15,000) and adjacent residences on Plains Rd	Overburden / 95 ft
1.25 mile SW	Kingston Water District/ three supply wells	24,000	Overburden / 65 ft
3.8 mile N-NW	Joseph H. Ladd State Hospital	200	Overburden / 55 ft

The estimated population that relies on private wells for drinking water within four miles of the Site is summarized in **Table F-2** below:

Table F-2: Estimated Drinking Water Populations Served by Private Wells Within Four Miles of the Site	
Radial Distance from Site (miles)	**Total Population Served**
0.00 - <0.25	8
0.25 - <0.50	41
0.50 - <1.00	661
1.00 - <2.00	2,101
2.00 - <3.00	5,691
3.00 - <4.00	3,777
TOTAL	**12,279**

Groundwater at the Site is federally classified as a drinking water aquifer or a potential drinking water aquifer. Although this aquifer is also classified under State groundwater regulations, because the State has not obtained EPA approval of a Comprehensive State Ground Water Protection Plan (GSCWPP), all groundwater affected by Site contaminants must be restored to drinking water standards at the completion of the remedy.[6] The goal of the selected remedy is to bring the groundwater at the Site into compliance with both federal and state drinking water standards, which is estimated to take 80 to 325 years (although the selected remedy achieves significant contaminant mass reductions within approximately 6 to 12 years, as described more below). The potential beneficial uses of the groundwater at the Site and surrounding areas are public and private water supply and irrigation.

3. Surface Water Uses

The current uses of the surface water at the Site and surrounding areas are recreational. Trespassers can access on-site surface water bodies. Prior to landfill closure, the property owner pumped the Tibbits Pond for irrigation of the nearby turf fields. This property, along with the Tibbits Pond, is currently being transferred to Town of South Kingstown. Hundred Acre and Thirty Acre Ponds, located on the Chipuxet River, are classified as 'Open Space' and are designated for swimming and other recreational activities. Other, smaller water bodies onsite provide habitat for ecological receptors.

Following the landfill closure, the Tibbits Pond and the URI Pond have been incorporated into the stormwater retention system of the landfill closure.

URI Pond (the only surface water body where an exceedance of ambient water quality criteria was detected, as described more below) is classified by RIDEM as Class A waters, inasmuch as all water bodies not classified by name are deemed Class A (see RIDEM Water Quality Regulations, Appendix A and Rule 8.C.4). Class A waters are designated by the State of Rhode Island for primary and secondary contact recreational activities, for fish and wildlife habitats, for certain industrial purposes, and for irrigation; Class A waters are also required to have "excellent aesthetic value." The potential beneficial use of surface water at the Site is passive recreation. Future uses of the much larger Hundred Acre and Thirty Acre Ponds (which were found to have been essentially unaffected by contamination from the Site, and which are subject to the same RI AWQCs as URI Pond) are not expected to change; passive and active recreational uses are expected to continue.

[6] RIDEM has classified the aquifer at the Site as GAA (suitable for use as drinking water without treatment before consumption), except that the water directly below the closed landfills is classified as GB (not suitable for public drinking water use without prior treatment).

G. SUMMARY OF SITE RISKS

A baseline risk assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The human health risk assessment followed a four-step process: 1) hazard identification, which identified those hazardous substances which, given the specifics of the Site were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the site, including carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates. A summary of those aspects of the human health risk assessment which support the need for remedial action is discussed below, followed by a summary of the ecological risk assessment (addressing impacts on the non-human part of the environment).

1. Human Health Risk Assessment

Identification of Chemicals of Concern:

Groundwater is the only media found to present unacceptable risks. Seven of the more than 20 chemicals detected in the Site groundwater were selected for evaluation in the human health risk assessment as chemicals of potential concern (COPCs). The chemicals of potential concern were selected as potential site-related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment; they are listed in Tables 6-2.1 through 6-2.6 of the RI. From the COPCs, a subset of chemicals was identified in the Feasibility Study as presenting a significant current or future risk. The chemicals in this subset are referred to as the chemicals of concern (COCs) in this ROD and they are summarized in Tables G-1 and G-2 below. These Tables contain the exposure point concentrations – e.g., the concentration of the chemical that could be present in Site groundwater were groundwater to be used for drinking water – derived from Site sampling data according to EPA protocols. These exposure point concentrations were used to estimate the reasonable maximum exposure (RME) to humans from the chemicals of concern.

Table G-1
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations for Groundwater East of Plains Road

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater, Shower Air

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
East of Plains Road	Tetrachloroethene	3.0	324	(ug/L)	6/9	0.324	(mg/L)	Maximum
	Trichloroethene	2.0	317	(ug/L)	7/9	0.269	(mg/L)	Adjusted Gamma UCL

Key

PCE = Tetrachloroethene

TCE = Trichloroethene

mg = milligram, ug = microgram, L = Liter

The Upper Confidence Limit (UCL) value of the mean temporal average groundwater concentrations in each exposure area for each COC was calculated using EPA's ProUCL statistical software (version 3.00.02). Outputs are provided in Appendix F-2 of the RI. Exposure Point Concentrations (EPCs) represent the lesser value between the 95% UCL and the maximum detected concentration.

This table represents the Chemicals of Concern (COCs) and exposure point concentration (EPC) for each of the COCs detected in groundwater on the part of the Site that is east of Plains Road (i.e., the concentrations that are used to estimate the exposure and risk from each COC in groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in collected samples), the EPC and how the EPC was derived. The table indicates that TCE is the most frequently detected COC in groundwater at this exposure point.

Table G-2
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations for Groundwater West of Plains Road

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater, Shower Air

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
West of Plains Road	PCE	1.0	6.0	(ug/L)	4/5	0.006	(mg/L)	Maximum
	TCE	3.0	9.5	(ug/L)	3/5	0.010	(mg/L)	Maximum

Key

PCE = Tetrachloroethene
TCE = Trichloroethene
mg = milligram, ug = microgram, L = Liter

Values for the area west of Plains Road are calculated using the temporal average of groundwater samples from wells MW-7S, MW-7D, MW-12R, MW-13 and MW-14.
Exposure point concentrations are equal to the Maximum Detected Concentration, as the data set was too small to calculate 95% UCL values

The table presents the COCs and EPC for each of the COCs detected in groundwater in the part of the Site that is west of Plains Road (i.e., the concentrations used to estimate the exposure and risk from each COC in the groundwater). The table includes a range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in samples collected in this area), the exposure point concentration and how the EPC was derived. The table indicates that PCE is the most frequently detected COC in groundwater at this exposure point. Due to the limited amount of sample data available for the COCs, the maximum concentration was used as the default EPC.

Exposure Assessment:

Current and potential future Site-specific pathways for exposure to chemicals of concern were determined. The extent, frequency and duration of current and future potential exposures were estimated for each pathway. From these exposure parameters, a daily intake value for each site-related chemical was estimated.

These pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of the Site. The Site is located on Plains Road in South Kingstown, RI. Two former landfills at the Site, the former West Kingston Town Dump and URI Disposal Area, have been capped with a RCRA closure system. To the south of the Site is the University of Rhode Island Main Campus. To the west of the Site is Hundred Acre Pond; and on Plains Road there are several residential properties. Land use in the vicinity of the Site consists of residential, agricultural, and commercial land uses. Except for the adjacent URI campus, land in the vicinity of the Site is used primarily for agriculture and forestry. Turf farming and hay production occur both south and west of the Site, while the areas to the north and east are primarily forested. The demography immediately surrounding the Site consists of a small residential population and the URI student and faculty population. The five residences on Plains Road have been connected to public water supply. The URI campus, which had 15,000 students and staff members as of 2004, is located 0.35 miles to the south/southeast of the Site.

The following is a brief summary of the exposure pathways that were found to present an unacceptable risk at the Site. A more thorough description of all exposure pathways evaluated in the risk assessment can be found in Section 6.1.5 and Tables 6-4.1 through 6-5.6 of the RI.

No current exposure pathways were found to present a significant risk at the Site.

The following future exposure pathways were found to present an unacceptable risk at the Site:

- Future child/adult resident:
    - Ingestion of groundwater as a drinking water source; and
    - Dermal contact with groundwater and inhalation of volatiles while showering.
- Future adult commercial/industrial facility worker:
    - Dermal contact and ingestion of groundwater as a drinking water source.

For potential future residential exposures to untreated groundwater, age-weighted drinking water ingestion rates of 1.53 L/day and 1.3 L/day for an adult and a young child, respectively, were assumed. An exposure frequency of 350 days/year was used for a combined exposure duration of 30 years. Dermal contact was assumed to be 18,000 cm^2 of skin surface area for the adult and 6,600 cm^2 for the child. Shower/baths were assumed to occur 350 days/year for 0.58 hr/day for the adult and 1 hr/day for the child. For the inhalation pathway, airborne concentrations of volatile compounds released during showering/bathing were estimated using the Foster and Chrostowski shower model.

Exposure assumptions for a future adult commercial/industrial facility worker, which result in lower exposure than residential exposure to untreated groundwater, are presented in Table 6-4.3 of the RI. Lower ingestion rate (1.15 L/day), lower exposure frequency (250 days/year) and lower exposure duration (25 years) are main factors resulting in lower exposure for that receptor. See Table 6-8.4 of the RI for the calculated risks to such site worker.

Media other than groundwater at the Site presented no unacceptable risk under baseline conditions. The soil in the source area is contaminated with VOCs, but the contamination is 12-18 feet below ground surface; there is no exposure pathway leading to human contact, except insofar as leaching has contributed to the groundwater risk identified above (which may merit addressing soils as part of a groundwater remedy, even in the absence of a risk directly attributable to soils). The soil in the landfill areas is underneath the RCRA caps; these soils were not tested as part of the RI and it is assumed in this ROD that these caps and associated land use restrictions will be maintained so as to prevent human exposure to these soils. As for surface waters and sediments, the RI found that there were no COPCs in surface waters or sediments on the Site, except for PCE and metals detected in URI Pond. The sampling showed that the PCE levels in particular exceed the Rhode Island Ambient Water Quality Standard for chronic exposures to aquatic life. However, the only human exposure would be through dermal contact, i.e., wading. It was determined that the exposure resulting from this activity would not lead to an unacceptable risk, carcinogenic or otherwise, under baseline conditions. Inasmuch as no unacceptable risk results from contact with soil, surface water and sediment, the remainder of this summary of the human health risk assessment will focus on risks attributable to use of groundwater (where there is an unacceptable risk under baseline conditions, as described in more detail below).

Toxicity Assessment:

EPA assessed the potential for cancer and non-cancer health effects for each exposure pathway identified at the Site.

The potential for carcinogenic effects is evaluated with chemical-specific cancer slope factors (CSFs) and inhalation unit risk values (URs), which convert dosages or exposures into the excess cancer risk resulting from these dosages or exposures. CSFs and URs have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds -- that is, the true risk is unlikely to be greater than the risk predicted using the CSFs and URs. In addition, a weight-of-evidence classification is available for each chemical (human carcinogen, possible human carcinogen, etc.). A summary of the cancer toxicity data relevant to the chemicals of concern is presented in Table G-3.

The potential for non-carcinogenic effects is quantified by reference doses (RfDs) for oral exposure and reference concentrations (RfCs) for inhalation exposures. RfDs and RfCs have been developed by EPA and they represent an estimate of a daily exposure that is likely to be without an appreciable risk of deleterious effect during a lifetime. RfDs and RfCs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. A summary of the non-carcinogenic toxicity data relevant to the chemicals of concern is presented in Table G-4.

Table G-3
Cancer Toxicity Data Summary

Pathway: Oral, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
PCE	0.54	0.54	(mg/kg)/day	C-B2	Region 9 EPA	1/1/2006
TCE	0. 4	0.4	(mg/kg)/day	C-B2	RAIS	2/7/2006

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Slope Factor Units	Units	Weight of Evidence/Cancer Guideline Description	Source	Date
PCE	0.0059	$(mg/m^3)^{-1}$	N/A	N/A	C-B2	RAIS	2/7/2006
TCE	0. 11	$(mg/m^3)^{-1}$	N/A	N/A	C-B2	RAIS	2/7/2006

Key
RAIS = Oak Ridge National Laboratory Risk Assessment Information System.
(http://risk.lsd.oml.gov/tox/tox_values.shtml).
Values presented are Provisional Peer Reviewed Toxicity Values (PPRTV), unless otherwise noted.
PCE = Tetrachloroethene
TCE = Trichloroethene
kg = kilograms
mg = milligrams
m^3 = cubic meters
N/A = Not Applicable

EPA Group
A-Human Carcinogen
B1 – Probable Human Carcinogen – Limited Human Data Available
B2 – Probable Human Carcinogen – Sufficient Evidence Available in Animals Only
C- Possible Human Carcinogen
D – Not classified as a Human Carcinogen
E – Evidence of Non-carcinogenicity

This table provides carcinogenic risk information, which is relevant to the COCs in groundwater at the Site. Although EPA has withdrawn carcinogenicity classification for both TCE and PCE from IRIS, the RAIS indicated that TCE and PCE had previously been classified within a continuum between "C-possible human carcinogen" and "B2-probable human carcinogen." At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in the assessment have been extrapolated from oral values. An adjustment factor is sometimes applied and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularity important for chemicals with less than 50% adsorption via the ingestion route. However, adjustment is unnecessary for the chemicals evaluated here because EPA guidance recommends an assumption of 100% absorption for most organic chemicals. Therefore the dermal slope factors and the oral slope factors are the same for these contaminants. The COCs are also considered carcinogenic via the inhalation route. Trichloroethene (TCE) and Tetrachloroethene (PCE) have inhalation unit risk factors of 0.0059 mg/m^3 and 0.11 mg/m^3, respectively (Source: RAIS).

Table G-4
Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty /Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YYYY)
PCE	Chronic	0.01	mg/kg/ day	0.01	mg/kg/ day	Liver, kidney, nervous system	1000x1	IRIS	2/7/2006
TCE	Chronic	0.0003	mg/kg/ day	0.0003	mg/kg- day	Liver, kidney, nervous system	--	RAIS	2/7/2006

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty /Modifying Factors	Sources of RfC:RfD : Target Organ	Dates (MM/DD/YYYY)
PCE	Chronic	0.6	(mg/m^3)	N/A	N/A	Nervous system, eye, respiratory system	--	RAIS	2/7/2006
TCE	Chronic	0.04	(mg/m^3)	N/A	N/A	Nervous system	--	RAIS	2/7/2006

Key
RAIS = Oak Ridge National Laboratory Risk Assessment Information System.
(http://risk.lsd.oml.gov/tox/tox_values.shtml).
Values presented are Provisional Peer Reviewed Toxicity Values (PPRTV), unless otherwise noted.
--- = No information available
PCE = Tetrachloroethene
TCE = Trichloroethene
kg = kilograms
mg = milligrams
m^3 = cubic meters
N/A = Not Applicable

This table provides non-carcinogenic risk information, which is relevant to the COCs in groundwater at the Site. The COCs have toxicity data indicating their potential for adverse non-carcinogenic health effects in humans. The chronic toxicity data available for both Tetrachloroethene (PCE) and Trichloroethene (TCE) for oral exposure have been used to develop oral reference doses (RfDs). The oral RfDs for PCE and TCE are 0.01 mg/kg/day and 0.0003 mg/kg/day, respectively (Source: IRIS and RAIS). Both COCs are estimated to affect the liver. As no dermal RfDs were available, dermal RfDs were assumed to be equal to oral RfD values. The chronic toxicity data available for both Tetrachloroethene (PCE) and Trichloroethene (TCE) for inhalation exposure have been used to develop inhalation reference concentrations (RfCs). The inhalation RfCs for PCE and TCE are 0.6 mg/m^3 and 0.04 mg/m^3, respectively (Source: RAIS).

Risk Characterization:

Risk characterization combines estimates of exposure with toxicity data to estimate potential health effects that might occur if no action were taken.

Excess lifetime cancer risks were determined for each exposure pathway by multiplying the daily intake values or exposure concentration (see exposure assessment) by the CSF or the UR value, respectively. These toxicity values are conservative upper bound estimates, approximately a 95% upper confidence limit, on the increased cancer risk from a lifetime exposure to a chemical. Therefore, the true risks are unlikely to be greater than the risks predicted. Cancer risk estimates are expressed as a probability. For example, one in a million risk (1 in 1,000,000) is indicated by 1×10^{-6} or 1E-06. In this example, an individual is not likely to have greater that a one in a million chance of developing cancer over a lifetime as a result of exposure to the concentrations of chemicals at a particular site. All risks estimated represent an "excess lifetime cancer risk" in addition to the background cancer risk experienced by all individuals over a lifetime. The chance of an individual developing cancer from all other (non-site related) causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposure is 10^{-4} to 10^{-6}. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake value or exposure concentration by the RfD or RfC, respectively. A HQ < 1 indicates that a receptor's dose of a single contaminant is less than the RfD or RfC, and that toxic non-carcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. liver) within or across those media to which the same individual may reasonably be exposed. A HI < 1 indicates that toxic non-carcinogenic effects are unlikely. A summary of the non-carcinogenic toxicity data relevant to the chemicals of concern is in Table G-4.

The following is a summary of the media and exposure pathways which were found to present a risk exceeding EPA's cancer risk range and non-cancer threshold at the Site. Only those exposure pathways deemed relevant to potential uses of the Site are presented in this ROD. Tables G-5 through G-8 depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in groundwater evaluated to reflect potential future use of groundwater on both sides of Plains Road as a drinking water source, corresponding to the reasonable maximum exposure (RME) scenario. Readers are referred to Section 6.1.7 of the RI for a more comprehensive risk summary of all exposure pathways evaluated for all chemicals of potential concern.

Tables G-5 and G-6 present the carcinogenic and non-carcinogenic risk summary for the chemicals of concern for potential future residential use of the Site and use of groundwater east of Plains Road as a drinking water source. Similarly, Tables G-7 and G-8 represent the carcinogenic and non-carcinogenic risk summary for the chemicals of concern for potential future use of groundwater west of Plains Road as a drinking water source. For potential future use of untreated groundwater as potable water throughout the Site, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and a target organ HI of 1 for groundwater. The exceedances were due to the presence of tetrachloroethene and trichloroethene in Site groundwater.

The RI also calculated risk for ingestion of and dermal contact with groundwater for a future commercial/industrial facility worker on the east side of Plains Road. While this exposure pathway also exceeds acceptable risk levels (carcinogenic risk of 1.3E-03 and a target organ HI of 16), it is lower than risk estimates calculated for a future residential user of groundwater as a drinking water source living east of Plains Road. As a result, the more conservative risk values associated with future residential use were used in the risk characterization (and to calculate cleanup levels described later in this ROD). See Table 6-8.4 of the RI for additional information on the Site worker receptor.

Table G-5
Risk Characterization Summary (East of Plains Road) – Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Ground-water	Ground-water	East of Plains Road	PCE	2E-03	N/A	2E-03	N/A	4E-03
			TCE	1E-03	N/A	3E-04	N/A	2E-03
	Shower Air	East of Plains Road	PCE	N/A	1E-06	N/A	N/A	1E-06
			TCE	N/A	2E-05	N/A	N/A	2E-05
							Groundwater risk total=	**5E-03**

Key
PCE = Tetrachloroethene; TCE = Trichloroethene; N/A = Route of exposure is not applicable to this medium.

This table provides risk estimates for the use of groundwater from that part of the Site that is east of Plains Road. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a resident's exposure to groundwater using age-weighted exposure assumptions for a 6-year exposure for a child and 24-year exposure for an adult, as well as the toxicity of the COCs (PCE and TCE). The total risk from direct exposure to contaminated groundwater at this exposure point to a future resident is estimated to be 5E-03 (i.e. 5×10^{-3}). Risk due to ingestion of groundwater is the most significant. The COCs contributing to this risk are PCE and TCE in groundwater. The risk level indicates that if no clean-up action is taken and groundwater is used in the future as potable water, an individual would have increased probability of 5 in 1,000 of developing cancer as a result of site-related exposure to the COCs.

Table G-6

Risk Characterization Summary (East of Plains Road) - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground-water	Ground-water	East of Plains Road	PCE	Liver, Kidney, Nervous system	2	N/A	1	3
			TCE	Liver, Kidney, Nervous system	66	N/A	8	74
Ground-water	Shower Air	East of Plains Road	PCE	Nervous systems, eye, respiratory system	N/A	1.3E-04	N/A	1.3E-04
			TCE	Nervous system	N/A	1.8E-03	N/A	1.8E-03
							Groundwater Hazard Index Total =	78

Key

PCE = Tetrachloroethene
TCE = Trichloroethene
N/A: Route of exposure is not applicable to this medium.

This table provides hazards quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure using age-weighted exposure assumptions for a 6 year exposure for a child and 24 year exposure for an adult. The Risk Assessment Guidance for Superfund (RAGS) states that generally a hazard index (HI) greater than 1 indicates the potential for non-cancer effects. The estimated HI of 78 indicates that adverse target organ effects can be anticipated in the event groundwater from that part of the Site that is east of Plains Road is used for drinking water. The largest risk is due to ingestion of TCE.

Table G-7

Risk Characterization Summary (West of Plains Road) – Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Ground-water	Ground-water	West of Plains Road	PCE	3.9E-05	N/A	2.9E-05	N/A	6.8E-05
			TCE	4.6E-05	N/A	1.0E-05	N/A	5.6E-05
	Shower Air	West of Plains Road	PCE	N/A	2.3E-08	N/A	N/A	2.3E-08
			TCE	N/A	7.5E-07	N/A	N/A	7.5E-07
							Groundwater risk total=	**1.2E-04**

Key

PCE = Tetrachloroethene
TCE = Trichloroethene
N/A: Route of exposure is not applicable to this medium.

This table provides risk estimates for the use of groundwater from that part of the Site that is west of Plains Road. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of exposure to groundwater using age-weighted exposure assumptions for a 6-year exposure for a child and 24-year exposure for an adult, as well as the toxicity of the COCs (PCE and TCE). The total risk from ingestion of contaminated groundwater at this exposure point to a future resident is estimated to be 1.2E-04. Risk due to ingestion of groundwater is the most significant. The COCs contributing to this risk are PCE and TCE in groundwater. The risk level indicates that if no clean-up action is taken and groundwater is used in the future as potable water, an individual would have increased probability of 1 in 10,000 of developing cancer as a result of site-related exposure to the COCs.

Table G-8

Risk Characterization Summary (West of Plains Road) - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground-water	Ground-water	West of Plains Road	PCE	Liver, Kidney, Nervous system	4.4E-02	N/A	1.9E-02	6.3E-02
			TCE	Liver, Kidney, Nervous system	2.3E+00	N/A	3.0E-01	3E-00
Ground-water	Shower Air	West of Plains Road	PCE	Nervous systems, eye, respiratory system	N/A	2.5E-06	N/A	2.5E-06
			TCE	Nervous system	N/A	6.4E-05	N/A	6.4E-05
							Groundwater Hazard Index Total =	3

Key

PCE = Tetrachloroethene
TCE = Trichloroethene
N/A: Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure using age-weighted exposure assumptions for a 6-year exposure for a child and 24-year exposure for an adult. The Risk Assessment Guidance for Superfund (RAGS) states that generally a hazard index (HI) greater than 1 indicates the potential for non-cancer effects. The estimated HI of 3 indicates that adverse target organ effects may be anticipated in the event groundwater from that part of the Site that is west of Plains Road is used for drinking water. Ingestion of TCE in groundwater would lead to the greatest risk.

Uncertainties:

The foregoing analysis is subject to some uncertainties.

Trichloroethene is being re-evaluated for carcinogenic potency by EPA. The high-end of the range of oral slope factors and unit risk values were used in the RI to calculate the excess lifetime cancer risks posed at the Site. This approach may have resulted in an overestimate of the risks associated with trichloroethene in groundwater. This uncertainty will be periodically reviewed to address changes in trichloroethene toxicity values.

The risk analysis performed for this Site only includes evaluation of the "Reasonable Maximum Exposure" (RME) for each receptor, rather than also including evaluation of the "Central Tendency" (CT) exposure – i.e., the amount of contamination the average person would be exposed to from drinking and showering in Site groundwater. The CT exposure at the Site is likely lower than the exposure assumed to occur for purposes of this risk analysis. The RME exposure assumptions reflect upper bound or maximum values and thus likely overstate risks.

2. Ecological Risk Assessment

As part of the RI for the Site, a screening level ecological risk assessment (SLERA) was conducted for the aquatic and terrestrial environments at and around the Site. The information gathered below has been taken from the RI.

The SLERA focused on areas that are, or could be, affected by Site contaminants in soils or groundwater. Specifically, these areas consisted of:

- Site soils in the area of the original release in the Former Drum Storage Area;
- URI Pond, located above the groundwater plume, which may receive discharging groundwater; and
- Hundred Acre Pond, located west of the Site, which also is a discharge point for the PCE/TCE groundwater plume.

These areas will be referred to as Study Areas throughout the discussion of this SLERA.

Study Area Characteristics

The areas evaluated by this SLERA are geographically and ecologically distinct, connected only through the migration pathway of contaminants originating at the Former Drum Storage Area. As described previously, VOCs (primarily PCE and TCE) were released to soils and ultimately to groundwater at the Former Drum Storage Area, located uphill and to the east of the historical landfill areas. The VOC groundwater plume created by this release flows west with the groundwater, under the landfill areas, discharging along the way to the URI Pond before reaching the wetlands of Hundred Acre Pond, approximately one half mile to the west of the source area. Thus, the three Study Areas are separated by uncontaminated terrestrial areas. The habitat characteristics of the three Study Areas are described below.

Former Drum Storage Area
The Former Drum Storage Area formerly consisted of a forested area of second-growth maple, oak and white pine, with a thick shrub layer typical of re-vegetating fields. It was recently cleared as part of the RI and currently consists of open ground with exposed native soils. This area is expected to re-vegetate in the future.

This area would provide good habitat for a variety of songbirds and small herbaceous mammals, such as mice, voles, and groundhogs. Because of the mix of open fields and deciduous forest with significant young growth, this area would also be a suitable habitat for the American woodcock, used as a representative species in evaluating this area.

URI Pond
The URI Pond area consists primarily of URI Pond, a groundwater-fed, essentially stagnant water body, which lies directly over the groundwater plume and is the only water body in which COPCs have been detected. For the purposes of the SLERA, this Study Area includes both the Pond and nearby shallow wetland pools that exist within or near the current groundwater plume boundaries. Emergent vegetation lined the shores of the pond, and pond sediment consists of fine silt and muck. URI Pond, located directly adjacent to the now capped landfill (formerly Fill Area 5) has no surface inflow or outflow. This pond has been incorporated into the storm water retention system for the landfill closure. The areas around the pond which have been disturbed as a result of the construction were used for wetland restoration under RIDEM oversight. This pond is not believed to contain fish, but would provide suitable habitat for aquatic invertebrates, amphibians, and waterfowl. TCE and PCE were detected in both surface water and sediment in the URI Pond.

Hundred Acre Pond
Hundred Acre Pond is a large water body surrounded by residential properties, woods, and fields. The shoreline area downgradient of the landfill consists of a thick scrub-shrub wetland, with pockets of standing water and woody vegetation less than 20 ft. high. An upland "island" lies to the west of the scrub-shrub wetland, and open water lies to the north and south. Surface water and sediment sampling in Hundred Acre Pond showed no detectable concentrations of VOCs. However, deep porewater samples from three locations showed PCE and/or TCE concentrations of 9 ug/L or less.

Although much of the western shoreline of the Pond is developed into residential properties, these properties are typically separated by second-growth maple-oak woodlands, providing suitable habitat for raccoon, fox, rabbit, deer, and other woodland and wetland species adapted to coexisting with human development.

Identification of Ecological COPCs

The identification of ecological chemical stressors for further evaluation was the first step in development of the SLERA process. Site-related compounds consist of VOCs, primarily PCE and TCE. These are the only site-related compounds that have been detected in surface water, soil, or sediment, and are believed to originate from the Former Drum Storage Area. However, samples were also analyzed for metals, and since metals can result from either natural or anthropogenic sources, they were evaluated as ecological COPCs in the SLERA. All detected compounds in target media were considered to be ecological COPCs, unless shown to result from laboratory contamination, except as noted below. Also, in accordance with standard risk assessment practice, metals considered to be essential nutrients (calcium, magnesium, potassium, and sodium) were not evaluated. The data sets and ecological COPCs for each of the Study Areas are summarized below and are presented in Section 6.2.2 of the RI.

Former Drum Storage Area COPCs
Only data from soil samples collected from 0-2 feet below ground surface were used, since this is the zone of greatest root activity and is used for burrowing by small and medium-sized mammals. Within this area, 14 samples were collected as part of the RI and used in the SLERA evaluation. These samples were used to identify COPCs, including: PAHs, PCE, and metals.

URI Pond COPCs
Surface water and sediment from the URI Pond were sampled during the RI. Surface water COPCs included PCE, TCE, methyl-t-butyl ether, trichlorofluoromethane and metals. Sediment COPCs included cis-1, 2-dichloroethene, PCE, TCE, and metals.

Hundred Acre Pond COPCs
No VOCs were detected in surface water or sediment from Hundred Acre Pond and are not considered COPCs in these media. Due to the absence of VOCs in these surface waters and sediments, and due to the absence of elevated concentrations of metals in the groundwater plume, metals are also not considered to be COPCs in the Pond – i.e., any metals concentrations in Pond surface water or sediments are not believed to be due to plume VOCs exacerbating metals concentrations or due to any metals from the plume itself. Therefore, these media were not evaluated in the SLERA. However, TCE and PCE were detected in deep sediment porewater, which was collected from a depth of 1 to 3 ft. below the sediment surface. The maximum concentrations of these VOCs were used in a conservative approach to evaluate risk to some wildlife receptors at this location.

Ecological Exposure Assessment

Complete exposure pathways at the Former Drum Storage Area and potential receptors in the other two Study Areas are as follows:

Former Drum Storage Area: The exposure pathway in this area is from the direct discharge of COPCs to Site soils during historical operations. Site soils are a potential exposure medium in this area.

URI Pond: VOCs may reach the URI Pond through groundwater emanating from the Former Drum Storage Area. Exposure media consist of surface water and sediment.

Hundred Acre Pond: No Site COPCs were detected in either surface water or sediment, eliminating these media as components of a complete exposure pathway. Low concentrations of VOCs were detected in deep sediment porewater collected approximately 3 ft below the surface of the sediment and as such were considered to be potentially reflective of concentrations that may occur under some circumstances in shallow and stagnant pools right at the water's edge. While not a true aquatic habitat, these shallow puddles of "daylighting" porewater may be utilized by riparian mammals as a drinking water source. The deep porewater of Hundred Acre Pond is thus considered to be the exposure media under this conservative scenario.

Potential receptors at the Site are summarized in Table G-9. These receptors are a function of both the habitat around the groundwater discharge areas as well as the fate and transport characteristics of the COPCs. Site-related ecological COPCs consist of VOCs, which do not in general bioaccumulate in the food chain, and of metals, some of which do bioaccumulate.

Table G-9: Potential Ecological Receptors

Study Area	Exposure Media	Potential Receptors
Former Drum Storage Area	Soils	• Terrestrial plants and invertebrates • Higher trophic level receptors (herbivores and carnivores) that feed on Site invertebrates or vegetation
URI Pond	Surface Water and Sediment	• Benthic invertebrates • Amphibians that may breed or live in or near the ponds • Waterfowl that may feed in the ponds or ingest VOCs from the URI Pond.
Hundred Acre Pond	Riparian surface water	• Terrestrial mammals that may ingest VOCs in surface water (deep porewater that has migrated to the water's edge).

Summary of Ecological Risk Characterization

Little or no potential risk to soil invertebrates, plants, herbivores, or carnivores is expected at the Former Drum Storage Area as the result of Site COPCs in surface soil. Detected concentrations of COPCs in soils were typically below the most conservative benchmarks, and exceedances, where they occurred, were relatively low and associated with single samples or highly unlikely exposure scenarios.

The URI Pond was evaluated for potential risks to aquatic invertebrates, amphibians, and birds. VOCs, which were the only COPCs related to Site activities, were detected in URI Pond While exceedances of benchmarks occurred for some constituents, exceedances were neither sufficient in number or magnitude to suggest a potential for significant risk. Exceedances in surface water for aluminum and iron are believed to be associated with suspended sediment. Available data indicate little or no potential for significant risk to ecological receptors at the URI Pond.

As described previously, potential receptors to Hundred Acre Pond surface water consist primarily of riparian mammals that may utilize the pond as a drinking water source. Since no COPCs were actually detected in any surface water from Hundred Acre Pond, porewater was used as a conservative representation of exposure, since it may be reflective of conditions in very shallow riparian surface water or wetland standing water where groundwater initially discharges. Porewater samples, which were collected from a depth of 1 to 3 ft below the sediment surface, are a conservative estimator of surface water because they do not reflect the attenuating effects of biodegradation, dilution, or volatilization that would occur as contaminants move through sediment into surface water.

Potential effects on riparian receptors were evaluated by comparing porewater values to water ingestion-based wildlife benchmarks. These benchmarks define the concentrations in receptor drinking water that will result in a body dose that exceeds the no-observed adverse effect level (NOAEL) and/or the lowest-observed adverse effect level (LOAEL) for a variety of avian and mammalian species. Any modeled dose below the NOAEL-based benchmark would indicate that there was no unacceptable risk. Any modeled dose above the NOAEL-based benchmark but below the LOAEL-based benchmark would indicate that there might be effects on individual animals but no likely effect on the population of that species. For this evaluation, the maximum detected concentration of VOCs in Hundred Acre Pond porewater was compared to the lowest NOAEL-based benchmark for surface water for any of the mammalian species listed in the benchmark literature. Since the most conservative benchmarks were not exceeded, it was concluded that there was no unacceptable risk.

3. Basis for Response Action

Because the baseline human health risk assessment revealed that future residential users potentially exposed to contaminants of concern in groundwater (from either side of Plains Road) via ingestion, inhalation and dermal contact may present an unacceptable human health risk (cancer risks exceeds 10^{-4}, and HI exceeds 1), actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health or welfare. The Screening Level Ecological Risk Assessment (SLERA) concluded that there is negligible ecological risk to organisms and wildlife within the Former Drum Storage Area, URI Pond and Hundred Acre Pond.

The selected remedial action will address this endangerment to human health through in-situ treatment of source soil and groundwater, monitored natural attenuation of the downgradient plume, long-term environmental monitoring of groundwater and surface water, and institutional controls.

H. REMEDIAL ACTION OBJECTIVES

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment from groundwater. The RAOs for the selected remedy at the West Kingston Town Dump/URI Disposal Area Superfund Site are:

- Prevent potential human exposure (dermal contact, ingestion, inhalation) to groundwater containing Site contaminants at concentrations that exceed state drinking water standards or federal maximum contaminant levels (MCLs) until this groundwater has been restored to safe drinking water levels. For contaminants for which no state drinking water standard or MCL has been established, prevent potential human exposure (dermal contact, ingestion, inhalation) to concentrations which exceed human health risk-based levels (i.e., greater than 1×10^{-6} to 1×10^{-4} excess carcinogenic risk or non-carcinogenic hazard quotient greater than 1.0). The groundwater at the Site currently exceeds EPA risk criteria (lifetime excess cancer risk above 1×10^{-4} and a hazard quotient greater than 1) and MCLs for PCE and TCE. Reducing the risk to potential future residents from groundwater as a drinking water source to acceptable levels and eliminating the MCL exceedance for PCE and TCE is an RAO at the Site.[7]

- Prevent migration/leaching of contaminants from subsurface soil that would result in groundwater contamination (by eliminating contaminant concentrations in soil above the RIDEM soil leachability criteria). The subsurface soil currently shows an exceedance of the soil leachability criterion of 0.1 mg/kg for PCE.

[7] Sampling data indicated an exceedance in URI Pond of the Rhode Island aquatic life criterion for chronic exposures to PCE (set at 5.3 ug/L). The risk assessment showed that this exceedance did not cause an unacceptable risk to human health or the environment. The surface water in URI Pond will be monitored as a way of measuring the performance of the groundwater remediation. It is expected that the exceedance will be eliminated as the groundwater discharging to the Pond is cleaned up.

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

1. Statutory Requirements/Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, comply with all federal and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment that permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

2. Technology and Alternative Development and Screening

CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives was developed for the Site.

With respect to source control, the RI/FS developed a range of alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element. This range included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing to the extent possible the need for long-term management. This range also included alternatives that treat the principal threat posed by the Site but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed; alternative(s) that involve little or no treatment but provide protection through engineering or institutional controls; and a no action alternative.

With respect to groundwater, the RI/FS developed a limited number of remedial alternatives that attain site-specific remediation levels within different time frames using different technologies; and a no-action alternative.

As discussed in Section 6 of the FS, soil and groundwater treatment technology options were identified, assessed and screened based on implementability, effectiveness, and cost. These technologies were combined into Site-wide remedies addressing both source control (i.e., source area soil) and management of migration (i.e., source area groundwater and downgradient groundwater). Section 7 of the FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial alternatives for further detailed analysis while preserving a range of options. Each alternative was then evaluated in detail in Sections 7 and 8 of the FS.

More specifically, Section 6 of the FS screened two source-control (i.e., for source area soil) remedial alternatives in addition to the limited-action alternative[8] and the no-action alternative: in-situ oxidation and off-site disposal. Both these alternatives were retained as possible options for cleanup of source area soils. Section 6 of the FS also screened five management of migration (i.e., groundwater) alternatives, in addition to no action and limited action: in-situ oxidation, air sparging/soil vapor extraction (SVE), a permeable reactive barrier, enhanced biological treatment, and groundwater capture and treatment. Of these management of migration alternatives, three (in-situ oxidation, the permeable reactive barrier, and groundwater capture and treatment) were retained for further analysis. These three management of migration alternatives were combined with the two retained source control alternatives to create three Site-wide alternatives (in addition to the limited-action and no-action alternatives), which were subjected to detailed analysis in Sections 7 and 8 of the FS. The selected remedy -- in-situ oxidation for source area soil, in-situ oxidation combined with MNA for source area groundwater, and MNA for downgradient groundwater[9] -- was one of these three site-wide remedial alternatives subjected to detailed analysis, in addition to a limited-action alternative and a no-action alternative.

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8 As described more below, the limited-action alternative relies on institutional controls and monitored natural attenuation to address contamination at the Site.

9 Under the selected remedy, surface waters will also be monitored as a way of measuring the performance of the groundwater remediation. It is expected that the exceedance will be eliminated as the groundwater discharging to the Pond becomes cleaner.

J. DESCRIPTION OF ALTERNATIVES

This following section summarizes the five Site-wide alternatives for cleaning up the Site that were subjected to detailed analysis in the FS. A breakdown of the costs for each alternative is shown in Appendix C of the FS.

Alternative 1: No Action

Under this alternative, the Site would remain as is; there would be no treatment or containment of contaminated media and no institutional controls to prevent groundwater use. Because waste is left in place periodic reviews would be conducted every five years to assess the long-term appropriateness of continued No Action. The significant applicable or relevant and appropriate requirement (ARAR) associated with source area soil, the leachability criteria established in Section 8.02.B.ii of the RI Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases, would not be met, and the source area soil would continue to leach contaminants into the groundwater. Groundwater ARARs, the Maximum Contaminant Levels set under the federal Safe Drinking Water Act for PCE and TCE, would also not be met. VOC mass would remain unaddressed in the subsurface soil and in the source area groundwater (bedrock and overburden). It is estimated that groundwater cleanup levels would not be achieved for 110 to 460 years under this alternative. There would be no capital costs. Each five-year review, with associated monitoring, would cost an estimated $91,500 (an average of $18,300 annually), for a total present worth of $227,000 (based on costs over a 30-year period, discounted at 7% per year).

Table J -1: Summary of Alternative 1 – No Action	
Treatment Components	No active treatment
Containment Components	None
Institutional Control Components	None
Monitoring Requirement	Monitoring of groundwater and surface water once every five years
Operation and Maintenance Requirements	• Review of Site conditions and risks at five-year intervals. • O&M of the monitoring well system associated with five-year reviews.
ARARs	State soil leachability criteria and MCLs: not met.
Long-Term Reliability	Not applicable.
Quantity of Untreated Wastes and/or Residuals	Minimal investigation-derived waste from groundwater monitoring associated with five-year reviews.
Estimated Time to Design and Construct	Not applicable.
Estimated Time to Reach Remediation Levels	RAOs estimated to be achieved in approximately 110 to 460 years (see Appendix B to the FS).
Use of Presumptive Remedies or Innovative Technologies	None
Expected Reuse Outcomes	The aquifer will not be restored to drinking water standards for approximately 110 to 460 years.
Cost	Total Capital Costs: $0 Annual O&M & Periodic Costs: $18,300 Total NPW Costs: **$227,000**

Alternative 2: Limited Action

This alternative is similar to no action in that groundwater cleanup levels would be achieved within the same time frame. Similarly, this alternative does not include active treatment to reduce VOC masses or address soil leachability. The alternative includes annual monitoring and deed restrictions (ELURs to be implemented by the PRPs on the URI- and Town-owned land and the privately-owned adjacent downgradient properties) to prevent use of the groundwater while natural attenuation processes work to degrade TCE and PCE into innocuous byproducts. There would be $75,000 in capital costs to implement the deed restrictions. The costs of operations and maintenance, including five-year reviews, would be approximately $79,000 per year, for a total present worth of $1,055,000. The same assumptions outlined above apply to this cost estimate.

Table J-2: Summary of Alternative 2 – Limited Action	
Treatment Components	No active treatment.
Containment Components	None
Institutional Control Components	Deed restrictions to restrict groundwater use.
Monitoring Requirement	Periodic monitoring of groundwater and surface water to assess the effectiveness of natural attenuation processes.
Operation and Maintenance Requirements	• Review of Site conditions and risks at five-year intervals. • O&M of the monitoring well system associated with five-year reviews.
ARARs	State soil leachability criteria and MCLs would not be achieved for approximately 110 to 460 years; in the meantime deed restrictions would prohibit groundwater use.
Long-Term Reliability	• Site characterization data indicate that natural attenuation processes are degrading site-related VOCs in groundwater. • Source Area Soil will not be addressed, and would continue to be a source of contaminants to groundwater. • Institutional controls would effectively limit groundwater use.
Quantity of Untreated Wastes and/or Residuals	Minimal investigation-derived waste from groundwater monitoring associated with five-year reviews.
Estimated Time to Design and Construct	No design or construction is associated with this alternative.
Estimated Time to Reach Remediation Levels	RAOs estimated to be achieved in 110 to 460 years (see Appendix B to the FS).
Use of Presumptive Remedies or Innovative Technologies	None
Expected Reuse Outcomes	The aquifer will not be restored to drinking water standards for approximately 110 to 460 years.
Cost	Total Capital Costs: $75,000 Annual O&M & Periodic Costs: $79,000 Total NPW Costs: **$1,055,000**

Alternative 3: In-situ oxidation of soil; treatment of source area groundwater with a permeable reactive barrier; MNA for downgradient groundwater

Under this alternative, clean soil lying over the source area would be excavated until contaminated soil is encountered, using a side slope of 2:1 (horizontal to vertical) so that shoring would not be necessary. Clean soil (estimated at 2,300 cubic yards) would be stockpiled onsite for use as backfill. Oxidants would then be used to treat the contaminated source area soil, which is estimated to contain less than one pound of VOCs and constitutes the principal threat waste at the Site. It is estimated that the area of contaminated soil is 30 feet by 50 feet and lies between 12 and 18 feet below ground surface. Specifically, contaminated soil would be mixed in-situ with an oxidant, such as solid potassium permanganate, using an excavator-mounted hydraulic mixing tool. Water would be added as needed to optimize mixing. The oxidant would destroy the VOCs in the source area soil, almost immediately achieving the State soil leachability ARAR and eliminating a continuing source of contamination to the groundwater. Once confirmation samples indicate that the soil leachability criteria have been met in the source area soil, the excavation would be backfilled with the stockpiled clean soil and the surface restored. The oxidation treatment is expected to result in innocuous residuals: carbon dioxide, oxygen, water, and inorganic soluble salts. Any oxidant that does not react with VOCs in the source area soils may help oxidize contaminants in the groundwater below these soils. Although no treatability testing has been done, in-situ chemical oxidation is considered a reliable, well-established technology, and can be implemented in less than one month. Some subsurface characterization may be necessary to determine the quantity of oxidants to be mixed into the soil.

Source area groundwater would be treated with a permeable reactive barrier (PRB). A PRB is a trench constructed perpendicular to the direction of groundwater flow, backfilled with granular iron. The fill material is relatively permeable, allowing the contaminated groundwater to flow through the barrier without redirecting its path. When the VOCs in the plume come in contact with the granular iron, they are eventually reduced to ethane and chloride, reducing contaminant mass in the source area groundwater. The PRB would be placed downgradient of the source area groundwater at the toe of the slope near the URI Pond, spanning the depth of the plume (between 9 and 15 feet below ground surface). The lower six feet of the trench would be filled with granular iron, to intercept the plume. The trench would be approximately 700 feet long to intercept groundwater flow within the 5 ug/L contour of the PCE/TCE overburden plume, and wide enough to provide sufficient residence time in the granular iron for treatment to occur.

PRBs are a relatively new, innovative technology with limited long-term field data concerning the longevity of PRB reactivity and/or the loss of permeability due to precipitation of metal salts; pre-design and bench scale studies would be necessary to ensure the PRB is effectively designed and installed. Cost estimates include costs for this pre-design and bench scale studies, and assume that the PRB will be replaced every 15 years. The PRB would take approximately 1.5 years to put in place, and would be expected to remain in place for as long as it continued to intercept significant volumes of VOCs. Soil excavated to create the trench and soil cuttings (estimated at 218 cubic yards) would be disposed of at a licensed off-site hazardous waste facility, to the extent testing found these soils to be contaminated.

The downgradient groundwater plume would be monitored for natural attenuation.[10] Deed restrictions (ELURs to be implemented by the PRPs on the URI- and Town-owned land and the privately-owned adjacent downgradient properties) would prohibit use of groundwater until

[10] Under this alternative, surface waters would also be monitored as a way of measuring the performance of the groundwater remediation.

cleanup levels were reached.

Under Alternative 3, it is expected that MCLs would be achieved throughout the groundwater plume in 75 to 310 years, with significant mass reductions occurring earlier in that period as a result of the soil remediation and the reactive barrier. The total capital costs of Alternative 3 are estimated at $2,162,000. Of these capital costs, $160,000 is directly attributable to the soil remediation; $1,114,000 to the PRB; $255,000 to contingencies; and $633,000 to indirect costs. The O&M cost is estimated at approximately $78,000 per year (including the cost of five-year reviews). The total present worth of Alternative 3 is $3,130,000. The same assumptions used in the above alternatives apply.

Table J-3: Summary of Alternative 3 – In-situ oxidation of soil; PRB for source area groundwater; MNA for downgradient groundwater	
Treatment Components	• Excavation/chemical oxidation for approximately 350 cubic yards of source area soil. • PRB for source area overburden groundwater.
Containment Components	None
Institutional Control Components	Deed restrictions to restrict groundwater use.
Monitoring Requirement	• Periodic monitoring of groundwater to assess the effectiveness of the source area soil and groundwater remedy components, as well as to assess the effectiveness of natural attenuation parameters in downgradient groundwater. • Periodic monitoring of surface water to evaluate the treatment of upgradient groundwater that discharges to the URI Pond.
Operation and Maintenance Requirements	• Review of Site conditions and risks at five year intervals. • O&M of the monitoring well system. • Minimal O&M associated with PRB.
ARARs	• State soil leachability criteria would be achieved quickly. • Despite significant initial mass reductions, MCLs would not be achieved for approximately 75 to 310 years. In the meantime deed restrictions would prohibit groundwater use.
Long-Term Reliability	• Reliability of chemical oxidation to treat PCE in soil is high. • Reliability of PRB to treat overburden groundwater is dependent on thorough understanding of subsurface hydrogeologic and geochemical conditions. • Long-term reliability/service life of PRB is unknown, but estimated to be 15 years. • Institutional controls would prohibit groundwater use.
Quantity of Untreated Wastes and/or Residuals	• Potential to generate soil requiring special handling during excavation of trench for PRB. • Minimal investigation derived waste from groundwater monitoring.
Estimated Time to Design and Construct	• Less than a month is needed to perform the soil remedy. • Pre-design and bench-scale studies and construction of the PRB estimated at approximately 1.5 years to implement.
Estimated Time to	RAOs estimated to be achieved in approximately 75 to 310

Table J-3: Summary of Alternative 3 – In-situ oxidation of soil; PRB for source area groundwater; MNA for downgradient groundwater	
Reach Remediation Levels	years (see Appendix B to the FS).
Use of Presumptive Remedies or Innovative Technologies	PRB is an innovative technology.
Expected Reuse Outcomes	Aquifer would be restored to drinking water standards within approximately 75 to 310 years.
Cost	Capital Costs: Direct soil costs: $160,000 Direct GW costs: $1,114,000 Contingent costs: $255,000 Indirect costs: $633,000 Total capital costs: $2,162,000 Annual O&M & Periodic Costs: $78,000 Total NPW Costs: **$3,130,000**

Alternative 4: In-situ oxidation of soil/in situ oxidation of source area groundwater/MNA of downgradient groundwater

This alternative uses the same methods as Alternative 3 to treat the source area soil and downgradient groundwater. It differs from Alternative 3 in that it involves treating source area groundwater with injections of oxidants, rather than with a PRB. A sodium permanganate (or similar oxidant) solution would be injected into the source area groundwater plume at the top of the hill near the Former Drum Storage Area, upgradient of the presumed groundwater source. The injection system would consist of a row of bedrock wells and a chemical feed system. The chemical feed system would be in a small building near the west end of the access road, outside the zone of contamination. Sodium permanganate would be pumped directly from the shipping container to a recirculation tank where it would be diluted with water, mixed, and then sent to a recirculation pump that would pump the diluted oxidant to each of the injection wells. Soils excavated to install the feed system are not anticipated to be hazardous but will be tested and disposed of at a licensed facility if necessary. It is estimated that up to 6.5 cubic yards of soil cuttings would be generated during injection well installation. This soil is also likely to be non-hazardous, but the cost estimates assume that off-site disposal at a licensed hazardous waste facility would be required once the soil is tested.

Injection of oxidant to the source area groundwater plume would be anticipated to continue until approximately 90 percent of the VOC mass in the source area has been destroyed, as determined by environmental monitoring. For costing purposes, it was assumed that injection would be continuous and last for six to twelve years. Over this period approximately 10 tons of sodium permanganate (or similar oxidant) would be added. The byproducts would be innocuous, just as with the potassium permanganate mixing described in Alternative 3, although there is the potential for temporary pink coloration of sediments and surface waters in the URI Pond.

Injection of oxidants is an established groundwater remedy and is considered reliable. However, prior to implementation of this alternative, pilot studies would be performed to obtain, among other things, additional characterization of subsurface conditions. The installation of the system is expected to take approximately 1.5 years.

Under Alternative 4, it is expected that MCLs would be achieved throughout the groundwater plume in 80 to 325 years, with significant VOC mass reductions occurring earlier in that period as a result of the soil remediation and the injection of oxidant into the source area groundwater.[11] Deed restrictions (ELURs to be implemented by the PRPs on the URI- and Town-owned land and the privately-owned adjacent downgradient properties) would restrict use of groundwater until cleanup levels are achieved. The total capital costs of Alternative 4 are estimated at $954,000. Of these capital costs, $160,000 is directly attributable to the soil remedy; $355,000 to the injection wells; $103,000 to contingencies; and $336,000 to indirect costs. The O&M cost is estimated at approximately $138,000 per year (including the cost of 5-year reviews). The total present worth of Alternative 4 is $2,343,000. The same cost assumptions used for the above alternatives apply.

Table J-4: Alternative 4: In situ oxidation of soil; in situ oxidation of source area groundwater; MNA for downgradient groundwater	
Treatment Components	• Excavation/chemical oxidation for source area soil. • In situ chemical oxidation for source area groundwater.
Containment Components	None
Institutional Control Components	Deed restrictions to restrict groundwater use.
Monitoring Requirement	• Periodic monitoring of groundwater to assess the effectiveness of the source area soil and groundwater remedy components, as well as to assess the effectiveness of natural attenuation parameters in downgradient groundwater. • Periodic monitoring of surface water to evaluate the treatment of upgradient groundwater that discharges to the URI pond.
Operation and Maintenance Requirements	• Review of Site conditions and risks at five year intervals. • O&M of the monitoring well system and chemical oxidation injection wells.
ARARs	• State soil leachability criteria would be achieved quickly. • Despite significant initial mass reductions, MCLs would not be achieved for approximately 80 to 325 years. In the meantime deed restrictions would prohibit

[11] The surface water in URI Pond will be monitored as a way of measuring the performance of the groundwater remediation. It is expected that the exceedance will be eliminated as the groundwater discharging to the Pond is cleaned up.

Table J-4: Alternative 4: In situ oxidation of soil; in situ oxidation of source area groundwater; MNA for downgradient groundwater	
	groundwater use.
Long-Term Reliability	• Reliability of chemical oxidation to treat PCE in soil is high. Pilot studies would have to be conducted to optimize effectiveness of the delivery system for injection of oxidant into the groundwater. • Institutional controls would effectively limit groundwater use.
Quantity of Untreated Wastes and/or Residuals	Minimal investigation derived waste from groundwater monitoring wells. Potential to generate soil requiring special handling for injection well installations.
Estimated Time to Design and Construct	• Less than a month is needed to perform the soil remedy. • The time to complete pre-design studies, design, and construct the in situ chemical oxidation system for groundwater is estimated to be approximately 1.5 years.
Estimated Time to Reach Remediation Levels	RAOs estimated to be achieved in approximately 80 to 325 years (see Appendix B to the FS).
Use of Presumptive Remedies or Innovative Technologies	None
Expected Reuse Outcomes	The aquifer would be restored to drinking water standards within approximately 80 to 325 years.
Cost	Capital Costs: Direct soil costs: $160,000 Direct GW costs: $355,000 Contingent costs: $103,000 Indirect costs: $336,000 Total capital costs: $954,000 Annual O&M & Periodic Costs: $138,000 Total NPW Costs: **$2,343,000**

Alternative 5: Off-site disposal of source area soils/groundwater capture and treatment

Under this alternative, contaminated source area soils would be excavated and disposed of off-site, and the entire groundwater plume would be captured and treated by a network of extraction wells.

To implement the soil remediation, the Site would first be cleared of vegetation. Excavation would then commence using a side slope of 2-to-1 (horizontal to vertical) so that shoring would not be necessary. For costing purposes, it was assumed that an area 122 feet by 102 feet would be excavated. It was also assumed that approximately 2,300 cubic yards of non-impacted soil would be excavated before the impacted soil is encountered and stockpiled for use as backfill, and that approximately 350 cubic yards of impacted soil would be removed and stockpiled in roll-off containers. Soil samples would be sent to a testing laboratory to determine disposal requirements. Depending on the test results, the soil would either be transported for off-site disposal at a licensed disposal facility, or stockpiled at the Site and used to backfill the excavation. (For costing purposes, disposal at a RCRA Subtitle C landfill was assumed.) Once sampling confirmed the removal of all contaminated soil, the source area would be backfilled and the surface restored, using imported clean fill as necessary.

The groundwater remedy (for both downgradient and source area groundwater) would be to install approximately 18 extraction wells throughout the plume to prevent further migration of the plume. The extraction wells would be six- to ten-inches in diameter, and pump between 30 and 60 gallons per minute each. These wells would be installed to an average depth of approximately 90 feet below ground. Collection piping located below ground would transport the extracted groundwater to a treatment building located between URI Pond and Plains Road. Once treated (see next paragraph on treatment methods), extracted groundwater would be discharged to 10 wells via a network of distribution piping. These discharge wells would reinject the treated water into the aquifer at the downgradient edge of the plume, near Hundred Acre Pond.

The groundwater from the extraction wells would be treated before re-injection with granular activated carbon (GAC), unless pre-design studies determined that another treatment system was preferable. Activated carbon removes contaminants from liquid streams by adsorption. It has a particularly high affinity for PCE and TCE, is a proven technology for treatment of chlorinated VOCs, and is considered a presumptive ex-situ technology by EPA for treatment of dissolved organic contaminants in extracted groundwater at Superfund sites. Groundwater from the wells would be pumped to the treatment system, would pass through bag filters to remove particulate material, and then into aqueous-phase GAC vessels that would remove PCE and TCE. Effluent from the vessels would then pass to an equalization tank and then out through the distribution system to the injection wells. The GAC within the vessels would periodically need to be replaced; spent carbon would be removed from the Site for regeneration or disposal at an approved, licensed facility. It is expected to take approximately two years to design and build this treatment system.

The soil remedy proposed by this alternative would remove contaminated soil from the Site and achieve the soil leachability criteria ARARs almost immediately. The pump-and-treat system would be expected to achieve MCLs throughout the aquifer in 25 to 50 years. In the meantime, environmental monitoring would measure the progress of the remedy and deed restrictions (ELURs to be implemented by the PRPs on the URI- and Town-owned land and the privately-owned adjacent downgradient properties) would prohibit use of the groundwater as drinking water. The groundwater treatment system would disturb wetlands near Hundred Acre Pond (where reinjection wells would have to be installed); care would have to be taken to minimize impact to comply with the ARARs related to wetlands. Both the soil and groundwater remedies of this alternative would generate residuals that would have to be disposed of at off-site hazardous waste facilities (or regenerated, in the case of spent GAC). As in the other active treatment alternatives, concentrations of PCE in URI Pond are expected to diminish as a result of cleaning up the groundwater flowing into the Pond.

The total capital costs of Alternative 5 are estimated at $7,237,000. Of these capital costs, $392,000 is directly attributable to the soil remedy; $4,135,000 to the groundwater treatment system; $905,000 to contingencies; and $1,805,000 to indirect costs. The O&M cost is estimated to be approximately $218,000 per year (including monitoring and the cost of 5-year reviews, but not including the cost of buying more carbon, estimated at $31,000 over the life of the remedy). The total present worth of Alternative 5 is $9,973,000. The same cost assumptions used in the above alternatives apply.

Table J-5: Summary of Alternative 5: Off-site disposal of soil; Groundwater pump, treat and reinjection	
Treatment Components	• Excavation/off-site disposal for source area soil. • Extraction and ex-situ treatment using carbon adsorption for the entire PCE/TCE plume followed by reinjection of treated groundwater.
Containment Components	Groundwater extraction would prevent source groundwater from migrating downgradient.
Institutional Controls	Deed restrictions to restrict groundwater use.
Monitoring Requirement	• Periodic monitoring of groundwater to assess the effectiveness of the soil and groundwater remedy components. • Periodic monitoring of surface water to evaluate treatment of upgradient groundwater that discharges to the URI Pond. • *Routine monitoring of treatment system effluent to* evaluate the effectiveness of the treatment system and verify that reinjection criteria are achieved.
Operation and Maintenance Requirements	• Review of Site conditions and risks at five year intervals. • O&M of the monitoring well system and extraction/reinjection system.
ARARs	• State soil leachability criteria would be achieved quickly. • MCLs would be achieved in approximately 25 to 50 years. In the meantime deed restrictions would prohibit groundwater use. • Wetlands protection ARARs may present a difficulty in that some of the reinjection wells are located in a wetland.
Long-Term Reliability	• Groundwater extraction is a demonstrated and reliable method for capturing and collecting contaminated groundwater. • GAC is a *proven technology for treatment of site-related*

Table J-5: Summary of Alternative 5: Off-site disposal of soil; Groundwater pump, treat and reinjection	
	chlorinated VOCs. • Discharge of treated groundwater via a reinjection system is considered reliable. • Institutional controls would effectively limit groundwater use.
Quantity of Untreated Wastes and/or Residuals	• Relatively small amounts of investigation-derived waste from groundwater monitoring. • Use of GAC would produce treatment residuals that would require off-site treatment/disposal.
Estimated Time to Design and Construct	The estimated time to design and construct the extraction, treatment, and reinjection system is approximately 2 years. The soil remedy would be implemented more quickly.
Estimated Time to Reach Remediation Levels	RAOs estimated to be achieved in approximately 25 to 50 years (see Appendix B to the FS).
Use of Presumptive Remedies or Innovative Technologies	None
Expected Reuse Outcomes	It is estimated that the aquifer would be restored to drinking water standards in 25 to 50 years.
Cost	Capital Costs: Direct soil costs: $392,000 Direct GW costs: $4,135,000 Contingent costs: $905,000 Indirect costs: $1,805,000 Total capital costs: $7,237,000 Annual O&M & Periodic Costs: $218,000 Total NPW Costs: **$9,973,000**

K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the five alternatives previously described in Section J, using the nine evaluation criteria in order to select a Site remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These criteria are as follows:

Threshold Criteria
The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with applicable or relevant and appropriate requirements (ARARs)** addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked.

Primary Balancing Criteria
The following five criteria are utilized to compare and evaluate the elements of the alternatives meeting the threshold criteria:

3. **Long-term effectiveness and permanence** addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.

5. **Short-term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

Modifying Criteria
The modifying criteria are used as the final evaluation of remedial alternatives, generally after EPA has received public comment on the RI/FS and Proposed Plan:

8. **State acceptance** addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in Table 8-1 of the Feasibility Study.

The section below evaluates each of the five alternatives under the nine criteria. Only those alternatives which satisfied the first two threshold criteria are subject to the analysis using the balancing and modifying criteria.

1. Overall Protection of Human Health and the Environment
Since the RI determined that there was no ecological risk at the Site (see Section G, above), the discussion herein is limited to whether each alternative adequately protects human health.

All of the Alternatives except Alternative 1 are protective of human health. Alternative 1, no further action, does nothing to help diminish groundwater contamination, and does not implement institutional controls to prohibit consumption of the contaminated groundwater. Since the groundwater exceeds MCLs and would pose unacceptable risks to human health in the event it is used as drinking water (see Section G, above), Alternative 1 fails to protect human health.

Alternative 2, Limited Action, does not actively clean up groundwater; rather it is limited to monitoring the biodegradation of contaminants, which should eventually reduce VOCs to acceptable levels. Institutional controls will prohibit groundwater consumption during the long period of natural recovery. This alternative remains protective of human health and the environment only as long as the institutional controls remain in place and are effectively enforced. Alternatives 3 through 5 all rely on active treatment to achieve significant mass reductions in the short term, in some cases of up to 90% within 10 years (Alternative 4). Despite these initial reductions, achieving the last diminutions in contaminant concentrations remains a lengthy process under all the alternatives, taking anywhere from 25-50 years (for Alternative 5) to 80-325 years (Alternative 4). In the meantime, institutional controls would prohibit uses of groundwater.

Alternatives 3 through 5 offer the highest degree of human health protection in that treatment is used to reduce significant contaminant mass early in the remedy. Institutional controls provide long-term protection as long as they are maintained and enforced.

2. Compliance with Applicable or Relevant and Appropriate Environmental Requirements (ARARs)

The no-action alternative, Alternative 1, does not meet ARARs, or other advisories, criteria and guidance that are "to be considered" (TBCs). Since this alternative fails to meet the two threshold criteria, it will not be carried forward through the remaining comparative analysis.

Alternative 2 will meet State and Federal ARARs, insofar as contaminants are expected to eventually leach out of the soil such that the soil will eventually meet the state leachability criterion for PCE. Similarly, biodegradation of TCE and PCE in groundwater will eventually result in the groundwater achieving MCLs (in 110 to 460 years).

The active treatment alternatives, Alternatives 3 through 5, also meet the relevant ARARs, and do so somewhat more quickly. Under Alternative 3 through 5, soil ARARs would be expected to be achieved immediately upon completion of the active phase of treatment, i.e., either through chemical oxidation (Alternatives 3 and 4) or through shipment to an off-site facility (Alternative 5). Achieving MCLs in the groundwater will occur but not as fast, notwithstanding significant initial mass reductions: it will take 75-310 years to achieve MCLs for Alternative 3; 80-325 years for Alternative 4; and 25 to 50 years for Alternative 5. The active treatment alternatives would also meet all action-specific and location-specific ARARs, though care would have to be taken under Alternative 5 to minimize impacts in wetlands (under Alternative 5 wells would be placed in wetlands to reinject treated groundwater).

3. Long-Term Effectiveness and Permanence

Alternative 2 provides the least long-term effectiveness because no actions would be taken to reduce contaminant mass in either soil or groundwater during the time period required for natural attenuation; during this same period the effectiveness of the remedy would depend solely on adherence to institutional controls. The remaining three alternatives (Alternatives 3, 4, and 5) provide more long-term effectiveness in that each reduces contaminant mass significantly through active treatment at the outset, in addition to reliance on institutional controls during the time period between termination of active treatment and final attainment of cleanup levels. Alternative 5 is unique in that it relies on moving contaminated soils to offsite disposal facilities, potentially without treatment, thereby implicating the inherent uncertainty associated with long-term land disposal of contaminated media. Apart from this aspect of Alternative 5, none of the Alternatives depend on containment strategies (i.e., are not vulnerable to breaches in containment in the long term).

All of the alternatives would require periodic five-year reviews as long as hazardous materials remain onsite.

4. Reduction of Toxicity, Mobility and Volume through Treatment

Alternative 2 would not reduce contaminant toxicity, mobility, or volume through treatment, as no active treatment would be implemented. Over a long period of time, contaminant levels may decrease through natural processes.

Alternatives 3 and 4 rely on treatment technologies to reduce contaminant toxicity, mobility and volume. These alternatives would be expected to provide permanent reductions in the toxicity and mass of contaminants in both soil and groundwater using treatment. In both alternatives, source area soil would be treated through chemical oxidation to reduce contaminant levels. Source area groundwater would also be treated with chemical oxidation in Alternative 4. In Alternative 3, source area groundwater would be treated through a reactive barrier system. In both alternatives, downgradient groundwater (where contamination is more diffuse) would not be subjected to treatment apart from monitored natural attenuation.

Alternative 5 is somewhat different from, and inferior to, Alternatives 3 and 4 with respect to this criterion. Under Alternative 5, excavation and off-site disposal of contaminated soil in an off-site landfill would greatly reduce contaminant mobility, but would not provide a permanent reduction in contaminant toxicity or volume, unless the off-site facility treats the contaminated soils before disposal. Treatment of contaminated groundwater under Alternative 5 would reduce contaminant mobility, toxicity, and volume -- except that the contaminated spent carbon used to treat groundwater as part of the reactive barrier would eventually need to be disposed of in an off-site facility (in which case some volume of toxic substances might remain in the offsite landfill).

5. Short-Term Effectiveness

Alternative 2 requires only administrative time to implement the institutional controls in the form of land use restrictions. There are no short-term impacts to site workers or the community since there is no construction.

Alternatives 3, 4, and 5 are expected to take comparable amounts of time to construct the treatment portions of the remedy – approximately 1.5 to 2 years, with Alternative 3 taking the longest to install the permeable reactive barrier. Alternative 3 will also have more frequent impacts in that the reactive barrier must be recharged every 15 years. Alternative 5 requires that the groundwater wells continue to pump and reinject water until the cleanup levels are met (25-50 years).

The short-term impacts to the local community and to on-site remedial workers under Alternatives 3 and 4 are expected to be minimal and controllable, as all activities would be conducted within the boundaries of the Site property owned by the PRPs. The short-term impacts to the environment under Alternatives 3 and 4 are also expected to be minimal. Both Alternatives 3 and 4 involve minimal removal of soil and brief periods of construction; Alternatives 3 would involve somewhat more soils handling than Alternative 4, with the installation of the reactive barrier. No construction or remedial activity is proposed in wetland areas under either Alternative 3 or Alternative 4. However, the potential exists under Alternative 4 that chemical oxidants injected into groundwater could migrate to and potentially impact the URI Pond. Although no effects are anticipated, wetland areas and the URI Pond would be monitored to evaluate potential impact. But overall short-term impacts of all kinds are relatively small for both Alternatives 3 and 4.

Under Alternative 5, short-term construction impacts would be anticipated to be the greatest on the surrounding community. This is due to the soil handling involved in off-site disposal of excavated soil, and the need to install a portion of the extraction/reinjection system outside the property boundary owned by the PRPs and in the vicinity of wetland areas adjacent to Hundred Acre Pond, resulting in an increase in local truck traffic and impact to several property owners. All remedial activities would be conducted to minimize impacts on wetlands, in accordance with pertinent ARARs.

6. Implementability

Alternative 2 is easily implementable as it relies on natural attenuation processes to address groundwater contamination. Institutional controls to prevent the use of contaminated groundwater for drinking water and implementation of a long-term monitoring program are also easily implementable.

Alternatives 3, 4, and 5 are implementable, but more complex as they require the completion of treatability studies, engineering design efforts, and construction before the various treatment systems can be operated. The soil remedies under these alternatives – in-situ mixing of oxidants (Alternatives 3 and 4) and disposal off-site (Alternative 5) – are proven, relatively simple technologies. The construction of a PRB trench under Alternative 3 would require pre-design and bench scale studies to ensure the PRB was effectively designed and installed. It would also need re-charging every 15 years. The oxidant injection wells in Alternative 4 would require significant maintenance to prevent fouling caused by metals in groundwater. The treatment system contemplated under Alternative 5 involves a complex network of pipes, some of them located in wetlands. But each of these active treatment alternatives is not expected to present any extraordinary engineering or administrative problems, and all materials and services should be obtainable. All of these alternatives would also involve the implementation of institutional controls and long-term monitoring programs, which are also readily implementable.

7. Cost

Alternative 2 has no capital costs but would have costs associated with implementing institutional controls and a long-term monitoring program. The total present worth cost for

Alternative 2 is $1 million. The treatment alternatives (Alternatives 3 through 5) all have capital as well as operating costs. The total present worth cost of Alternative 3 is estimated at $3.1 million; Alternative 4 at $2.3 million; and Alternative 5 at $10 million.

8. State/Support Agency Acceptance

The State has expressed its support for Alternative 4, the remedy selected in this ROD.

9. Community Acceptance

The Proposed Plan presented to the community by EPA and RIDEM recommended Alternative 4. One set of written comments and one oral comment were received in response, both submitted by the Audubon Society of Rhode Island. The commenter expressed concern about the uncertainty in the fate of TCE and PCE at the Site, impacts on wildlife, and suggested that the ponds affected by the plume be monitored for ecological effects, particularly on amphibians. However, the commenter also agreed that Alternative 4 “appears to provide the most timely cleanup to appropriate levels.” The Responsiveness Summary provides EPA’s responses to these concerns.

L. THE SELECTED REMEDY

1. Summary of the Rationale for the Selected Remedy

The selected remedy is Alternative 4, a comprehensive, final remedy, which utilizes source control and management of migration components to address the principal Site risks which is ingestion, inhalation and dermal contact with groundwater for future residents on either side of Plains Road. The selected remedy includes treatment of source area soils by in-situ oxidation and injection of a chemical oxidant into the source area groundwater to reduce the leaching and mass of VOCs (PCE and TCE) at the Site. This treatment, in combination with the Monitored Natural Attenuation (MNA) of downgradient groundwater will destroy much of the VOC mass and reduce future migration of VOCs. Long-term monitoring of groundwater and surface water will be performed in order to evaluate the progress and success of the remedy. Institutional controls such as state land use restrictions will be implemented in order to restrict the future use of the Site until the Remedial Action Objectives are met. Five-year reviews will be conducted to ensure that the remedial action continues to protect human health and the environment. **Figure 7** shows site plan layout for Alternative 4.

2. Description of Remedial Components

The components for Alternative 4, Excavation/Treatment with In Situ Chemical Oxidation/MNA, the selected remedy, are summarized below. **Figure 8** shows a process flow diagram of the components of the chemical oxidation system. The estimated time to achieve the Remedial Action Objectives (RAOs) for groundwater restoration under this alternative is 80 to 325 years (see Appendix B of the FS).

This remedy provides the following components:

- Treatment of Source Area Soils with Chemical Oxidation
- Treatment of Source Area Groundwater with Chemical Oxidation
- Monitored Natural Attenuation of Source Area Groundwater After Treatment of the Groundwater Plume
- Environmental Monitoring
- Institutional Controls in the form of Land Use Restrictions to Prevent Use of Groundwater
- Five-Year Reviews

Treatment of Source Area Soils

Treatment of source area soils will consist of excavating approximately 2,300 cubic yards of clean soils in the Former Drum Storage Area to the depth of contamination using a side slope of 2:1 (horizontal to vertical) so that shoring is not necessary. This clean soil will remain onsite to be used as backfill for the excavated area after treatment is completed. The exposed contaminated soils will then be treated via in-situ mixing with a chemical oxidant (such as potassium permanganate). In sufficient concentrations, the chemical oxidant will oxidize the PCE and TCE in the soil to benign products (e.g., carbon dioxide, oxygen, water, inorganic soluble salts).

- Prior to in-situ treatment of contaminated soils, soil overlying the source area (estimated at 2,300 cubic yards) will be removed and stockpiled at the Site. Contaminated soils will be mechanically mixed in-place with the chemical oxidant. Water would be added as needed to optimize mixing. This water/chemical oxidation mix will eventually infiltrate into groundwater, providing an indirect benefit to the source area groundwater cleanup described below. The area of source soils requiring remediation is estimated to be 50 feet by 30 feet, with contaminated soil present at depths of 12 to 18 feet bgs. Close to 100% of the mass of contaminants in the soil will be destroyed.

- Following the in-situ oxidation, soil samples will be collected to confirm that the soil cleanup levels (the PCE leachability criterion of 0.1 mg/kg) have been achieved throughout the Former Drum Storage Area. The number of confirmatory samples will be determined during the design phase.[12] Following the treatment, the area will be backfilled and revegetated.

Treatment of Source Area Groundwater

Chemical oxidation of source area groundwater will include injection of chemical oxidants (such as sodium permanganate) in the vicinity of the Former Drum Storage Area through a series of injection wells. The chemical oxidant will convert chlorinated VOCs into benign end products, resulting in the decrease of VOC concentrations in groundwater over time.

- The chemical oxidant solution will be injected into the bedrock groundwater plume in the source area (e.g., upgradient of the source area soils, at the top of the hill in the vicinity of the Former Drum Storage Area). Groundwater modeling has suggested that 10 wells spaced 40 feet apart will be sufficient to distribute oxidant across the plume. Inner well casings will be made of a non-reactive material (such as PVC) designed to resist the chemical oxidant. Injection wells are expected to be advanced into the upper 40 feet of bedrock to span the depth of the plume. Soils displaced by the wells (approx. 6.5 cubic yards) will be tested and, if hazardous, will be sent to an off-site licensed facility.

[12] Soil data collected during the Remedial Investigation showed no exceedances of the RIDEM soil leachability criterion for TCE of 0.2 mg/kg.

- The chemical feed system will be housed in a small building outside the zone of contamination. Soils excavated to install the feed system are not anticipated to be hazardous; however, these soils will also be tested and disposed of at a licensed facility if hazardous. The chemical oxidant solution will be pumped into a recirculation tank located in the building where it will be diluted with water, prior to being pumped to each of the injection wells. The time to complete pre-design studies and to design and construct the in-situ chemical oxidation system is estimated to be approximately 1.5 years.

- The oxidant injection system is expected to operate until 90 percent of the mass of VOCs in the source area groundwater has been destroyed. Groundwater will be monitored to determine when the 90-percent decrease in the concentrations of VOCs is achieved within the source area groundwater. It is estimated that the in situ oxidation system will operate for 6 to 12 years to achieve this 90-percent reduction of VOCs contaminant mass

- Prior to installation of a full scale system, detailed pilot studies will be performed to obtain additional characterization of subsurface conditions and to obtain parameters necessary to design and install an effective chemical oxidant injection system.

Monitored Natural Attenuation (MNA) of the Groundwater

Environmental data collected at the Site indicates that the natural attenuation processes (e.g., biodegradation) are degrading Site contaminants in groundwater. The monitored natural attenuation will be used to reduce concentrations of dissolved contaminants in the source area groundwater (following the in-situ oxidation treatment) and in the downgradient groundwater over time.

- Monitored Natural Attenuation (MNA) of the groundwater plume refers to natural processes involved in reducing the concentrations of chlorinated solvents, including biodegradation, dispersion, dilution, sorption, volatilization, and/or chemical and biochemical stabilization. In biodegradation, VOC contaminants break down into degradation products and are ultimately transformed into innocuous byproducts such as ethene or carbon dioxide. Other natural attenuation processes result in the transfer of contaminants to another phase or matrix (i.e., soil, soil gas).

- Groundwater at the Site was tested for the MNA parameters and it is estimated that natural attenuation processes are occurring in the groundwater at the Site. The concentrations of contaminants in groundwater will be compared to the concentration decline rate predicted in the FS, which indicates that an additional 74 to 313 years of natural attenuation following the treatment of source area groundwater are required to achieve the groundwater cleanup levels throughout the plume.

- Under the selected remedy, natural attenuation will be monitored, using the existing system of monitoring wells. In addition to monitoring for VOCs, groundwater will be tested for water quality parameters and geochemical natural attenuation parameters.

Environmental Monitoring

Environmental monitoring will include sampling and analysis of groundwater and surface water to determine the effectiveness and progress of the remedy.

- Environmental monitoring will be implemented during the chemical oxidation of the source area soils and groundwater to determine effectiveness of the in-situ treatment and to confirm that there are no adverse impacts on the URI Pond surface waters and wetlands from the injection of the chemical oxidant into the soil and groundwater.

- Performance monitoring and necessary maintenance will be conducted throughout the time the chemical oxidations systems are operating to insure the that the chemical feed and injector well system are performing at optimal capacity.

- Long-term environmental monitoring of groundwater and surface water will be used to monitor effectiveness of the natural attenuation processes to reduce contaminant concentrations over time. This monitoring program will rely on the existing monitoring wells. Should the existing monitoring well network be found insufficient, additional monitoring wells may need to be installed. The surface water in URI Pond will be monitored as a way of measuring the performance of the groundwater remediation. It is expected that the exceedance in the Pond of the PCE AWQC for chronic exposure to aquatic life will be eliminated as the groundwater discharging to the pond is cleaned up.

- Initially, environmental monitoring is expected to consist of semi-annual sampling and analysis of groundwater and surface water. Specific parameters, locations, and frequency of sampling will be determined during the initial remedial action effort. The frequency of sampling may vary from media to media and may vary over the course of the remedial action.

- Long-term monitoring will also include a yearly review of the institutional controls associated with this remedy (deed restrictions prohibiting the use of groundwater) as well as those associated with the two landfills on site (deed restrictions or other controls preventing uses that would interfere with the integrity of the caps). In addition to state oversight of the landfill closure, reports on the status of these caps will be included in environmental monitoring reports submitted as part of this remedy.

Institutional Controls

Institutional Controls will be implemented to prevent damage and interferences with the remedial action components and to restrict the use of groundwater before cleanup levels are achieved.

- Institutional controls in the form of deed restrictions consistent with State requirements will be implemented on the properties located in the area wherever groundwater cleanup levels are exceeded from Site contaminants. These deed restrictions will run with the land and will be recorded in the appropriate local land records office.

- Institutional Controls will also require notification if land use development on the affected properties is proposed.

- This remedy also assumes that institutional controls put in place as part of the State landfill closures to protect the integrity of the two onsite landfill caps are in place, maintained and enforced as necessary. Should this not be the case, EPA will re-evaluate the remedy to determine if the protectiveness of this remedy is compromised and requires additional deed restrictions or some other further action.

- EPA may decide that other forms of institutional controls are preferable to, or should be implemented along with deed restrictions. Such institutional controls might include local ordinances and/or other state regulations that are enforceable and reliable for long-term protection.

- Once the institutional controls have been implemented, compliance with the restrictions will be monitored through the long-term monitoring program and enforced to ensure that the institutional controls are effective. Over time, EPA will evaluate whether restrictions can be removed or modified because acceptable levels have been met at the Site.

Five-Year Reviews

As required by law (since hazardous substances will remain at the Site), EPA will review the remedy at least once every five years after the initiation of remedial action at the Site.

- The five-year reviews will be conducted to assure that the remedial action continues to protect human health and the environment. This review will also include an evaluation of institutional controls required by this ROD as well as those necessary to ensure the integrity of the landfill caps. Additional actions may be implemented, if necessary, as a result of these reviews or if regulatory or statutory standards change.

- EPA and RIDEM will also review the Site prior to the eventual deletion from the National Priorities List, which essentially would end Superfund involvement at the Site.

For a more detailed description of the components of the selected remedy, Alternative 4, see Section 7 of the FS.

The selected remedy may change somewhat as a result of the remedial design and construction processes. Any changes to the Remedy described in this Record of Decision will be documented in a technical memorandum to the Administrative Record for the Site, an Explanation of Significant Differences (ESD) or a ROD Amendment, as appropriate.

3. Summary of the Estimated Remedy Costs

The following tables summarize the major capital and annual O&M costs for the selected remedy, Alternative 4. The information in the cost summary table is based on the best available information regarding the anticipated scope of the selected remedy. Changes in the cost elements are likely to occur as a result of new information and data collected over time. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD Amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. For a detailed description of the assumptions and components used to estimate the selected remedy cost, refer to Appendix C of the FS Report.

Table L-1
Cost Estimate Summary

Description	Cost	Assumptions
CAPITAL COSTS		
DIRECT COSTS		
Soil		
In-situ Chemical Oxidation	$153,000	Permanganate 15,000 lb
Soil Sampling	$7,000	
Groundwater		
Chemical Injection Wells	$23,000	
Permanganate Delivery System	$332,000	
Subtotal Direct Costs	**$515,000**	
Contingency	$103,000	20% of total direct costs
Total Direct Costs	**$618,000**	

Table L-1
Cost Estimate Summary

Description	Cost	Assumptions
INDIRECT COSTS		
Health & Safety	$31,000	5% of total direct costs
Legal, Admin, and Permitting	$31,000	5% of total direct costs
Engineering-Pilot Study	$75,000	
Engineering – Design	$62,000	10% of total direct costs
Engineering - Construction Svcs.	$62,000	10% of total direct costs
Institutional Controls	$75,000	
Total Indirect Costs	**$336,000**	
TOTAL CAPITAL COSTS (DIRECT&INDIRECT)	**$954,000**	
ANNUAL OPERATION AND MAINTENANCE COSTS		
Annual Operations and Maintenance Costs		
Labor	$27,000	
Power	$1,000	
Materials	$17,000	
Permanganate Residual Analysis	$1,000	
Subtotal Annual O&M Costs	**$46,000**	
Engineering	5,000	10% of annual O&M costs
Contingency	$9,000	20% of annual O&M costs
Total Annual O&M Costs	**$60,000**	
Present Worth of Annual O&M Costs	**$421,000**	10 years
Five-year Site Reviews, Cost Each	$60,000	
Present Worth of Five Year Site Reviews	**$149,000**	30 years
Environmental Monitoring, Annual Cost	$66,000	Semi-annual w/full MNA
Present Worth of Environmental Monitoring	**$819,000**	30 years
TOTAL OPERATION & MAINTENANCE COSTS	**$1,389,000**	
TOTAL PRESENT WORTH - ALTERNATIVE 4	**$2,343,000**	7% discount rate over 30 years

4. Expected Outcomes of the Selected Remedy

The primary expected outcome of the selected remedy is that the Site will no longer present an unacceptable risk to potential users from inhalation, dermal contact or use of the groundwater as a drinking water source. Approximately 80 to 325 years are estimated as the amount of time necessary to achieve the levels consistent with consumption of groundwater as a drinking water source and full restoration of the aquifer.

The selected remedy is also expected to provide environmental and ecological benefits, such as eliminating further degradation of the surface water quality in URI Pond.

Working in coordination with the capped landfills, this remedy will ultimately bring the Site groundwater back to use as a drinking water aquifer and will enhance the recreational and ecological value of the Site and the URI Pond as well as the shallow riparian waters in the fringe areas of Hundred Acre Pond for riparian animals that use these areas for drinking water purposes.

5. Cleanup Levels

Cleanup levels for groundwater and soil that pose unacceptable risks to human health have been set as described below. Because surface water onsite and at Hundred Acre Pond did not pose risks to human health or the environment, no cleanup levels were set for these media. However, because groundwater was found to discharge to surface water in URI Pond, state ambient water quality criteria were identified as an action-specific ARAR to measure the performance of the groundwater cleanup. It is also expected that the AWQC exceedance in URI Pond will be eliminated as the groundwater discharging to the pond is cleaned up.

EPA's new *Guidelines for Carcinogen Risk Assessment* (March 2005) and *Supplemental Guidance for Assessing Early-Life Exposure to Carcinogens* (March 2005) will be used as the basis for EPA's analysis of all risk assessments on carcinogenicity conducted in the future at the Site. If updated carcinogenicity risk assessments of the Site are performed or become available, EPA will determine whether an evaluation should be conducted as part of the remedial design to assess whether adjustments to the target cleanup levels for this remedial action are needed in order for this remedy to remain protective of human health.

a. Groundwater Cleanup Levels

Cleanup levels have been established in groundwater for all chemicals of concern identified in the Baseline Risk Assessment that were found to pose an unacceptable risk to either public health or to exceed an ARAR. No significant ecological risks were identified for the Site. These provisional cleanup levels have been set based on the ARARs (e.g., MCLs) or other suitable criteria described below. Periodic assessments of the protection afforded by the selected remedy will be made during implementation and at the completion of the remedial action. At the time that both the Groundwater Cleanup Levels identified in this ROD (and newly promulgated ARARs and/or modified ARARs which call into question the protectiveness of the remedy) have been achieved, and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on all residual groundwater contamination to determine whether the remedial action is protective. This risk assessment of the residual groundwater contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by the Site (including but not limited to the chemicals of concern) via relevant exposure pathways for residential use of groundwater. If, after review of the risk assessment, the remedial action is not determined to be protective by EPA, the remedial action shall continue until either: 1) protective levels are achieved, and are not exceeded for a period of three consecutive years, or 2) until the remedy is otherwise deemed protective or is modified. These protective residual levels shall constitute the final cleanup levels for this ROD and shall be considered performance standards for this remedial action.

Because the aquifer under the Site (at and beyond the compliance boundary for the closed landfills) is a potential source of drinking water, federal MCLs are ARARs. The regional aquifer, over which the Site is located, is considered one of the most productive and valuable aquifers in the State of Rhode Island.

Cleanup levels for known, probable, and possible carcinogenic chemicals of concern (Classes A, B, and C) have been established to protect against potential carcinogenic effects and to comply with ARARs. MCLs, any Maximum Contaminant Level Goals (MCLGs) set at a level higher than zero, or State standards, if more stringent, are used to set groundwater cleanup levels. In the absence of an MCL, non-zero MCLG, or State standard, other suitable criteria (e.g., health advisory, state guidelines) are used to set groundwater cleanup levels. As discussed further in Section M below, no non-zero MCLGs or more stringent State standards have been promulgated for the PCE and TCE, the two chemicals of concern at the Site; therefore the MCLs for PCE and TCE provide the relevant cleanup level.

Table L-2 summarizes the Cleanup Levels for carcinogenic and non-carcinogenic contaminants of concern identified in groundwater, with the risk levels associated with achieving these Cleanup Levels.

Table L – 2:
Groundwater Cleanup Levels

Carcinogenic Chemical of Concern	Cancer Classification	Cleanup Level (ug/L)	Basis	RME Risk
Tetrachloroethene	C-B2	5	MCL	6E-5
Trichloroethene	C-B2	5	MCL	2E-5
Sum of Carcinogenic Risk		8E-5		
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Cleanup Level (ug/L)**	**Basis**	**RME HQ**
Tetrachloroethene	Liver	5	MCL	0.05
Trichloroethene	Liver	5	MCL	0.03
HI Liver		0.08		

Key:
RME = Reasonable Maximum Exposure
MCL = Federal Maximum Contaminant Level
ug/L = micrograms per liter
HQ = Hazard Quotient
HI = Hazard Index

Although EPA has withdrawn the carcinogenicity classification for both TCE and PCE from IRIS (Integrated Risk Information System), the RAIS (Oak Ridge's Risk Assessment Information System) indicated that TCE and PCE had previously been classified within a continuum between "C-possible human carcinogen" and "B2-probable human carcinogen."

All Groundwater Cleanup Levels identified in the ROD, ARARs, and newly promulgated ARARs and modified ARARs that call into question the protectiveness of the remedy and the protective levels determined as a consequence of the risk assessment of residual contamination must be met at the completion of the remedy at the compliance boundary. The compliance boundary is at the perimeter of (and encompasses) the portions of the contaminated groundwater plume that are at and beyond the edge the waste management area where waste has been left in place beneath the landfill caps described above.[13] This plume currently extends approximately 2,500 feet from the Former Drum Storage Area toward Hundred Acre Pond. EPA has estimated that the Groundwater Cleanup Levels throughout the plume will be obtained within 80 to 325 years after completion of the source control component, i.e., in-situ treatment of the soils.

13 Monitoring wells upgradient and downgradient of the landfill caps are expected to ensure that any cleanup achieved as a result of the selected remedy is not vitiated by contaminated groundwater flowing from the area beneath the caps.

b. Soil Cleanup Levels

Current land uses of the Site include passive recreation by local residents and URI students, such as walking and jogging. Potential future uses of the Site include recreation, agricultural, residential and/or commercial uses. Based upon data developed in the RI and Baseline Risk Assessment, remedial measures to address health risk associated with possible exposure to PCE and TCE in source-area surface soils are not warranted because present and future risks for exposure to soils are within or below EPA's acceptable carcinogenic risk range or generally below a Hazard Index of one for compounds with non-carcinogenic effects. However, available data suggest that PCE in area subsurface soils leaches to groundwater, thereby contaminating groundwater. This phenomenon may result in an unacceptable risk to future residents who may ingest, contact or inhale contaminated groundwater. Therefore, a soil cleanup level for PCE in subsurface soils was established to protect the aquifer from potential soil leachate.

RIDEM has promulgated leachability criteria that establish the estimated residual soil levels that are not expected to impair future groundwater quality. The RIDEM soil leachability criterion for PCE of 0.1 mg/kg for migration/leaching was used to establish the soil cleanup level for subsurface soils at the Former Drum Storage area at the Site. Soil data collected during the RI showed no exceedances of the RIDEM soil leachability criterion of 0.2 mg/kg for TCE.

Table L-3 summarizes the soil cleanup levels established to protect the aquifer.

Table L–3: Soil Cleanup Levels for the Protection of the Aquifer Based on RIDEM Leachability Criteria

Carcinogenic Chemical of Concern	Cancer Classification	Targeted Groundwater Level (ug/L) (Basis)	Soil Cleanup Level (mg/kg)	Basis	RME Groundwater Risk
Tetrachloroethene	C-B2	5 (MCL)	0.1	RIDEM Soil Leachability Criteria	6E-5

Non-Carcinogenic Chemical of Concern	Target Endpoint	Targeted Groundwater Level (ug/L) (Basis)	Soil Cleanup Level (mg/kg)	Basis	RME Groundwater HI
Tetrachloroethene	Liver	5 (MCL)	0.1	RIDEM Soil Leachability Criteria	0.05

Key
RIDEM = Rhode Island Department of Environmental Management
RME = Reasonable Maximum Exposure
MCL = Maximum Contaminant Level
mg/kg = milligrams per kilograms
ug/L = micrograms per liter
HI = Hazard Index

These soil cleanup levels are consistent with ARARs for groundwater, attain EPA's risk management goal for remedial action, and have been determined by EPA to be protective. At this Site, soil cleanup levels must be met throughout the Former Drum Storage Area. The area requiring remediation is estimated at 50 feet by 30 feet, with contaminated soil present at depths of 12 to 18 feet bgs. Actual size of the area needing remediation may be modified based on observations during the excavation and treatment. Following the in-situ treatment, after allowing time for chemical oxidation reaction to proceed to completion, confirmatory samples will be collected to document that the soil cleanup level of 0.1 mg/kg for PCE had been obtained in all samples. The number of confirmatory samples required will be determined during the design phase.

M. STATUTORY DETERMINATION

The remedial action selected for implementation at the West Kingston Town Dump/URI Disposal Area Superfund Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs, and is cost-effective. In addition, the selected remedy utilizes permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable, and satisfies the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element.

1. The Selected Remedy is Protective of Human Health and the Environment

The remedy at this Site will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls and institutional controls. More specifically, the main risks associated with the Site are from ingestion, dermal contact and inhalation of groundwater contaminated by PCE and TCE. As described in Section L, the selected remedy eliminates this risk by (i) excavating the source area soil to the depth of contamination and then mixing an oxidant into the contaminated soils, thereby destroying the PCE that would otherwise continue to leach into groundwater, (ii) injecting an oxidant into source area groundwater, thereby destroying approximately 90% of the PCE and TCE in the source area groundwater, (iii) monitoring the progress of natural degradation of contamination remaining in source area and downgradient groundwater, and (iv) implementing environmental land use restrictions at the Site to prohibit use of groundwater for the period of time before Maximum Contaminant Levels are achieved throughout the groundwater plume.

The selected remedy will reduce potential human health risk levels such that they do not exceed EPA's acceptable risk range of 10^{-4} to 10^{-6} for incremental carcinogenic risk and such that the non-carcinogenic hazard index is below 1 (i.e., the cumulative exposure to site contaminants is below the level at which adverse non-cancer health effects would be observed). It will reduce potential human health risk levels to protective ARARs levels, i.e., the remedy will comply with ARARs and To Be Considered criteria. Implementation of the selected remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

At the time that the ARAR-based Ground Water Cleanup Levels identified in the ROD (and any newly promulgated ARARs and modified ARARs that call into question the protectiveness of the remedy) have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on the residual ground water contamination to determine whether the remedy is protective. This risk assessment of the residual ground water contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by ingestion and inhalation of, and dermal contact with, groundwater by possible future Site residents and commercial/industrial workers. If, after review of the risk assessment, the remedy is not determined to be protective by EPA, the remedial action shall continue until protective levels are achieved and have not been exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective.[14] These protective residual levels shall constitute the final cleanup levels for this Record of Decision and shall be considered performance standards for any remedial action.

2. The Selected Remedy Complies with ARARs

The selected remedy will comply with all federal and any more stringent state ARARs that pertain to the Site. In particular, this remedy will comply with the following ARARs (which are also listed in tables in Appendix B to this ROD):

- Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) and Non-Zero Maximum Contaminant Level Goals (MCLGs) (40 CFR Parts 141.60-66 and 141.50-55). MCLs prescribe chemical-specific maximum contaminant levels applicable to public drinking water systems. The water at the site is not part of such a system, so MCLs and MCLGs are not applicable. But the groundwater at the Site has been classified as potential drinking water, and under these circumstances the NCP requires that the remedy achieve MCLs and any MCLGs that are set above zero. *See* NCP 300.430(e)(2)(i)(B). MCLs and non-zero MCLGs are therefore relevant and appropriate and were used as the basis for the groundwater cleanup levels. However, the MCLGs for PCE and TCE are both zero, which means these particular MCLGs are not ARAR for the Site; the higher MCLs for PCE and TCE will be applied instead. See 40 CFR 141.50 and 141.61.

- Rhode Island Rules and Regulations for Groundwater Quality. These rules set chemical-specific numerical standards for contaminants in GAA and GA aquifers (i.e., drinking water aquifers under the state classification system), and require that such groundwater be maintained at a quality that does not have a reasonable potential to cause a violation of surface water quality standards. See Rule 11.2. These limits are applicable, insofar as the groundwater at the Site is federally classified as a potential drinking water source. For PCE and TCE, the numerical criteria are identical to MCLs. In addition, these Rules prescribe action-specific design requirements for construction of monitoring wells and prescribe how monitoring shall be undertaken and how wells shall be abandoned once monitoring is complete. See Rules 5.5, 12 and Appendix 1. Although at least part of these rules may not apply to groundwater monitoring undertaken in response to releases of hazardous substances or materials, see Rule 12.3.1 ("Groundwater monitoring plans approved pursuant to other DEM rules and regulations shall be exempt from this requirement"), at a minimum the activities regulated by the rule correspond to the monitoring activities required by the selected remedy, and are thus relevant and appropriate.

- RI Rules and Regulations for the Investigation and Remediation of Hazardous

[14] See the discussion of the *Guidelines for Carcinogen Risk Assessment* (March 2005) and *Supplemental Guidance for Assessing Early-Life Exposure to Carcinogens* (March 2005), above.

Material Releases. These rules set chemical-specific "direct exposure" and "leachability" criteria, i.e., numerical limits for substances located in soils at the surface and/or above groundwater, and require that soils contaminated as a result of a release of hazardous materials be cleaned up to achieve these numerical limits. See Rule 8.02. Site soil has been contaminated by a hazardous material release, so this requirement is applicable to the Site.

- RI Water Quality Regulations; Clean Water Act Ambient Water Quality Criteria, 33 U.S.C. § 1251 et seq.[15] The Rhode Island rules set ambient water quality criteria (AWQC) applicable to all surface waters in Rhode Island. These AWQCs may include numeric limits (with different sampling procedures) for chronic exposures to aquatic life, acute exposures to aquatic life, human consumption of water and aquatic organisms, and human consumption of aquatic organisms only. See Rule 8. Some samples from URI Pond indicated an exceedance of the AWQC related to chronic PCE exposure to aquatic life. Although this exceedance does not pose an unacceptable risk at the Site, the Pond will be monitored and this AWQC will be used as a means of measuring the performance of the groundwater remediation. It is expected that the AWQC exceedance will be eliminated as the groundwater discharging to the Pond is cleaned up. Similarly, federal AWQCs set numeric limits, although (unlike the Rhode Island limits) these limits are recommendations issued to states rather than regulations binding on a particular water body. These values may also be used as means of measuring the performance of the groundwater remediation.

- Wetlands Executive Order, 42 Fed. Reg. 26961 and 40 CFR Part 6, Appendix A. This order requires (among other things) federal agencies to minimize destruction, loss or degradation of wetlands in conducting federal activities and programs affecting land use. Wetlands are not expected to be impacted by Site activities but will be monitored to ensure that chemical oxidation treatment does not indirectly affect Site wetlands.

- RI Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act. Similar to the federal wetlands order, these rules require that Site activities avoid impacts to freshwater wetlands to the maximum extent possible. Site wetlands will be monitored as described above. See Rules 6, 7 and 10.

- Underground Injection Control Regulations, 40 CFR Part 144, subpart G. These rules forbid injections of fluids that allow movement of contaminants into certain potential drinking water aquifers, if the presence of these contaminants may cause a violation of certain drinking water and health-based standards, or may otherwise adversely affect the health of persons. These rules are applicable to the injections

[15] Current federal AWQCs appear at: http://www.epa.gov/waterscience/criteria/wqcriteria.html#C.

of oxidants into the source area groundwater that are expected to occur as part of the selected remedy.

- RI Rules and Regulations for Underground Injection Control Program. This rule forbids operating an injection well which pollutes or endangers groundwater quality. It is applicable to the injections of oxidants into source area groundwater that are expected to occur as part of the selected remedy. See Rule 5.03.

- Resource Conservation and Recovery Act – Groundwater Monitoring Requirements (40 CFR part 264, subpart F). These regulations set requirements for groundwater monitoring at facilities that treat, store or dispose of hazardous waste. Because in-situ treatment of soil is similar to the regulated activity, this regulation is relevant and appropriate to the selected remedy.

- RI Rules and Regulations for Hazardous Waste Management and R.I. Gen L. 23-18.9-5; R.I. Gen. L. 23-19.1-18. The rules and regulations govern generators and transporters of hazardous wastes. See Rules 5 and 6. The statutes require disposal of hazardous and solid waste at licensed facilities. These rules would be applicable in the event any cuttings generated by the selected remedy (e.g., from drilling the injection wells) turn out to be waste within the meaning of these rules.

- RI Air Pollution Control Regulation No. 5 – Fugitive Dust. This rule requires taking reasonable precautions to prevent airborne particulate matter from traveling beyond the property line. The rule will apply to any particulate matter generated as a result of the selected remedy. Dust suppression measures will be used during excavation, backfilling and well installation activities as necessary.

The following policies, advisories, criteria, and guidances will also be considered during the implementation of the remedial action:

- Threshold Limit Values. These are guidelines established by the American Conference of Governmental Industrial Hygienists. They estimate concentrations of particulate matter that may be safely inhaled by workers on a daily basis. These guidelines are recommendations by a private entity, but should be useful in protecting workers who carry out the selected remedy. They are therefore "to be considered" (TBC) in developing and implementing the selected remedy.

- Final OSWER Monitored Natural Attenuation Policy (OSWER Dir. 9200.4-17P (4/99). This document provides guidance on performing monitored natural attenuation. This policy is a TBC and will be considered when designing and implementing MNA in groundwater.

- EPA Risk Reference Doses and Carcinogen Assessment Group Cancer Slope Factors. These are non-regulatory daily exposure concentrations likely to be without adverse consequences and estimates of the probability that an individual will develop cancer based on a given exposure. These factors are cited as TBCs. They were used in developing the risk assessment and should be useful in future risk assessments.

- EPA Health Advisories. HAs offer guidance on thresholds of drinking water contamination unlikely to lead to adverse effects for a given level of exposure. These are non-regulatory guidance but should be useful in future risk assessments at the Site and are cited as TBCs.

- *Guidelines for Carcinogen Risk Assessment* (March 2005) and *Supplemental Guidance for Assessing Early-Life Exposure to Carcinogens* (March 2005) (EPA/630/P-03/001B & EPA/630/R-03/003F). Provides guidance on conducting carcinogen risk assessments. Until updated or replaced, these guidances will be used by EPA to evaluate all risk assessments on carcinogenicity conducted in the future at the Site.

- It is not expected that the selected remedy will result in off-site disposal of wastes subject to RCRA land disposal restrictions (LDRs), 40 CFR Part 268.

3. The Selected Remedy is Cost-Effective

In EPA's judgment, the selected remedy is cost-effective because the remedy costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness. The relationship of the overall effectiveness of the selected remedy was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

The selected remedy achieves significant, permanent reductions in contaminant mass quickly, at low cost. The selected remedy has a net present worth (total cost in today's dollars) of $2.3 million. The selected remedy achieves cleanup levels in source area soil and is expected to eliminate 90% of the PCE and TCE in source area groundwater (the most contaminated groundwater on the Site) in less than 15 years.

A survey of the costs and benefits of the other alternatives considered illustrates the cost-effectiveness of the selected remedy. The only alternatives that are less expensive than the selected remedy are Alternatives 1 and 2. Alternative 1 has a net present worth of $227,000, but it does not does not meet ARARs and is not protective of human health; it was therefore eliminated from consideration. Alternative 2 has a net present worth of $1.1 million. But it has no active treatment and does not achieve the dramatic contaminant mass reductions of the selected remedy. Instead Alternative 2 would rely wholly on institutional controls, which must be maintained and possibly enforced over many decades if they are to prevent people from drinking contaminated groundwater – a significant contingency. EPA believes the greater cost ($1.2 million more in NPW terms) of the selected remedy is worth the added benefits of achieving significant contaminant mass reductions early on – i.e., that the reductions in contaminant volume through treatment are worth paying for.

The selected remedy is less expensive and more cost-effective than the other two treatment alternatives, Alternatives 3 and 5. Alternative 3 has a net present worth of $3.1 million, and Alternative 5 has a net present worth of $10 million -- or $800,000 and $7.7 million more than the selected remedy, respectively. Moreover, as described at greater length in the next section, the selected remedy is in some ways more effective than Alternatives 3 or 5. The permeable reactive barrier of Alternative 3 does not achieve contaminant mass reductions as quickly as the selected remedy. Unlike the selected remedy, it also needs to be recharged every 15 years, and there is little long-term data on its effectiveness. The PRB generates contaminated residuals (spent carbon), whereas the selected remedy permanently eliminates PCE and TCE through treatment. This makes Alternative 3 less effective, and less cost-effective, than the selected remedy.

The extensive treatments proposed in Alternative 5 – excavation and offsite shipment of contaminated soil, plus a full groundwater pump-and-treat system – are not only more expensive, but require significant initial capital outlays ($7.2 million). These systems would require much more construction than is contemplated under the selected remedy (10 injection wells and a small chemical feed system in the selected remedy, versus 28 wells, a complex of pipes, and a treatment facility with Alternative 5), with greater impacts on the community and on wetlands over the 25-50 year period that the pump and treat system would need to operate. Although Alternative 5 would be expected to achieve cleanup levels sooner than the selected remedy, it would not permanently eliminate contamination, as does the selected remedy; instead residuals from the pump-and-treat system and all contaminated soil would be shipped offsite. For this reason, EPA believes Alternative 5 is less effective than the selected remedy, and (being more expensive) also less-cost effective.

In sum, EPA believes that the selected remedy is more cost-effective than any of the alternatives, and that its costs are proportional to its benefits. Additional information comparing the cost-effectiveness of the five remedial alternatives is in Table 8-1 of the FS. Additional discussion of the effectiveness of the selected remedy under the NCP criteria is also part of the next section.

4. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once EPA identified those alternatives that attain ARARs (or that are eligible for a waiver of ARARs), and that are protective of human health and the environment, EPA identified which alternatives utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: 1) long-term effectiveness and permanence; 2) reduction of toxicity, mobility or volume through treatment; 3) short-term effectiveness; 4) implementability; and 5) cost. The balancing test emphasized long-term effectiveness and permanence and the reduction of toxicity, mobility and volume through treatment and also considered the preference for treatment as a principal element, the bias against off-site land disposal of untreated waste, and community and state acceptance.

The selected remedy provides the best balance of trade-offs among the alternatives. It is expected to achieve cleanup levels in the source area soil in approximately one month and to reduce the mass of PCE and TCE in the source area groundwater by 90% in 6 to 12 years after installation of the injection wells. Oxidation is a proven method for permanently destroying VOCs. The selected remedy also eventually reduces PCE and TCE levels in groundwater to acceptable risk levels, without generating any hazardous byproducts. The simple, reliable, benign method of destroying most of the VOC mass gives the selected remedy good "long-term effectiveness and permanence," and achieves serious "reductions of toxicity, mobility, or volume through treatment."

The selected remedy is also easily implemented and has few short-term impacts. There is no extensive design work or planning needed before work on the source area soil can begin, and it is expected to take only 1.5 years to design and construct the wells to inject chemical oxidants into the source area groundwater. The impacts on the surrounding community are expected to be minimal during the relatively short period of remediation. It is not expected to have any negative affect on wetlands. More specifically, the source area soil remediation involves excavation of clean soils exclusively (2,300 cubic yards), which will be removed to permit access to the contaminated soils. Chemical oxidants will be mixed into the contaminated soils, eliminating VOCs, and then backfilled at the same spot; this is expected occur over a single month, with no offsite shipments of soil. Likewise, the treatment of source area groundwater has a relatively minimal impact on the surrounding community. Approximately 10 injection wells and a small chemical feed station will be installed initially, with routine operation and maintenance for the 6- to 12-year treatment period.

And, as stated above, the selected remedy is also the least expensive of the three active treatment alternatives under consideration, having a net present worth of $2.3 million.

By comparison, the other alternatives considered are less effective at meeting the balancing criteria, essentially for all the reasons provided in the previous section on cost-effectiveness. Alternative 2 (monitored natural attenuation and institutional controls) would not use any treatment to reduce contaminant mass; its protectiveness over the long period of natural degradation would be based wholly on institutional controls, which are effective only if monitored and enforced over many decades – a significant contingency that goes to the long-term effectiveness and the reductions (or lack of reductions) of toxicity, mobility or volume through treatment. By comparison, the selected remedy is expected to use active treatment in addition to institutional controls; this treatment is expected to achieve cleanup levels in the source area soil and to achieve 90% VOC mass reductions in the source area groundwater.

Alternative 3 (the permeable reactive barrier) would use the same method as the selected remedy to clean up source area soil, but the permeable reactive barrier used to clean up source area groundwater would require substantial excavation to install it, both initially and every 15 years as the barrier is recharged. By comparison the chemical oxidation of source area groundwater under the selected remedy involves minimal excavations and the period of active treatment is expected to end entirely after 6 to 12 years, resulting in lower community impacts and greater shot-term effectiveness. Alternative 3 also differs from the selected remedy in that it would not achieve contaminant reductions in the source area groundwater as quickly, and would result in residuals (spent carbon) subject to offsite disposal – compromising its long-term effectiveness and permanence and its ability to achieve reductions of toxicity, mobility or volume through treatment. Alternative 3 would also cost nearly $800,000 more than the selected remedy.

Alternative 5 would excavate contaminated soil and ship it offsite, and pump and treat the groundwater plume. Although this remedy would be expected to achieve cleanup levels sooner than the selected remedy, this alternative would have more significant impacts on the surrounding community and environment, and would ship contamination offsite instead of wholly eliminating contamination, as in the selected remedy. Specifically, under Alternative 5 there would be significant excavations of source area soil, with shipment of 350 cubic yards of contaminated soil to an offsite disposal facility. The groundwater part of this alternative would require the construction of a complex system of underground piping to pump and treat groundwater, with 28 total wells plus a treatment plant; part of this system would have to be installed in wetlands, resulting in construction impacts there. This system would have to be operated for 25 to 50 years, with periodic shipments of contaminated residuals to offsite disposal facilities. By comparison, under the selected remedy the period of active treatment is expected to end after 6 to 12 years, it destroys the contamination and generates no residual contamination, has no negative impacts on wetlands, and has fewer construction impacts on the surrounding community. Alternative 5 is also nearly five times more expensive than the selected remedy.

Given these defects in Alternatives 1 through 3 and 5, and given the quick, substantial and inexpensive contaminant mass reductions achieved by the selected remedy, EPA believes the selected remedy is the best way of meeting the NCP criteria. EPA therefore concludes that the selected remedy utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable

5. The Selected Remedy Satisfies the Preference for Treatment Which Permanently and Significantly Reduces the Toxicity, Mobility or Volume of the Hazardous Substances as a Principal Element

The principal element of the selected remedy is the destruction of contaminants through use of chemical oxidants, in both soil and groundwater. This technique addresses the primary threat at the Site, which is source area soil. It also satisfies the statutory preference for treatment as a principal element by treating both source area soil (which would otherwise continue to leach contaminants into groundwater) and source area groundwater (which is the most heavily contaminated groundwater on the Site) with oxidants, thereby destroying most or all of the VOC contamination in the source area. The only area that is contaminated under the standards set out in EPA's risk assessment and that is not subject to active treatment is the downgradient groundwater.[16] In this area contamination is much less concentrated and will be reduced as a result of treatment occurring upgradient. MNA is expected to achieve the final reductions in toxicity and volume necessary to achieve cleanup levels.

6. Five-Year Reviews of the Selected Remedy Are Required

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

[16] Sampling data indicated an exceedance in URI Pond of the Rhode Island aquatic life criterion for chronic exposures to PCE of 5.3 ug/L. The risk assessment showed that this exceedance did not cause an unacceptable risk to human health or the environment. The surface water in URI Pond will be monitored as a way of measuring the performance of the groundwater remediation. It is expected that the exceedance will be eliminated as the groundwater discharging to the pond is cleaned up.

N. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented a proposed plan for the Site-wide remediation of the Site on June 28, 2006. The preferred alternative included treatment of source area soils and source area groundwater using in-situ chemical oxidation processes. Contamination in downgradient groundwater under the preferred alternative would be subjected to monitored natural attenuation (MNA). MNA was also part of the preferred alternative for source area groundwater, following active treatment. In addition, surface water in the URI Pond would be monitored to measure the groundwater remediation. The preferred alternative included institutional controls in the form of deed restrictions. EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the proposed plan, were necessary.

O. STATE ROLE

The Rhode Island Department of Environmental Management (RIDEM) has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the Remedial Investigation, Risk Assessment and Feasibility Study to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental and facility siting laws and regulations. The State of Rhode Island concurs with the selected remedy for the West Kingston Town Dump/URI Disposal Area Superfund Site. A copy of the declaration of concurrence is attached as **Appendix C**.

WEST KINGSTON TOWN DUMP/URI DISPOSAL AREA SUPERFUND SITE RESPONSIVENESS SUMMARY

PREFACE

The Rhode Island Department of Environmental Management (RIDEM) and the U.S. Environmental Protection Agency (EPA) held a 30-day public comment period from June 29, 2006 to July 31, 2006, to provide an opportunity for public comment on the Proposed Plan to address contamination at the West Kingston Town Dump/URI Disposal Area Superfund Site (the "Site") in South Kingstown, Rhode Island. RIDEM in coordination with EPA prepared the Proposed Plan based on the results of the Remedial Investigation (RI) and Feasibility Study (FS). The RI was conducted to determine the nature and extent of contamination and to identify potential risks to human health and the environment. The FS examined and evaluated various options or alternatives to address the contamination found at the Site. The Proposed Plan was published before the comment period, and presented RIDEM and EPA's preferred alternative for the Site. All documents which were used in EPA's selection (in coordination with RIDEM) of the preferred alternative were placed in the site Administrative Record, which is available for public review at the EPA Records Center, One Congress Street, Boston, Massachusetts and at the South Kingstown Public Library, 1057 Kingstown Road, Peace Dale, Rhode Island.

The purpose of this Responsiveness Summary is to document EPA's responses to the questions and comments raised during the public comment period. EPA considered all of the comments summarized in this document before selecting the final remedial action to address contamination at the Site.

The Responsiveness Summary is divided into the following sections.

A. Overview of the Remedial Alternatives Considered in the FS and the Proposed Plan, including the Preferred Alternative
B. Site History and Background on Community Involvement and Concerns.
C. Summary of Comments Received During the Public Comment Period and EPA Responses.

A. OVERVIEW OF THE REMEDIAL ALTERNATIVES CONSIDERED IN THE FS AND THE PROPOSED PLAN, INCLUDING THE PREFERRED ALTERNATIVE

In the risk assessment performed as part of the RI, the only unacceptable risk to human health or the environment was the risk to human beings associated with potential future use of groundwater as a drinking water source. This groundwater has been contaminated with volatile organic compounds (VOCs) as a result of contamination that leached (and continues to leach) through soil into groundwater. The surface water in the URI Pond contains one contaminant at levels in excess of the ambient water quality criteria (AWQC) for chronic exposures to aquatic life, as set by RIDEM regulations, but this was found not to result in an unacceptable risk to humans or the environment. The primary cleanup objective is to eliminate the unacceptable risk to humans associated with use of the groundwater, and to bring the Site into compliance with all applicable or relevant and appropriate environmental protection laws, including "leachability" criteria promulgated for soils located over aquifers. Cleanup levels for soil and groundwater were set based on these laws and at levels that EPA and RIDEM consider protective of human health and the environment. Surface water in the URI Pond will be monitored to measure the performance of the groundwater remediation.

EPA's Selected Remedy includes the following features:

- Soils will be excavated within the source area (i.e., the area where the contamination originated, also known as the Former Drum Storage Area, as described below) to the depth of contamination. Contaminated soils will then be treated via in-situ mixing of a chemical oxidant (such as potassium permanganate) to reduce the mass and concentration of VOCs in source area soil, until soil cleanup levels are achieved. Following treatment, the excavation area will be sampled, backfilled and re-vegetated.

- Source area groundwater will also be addressed through oxidation. Chemical oxidants (such as sodium permanganate) will be injected into source area groundwater through injection wells to reduce the mass of VOCs present in groundwater, with the goal of achieving 90% mass reduction of VOCs over time.

- Additional VOC mass reductions necessary to achieve cleanup levels in the source area groundwater will be accomplished through monitored natural attenuation (MNA) – i.e., dissolved constituents in the source groundwater will be monitored to show the ability of natural attenuation processes to reduce the concentration and mass of dissolved site-related VOCs in groundwater over time. Surface water in the URI Pond will also be monitored to measure the performance of the groundwater remediation.

- Upon controlling the source of the contamination, the same process of MNA will be the exclusive means of achieving cleanup levels in the groundwater downhill from the source area (i.e., between the source area and Hundred Acre Pond), where the contamination is more diffuse.

- Environmental land use restrictions will be recorded to restrict future groundwater use at the Site. An environmental monitoring plan will be developed to evaluate the continued effectiveness of the remedy, including natural degradation processes.

In the Feasibility Study, the estimated net present worth of the remedy was estimated at $2,343,000. This alternative for cleaning up the Site achieves large reductions in the mass of contaminants at the Site relatively quickly, and at low cost. This alternative was selected because it achieved the best balance among the criteria which EPA is required by law to consider in evaluating remedial alternatives. The selected remedy provides an effective reduction in health risk through a combination of source control, management of migration, and treatment technologies. The remedy will attain federal and state cleanup standards, reduce the volume and toxicity of contaminated material, and utilize permanent solutions to the extent possible.

All of the remedial alternatives considered for implementation at the Site are described in the Record of Decision and are discussed in detail in the FS.

B. SITE HISTORY AND BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Site History

The West Kingston Town Dump/URI Disposal Area Superfund Site is located primarily on the eastern side of Plains Road in South Kingstown, Washington County, Rhode Island. To the south of the Site is the University of Rhode Island (URI) main campus. To the west of the Site is Hundred Acre Pond.

The Site contains three main disposal areas. The first area is the West Kingston Town Dump, also known as the South Kingstown Landfill #2. In the early 1950s, the Town of Narragansett, the Town of South Kingstown and URI began disposing solid waste in this landfill. Disposal continued in at least some form until 1987. The second area is the URI Disposal Area, also known as the URI Gravel Bank or Sherman Farm. Waste was dumped here from approximately 1945 to 1987, particularly by the University of Rhode Island after the West Kingston Town Dump closed in 1978. A small pond called URI Pond is located in this area, just south of the main disposal areas.

In addition to the two main landfill areas, in 1989 a Former Drum Storage Area was discovered during site investigations, uphill and east of the Town Dump and the URI Disposal Area. During a 1989 inspection, 12 rusted drums were observed lying on the ground, some with contents visible. The drums appear to have contained a brown, caked material, or a hardened tar-like substance, possibly roofing tar. Two additional drums containing roofing tar were discovered in 2004 and 2005. The RI determined that this area has been the primary source of a groundwater plume of tetrachloroethene (PCE) and trichloroethene (TCE) that extends approximately 2,500 feet from the Former Drum Storage Area west toward Hundred Acre Pond.

The remedy selected in the Record of Decision was developed to clean up the contamination at and from the Former Drum Storage Area only. The Town Dump and the URI Disposal Area have been capped with an impermeable cover system as part of a landfill closure administered by RIDEM.[17] Although separate from the selected remedy, the selected remedy assumes that this

[17] More specifically, waste from the West Kingston Town Dump and the URI Disposal Area was consolidated and placed in three distinct areas underneath an impermeable RCRA cover. Although the RCRA cover was designed using EPA guidance on presumptive remedies for landfills, this action was carried out by certain PRPs

landfill cap system will prevent any future leaching of contaminants into the groundwater from the landfill areas and that institutional controls protecting the integrity of the cap system will be maintained and, if necessary, enforced. The RCRA cover system will be inspected and maintained as part of the state-regulated landfill closure, with additional reporting on the caps submitted as part of the environmental monitoring under the selected remedy.

Environmental investigations have been conducted at the Site since 1975 at the behest of various entities, including the State Department of Public Health, RIDEM, USEPA, and URI. More recently, in October 1992, the Site was listed on EPA's National Priorities List (NPL). In November 1997, EPA sent Information Request letters to potential generators and transporters potentially liable for contamination at the Site, and in June 2000 EPA issued letters identifying four Potentially Responsible Parties (PRPs) (i.e., parties potentially responsible for cleaning up the Site). These parties were owners or operators of a facility at the Site at the time hazardous substances were disposed of at the Site, and/or were current owners of part of the Site.

In August 2001, EPA and RIDEM entered into an Enforcement Agreement to install the landfill caps described above, and to perform the RI/FS that ultimately led to the selected remedy (i.e., the remedy for the contamination the originated in the Former Drum Storage Area). The PRPs performed the RI/FS in 2002-2006, and installed the landfill caps in 2005-2006. As noted above, data collected for the RI/FS shows that the groundwater contamination was attributable to PCE and TCE from the Former Drum Storage Area rather than from the landfills.

RIDEM and EPA issued a Proposed Plan on June 16, 2006, which identified a preferred remedy from among the alternatives identified by the FS. The Proposed Plan was published in the Narragansett Times five days later.

History of Community Involvement

Throughout the Site's history, community concern and involvement has been low to moderate. The PRPs, EPA, and RIDEM have kept the community and other interested parties apprised of Site activities through informational meetings, fact sheets, press releases and public meetings. The most recent efforts to involve the community have included:

- On June 21, 2006, RIDEM published a notice and brief analysis of the Proposed Plan in the Narragansett Times and made the Plan available to the public at the Peace Dale Library, RIDEM, and EPA.
- On June 28, 2006, RIDEM and EPA held an informational meeting to discuss the results of the Remedial Investigation and the remedial alternatives presented in the Feasibility Study and to present the EPA's preferred alternative. At this meeting, representatives from EPA, RIDEM, and the PRPs answered questions from the public.

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under state supervision and pursuant to state law. The goal of this cover system has been to contain and consolidate the contaminant mass to significantly reduce possible direct exposure, leachate production, and contaminant migration through groundwater to surface waters and sediments.

- From June 29, 2006 to July 31, 2006, the Agencies held a 30-day public comment period to accept public comment on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public.
- On July 26, 2006, the Agencies held a public hearing to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting and the comments and the Agency's response to comments are included in this Responsiveness Summary, which is part of this Record of Decision.

C. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA RESPONSES

This Responsiveness Summary addresses comments on the Proposed Plan that were received by EPA and/or RIDEM during the 30-day comment period (June 29, 2006 to July 31, 2006). The Proposed Plan was published June 21, 2006 in the Narragansett Times and was made available to the public at the Peace Dale Library and at the offices of RIDEM and EPA. EPA received one set of written comments on the proposed plan and one oral comment at the July 26 public hearing. Both comments were from the Audubon Society of Rhode Island (Audubon), which owns undeveloped land (including wetlands) on the northwestern part of the Site, between the railroad tracks and Hundred Acre Pond. What follows is EPA's response to the written and oral comments as they pertain to the remedial action.

1. The Written Comments

The sole written comment received by the Agencies was from the Audubon Society of Rhode Island. It agrees that the selected remedy "appears to provide the most timely cleanup to appropriate levels," but identifies what it says are errors in the remedial investigation and risk assessment that led to the selection of this remedy. These comments were set out in numbered paragraphs; EPA's responses will follow the same format.

Comment 1a: Although the RI states that the plume of contaminants in groundwater travels approximately 2,500 feet and then is discharged into Hundred Acre Pond (where remaining contaminants tend to be volatilized), Audubon believes the plume "may have" traveled nearly 11,000 feet from the Former Drum Storage Area, i.e., below and beyond the Pond "along whatever slope the bedrock takes beneath the Chipuxet Valley." Audubon acknowledges that the injections of oxidants upgradient will prevent "further downstream contamination," but says that oxidant injection "may not be effective" in cleaning up this more distant, downgradient plume.

Response: The PCE/TCE source material is not migrating as a separate liquid phase along the bedrock and below the groundwater, as Audubon appears to assume. Instead, investigations indicate that the plume is dissolved in the groundwater, and that this groundwater discharges into Hundred Acre Pond (see RI Section 5-2, Contaminant Transport and Fate; see also the response to the next comment, below). Under the selected remedy, the injections of oxidants into groundwater are intended to clean up the source area groundwater, i.e., the approximately 700 feet of plume upgradient of the URI Pond (see FS Section 7.5). The downgradient groundwater (i.e., the groundwater between the URI Pond and Hundred Acre Pond, in which contamination is more diffuse) will be cleaned by monitored natural attenuation (MNA) once the source of contamination is controlled, with institutional controls prohibiting use of groundwater until the groundwater cleanup is complete. Testing of residential wells along the Hundred Acre Pond did not identify site-related contamination in groundwater. Accordingly, EPA does not believe that there are contaminants below and beyond Hundred Acre Pond, and does not believe that the selected remedy is defective because the oxidant injections will largely affect the source area groundwater only.

Comment 1b: Audubon is "not certain that the evidence supports" the conclusion that the PCE and TCE ultimately discharge into Hundred Acre Pond. Audubon notes that PCE and TCE are heavier than water, and suggests these chemicals may instead be sinking down to bedrock and flowing along this bedrock to a reservoir of contamination below and/or beyond Hundred Acre Pond, which in turn may be contaminating other water bodies.

Response: Although PCE and TCE can form a non-aqueous phase liquid (NAPL) that is denser than water, the testing done in the RI indicated that this has not occurred at the Site, and that instead the PCE and TCE are dissolved in the groundwater, as noted in Response to Comment 1a. Specifically, as part of the RI, soil and rock cuttings were screened during drilling for the presence of NAPL, using a hydrophilic dye, which would indicate color change should NAPL be present in sample. The results of this screening did not indicate the presence of NAPL in the Former Drum Storage Area or in any downgradient location. In addition, the maximum detected concentrations of PCE and TCE in groundwater are an order of magnitude lower than the minimum concentration associated with NAPL. (See p.5-5 of the RI.) This indicates that the PCE and TCE detected in the groundwater plume are dissolved in the groundwater, i.e., that the plume of contaminated groundwater has a density equal to that of water. Therefore, the plume travels with the groundwater via advection and discharges into Hundred Acre Pond, instead of sinking in a separate, denser layer that moves along the bedrock beneath and beyond Hundred Acre Pond. This groundwater path is confirmed by sampling data, as discussed on p. 3-7 of the RI. Accordingly, EPA believes the data does not support the hypothesis that there is a dense layer of PCE and TCE pooling beneath and beyond Hundred Acre Pond.

Comment 1c: This comment identifies two purported inconsistencies in the RI: (1) a statement that there is no NAPL made up of VOCs at the Site (on p. 5-5 of the RI) is supposedly contradicted by statements referring to a "residual mass" of VOCs and estimating that 52 to 89 pounds of VOCs are in the dissolved plume (on p. 5-5 and p. 5-10 of the RI); and (2) the concentrations of PCE and TCE detected by particular monitoring wells are shown at different levels on p. 5-11 and p. 5-15 of the RI. Audubon also says: "Furthermore the lack of discussion of groundwater recharge to overcome the molecular weight of TCE and PCE leaves the question, whether surface and sediment sampling would adequately characterize the fate of TCE."

Response: The two passages identified by Audubon are not inconsistent. The first purported inconsistency is explained by the fact that there is VOC mass in the groundwater plume, but it is in dissolved form, i.e., spread out throughout the entire plume. Thus it is not a contradiction for the RI to conclude that there is contaminant mass, yet no NAPL. The purported inconsistency related to monitoring well data is explained by the fact that the data on the two different pages of the RI are from the same monitoring well but not from the same sample; the samples were taken at different times, hence the minor difference in the amount of VOCs detected. Finally, the part of the comment related to the molecular weight of PCE and TCE also appears to assume that TCE and PCE are present at the Site in the form of a heavier NAPL separate from the groundwater. As noted above the PCE and TCE are dissolved in the groundwater and are not present as a separate liquid.

Comment 1d: Audubon points out that the layer of overburden (i.e., the soil above bedrock) extends for 100 feet below Hundred Acre Pond and for 145 feet in an area just east of Hundred Acre Pond, between Plains Road and the railroad. Audubon appears to suggest that the sampling wells in these areas may not have been drilled deep enough, "given the characteristics of movement [of VOCs] above bedrock."

Response: This comment assumes that the VOCs are present in the form of a NAPL plume that has sunk down to bedrock. This assumption is not correct, for the reasons given above. In addition, the groundwater sampling that was done around Plains Road (in the vicinity of Hundred Acre Pond) occurred at depths of more than 150 feet bgs – i.e., deep enough to sample the overburden layer described in the comment. This sampling did not identify any separate layer of PCE and TCE moving over the bedrock. Sample results are included in Table 4-11 of the RI report and boring logs are in Appendix B of the RI report. Additional bedrock sampling is in Table 4-12.

Comment 1e: This comment points out that, according to p. 5-16 of the RI, the plume is located 135 to 165 feet below ground surface. Audubon suggests that the existence of contamination at this depth supports its hypothesis that the plume is moving deeper along the bedrock, and that it may not be discharging to Hundred Acre Pond.

Response: As discussed above, contaminant concentrations and a hydrophilic dye test both indicated that the VOCs are not present as a NAPL moving along the bedrock. The statement in the RI cited by Audubon is not inconsistent with this; although the contaminant plume is 135 feet to 165 feet below ground surface in the vicinity of Plains Road (between the source area and Hundred Acre Pond, where there is a very thick overburden layer above the bedrock), the groundwater and the dissolved VOC plume are moving toward the surface as they approach Hundred Acre Pond, where they discharge. This groundwater path is confirmed by sampling data, as discussed on p. 3-7 of the RI.

Comment 2a: Audubon notes that in the RI it was said that no VOCs were detected in Hundred Acre Pond. Audubon says that a similar statement was made at the informational meeting on June 28, 2006. But Audubon points out that this statement seems to be contradicted by other statements in the RI indicating that contamination is present in deep porewater (water filling the spaces between grains of buried sediment) in Hundred Acre Pond.

Response: EPA believes there is no contradiction. The statement from the RI (p. 5-17) cited by Audubon says: "To assess the potential impact to the pond, surface water and sediment samples were collected during the RI. No VOCs were detected in the pond." This statement means that no VOCs were detected in *surface water* and *sediment* samples. As Audubon points out, the RI elsewhere states that *porewater* samples collected up to three feet beneath the Hundred Acre Pond bottom did contain PCE and TCE in detectable amounts. Porewater data (not surface water data, since these samples were non-detect) was used in the Screening Level Ecological Risk Assessment (SLERA) as a conservative method of estimating exposure point concentrations, which were compared to benchmarks at which there is risk to wildlife (see p. 6-27 and p. 6-44 of the RI).

Comment 2b: Audubon suggests that the ecological risk assessment in the RI should have modeled the effects of PCE and TCE on amphibians. Audubon acknowledges that VOC levels in groundwater "near the URI Pond" are "well below" the threshold for effects on wood frogs. But Audubon seems to suggest that such modeling is appropriate because "original" VOC levels might have been higher, or might now be higher in bedrock groundwater, where VOCs are less apt to volatilize. In addition, Audubon faults the ecological risk assessment included in the RI because it considered only riparian mammals, not aquatic macro-invertebrates, fish, or "wetlands habitats [near Hundred Acre Pond] and their organisms."

Response: EPA believes Audubon's objections do not call the ecological risk assessment into question. First, the purpose of the ecological risk assessment under the Superfund program is to evaluate the *current* exposure of ecological receptors to contaminants that exist in the habitats potentially affected by historical disposal practices. Measuring "original" concentration levels was not possible at the time the data for the risk assessment was collected. Even if it had been possible, knowing original or historical concentrations would not change the assessment of current exposures to contaminants by plants and animals on the Site, insofar as VOCs such as TCE and PCE do not bioaccumulate significantly. The evaluation of amphibians was therefore based on current detected concentrations of VOCs in surface water (rather than modeling bioaccumulation effects), and these values were compared with benchmark concentrations determined in laboratory studies to have a toxic effect. All concentrations were well below the benchmarks. Second, it is not appropriate to use concentrations of contamination in bedrock groundwater to determine impacts on ecological receptors, since receptors such as fish or invertebrates do not actually live in this medium and that exposure pathway does not exist.[18] Third, EPA disagrees that it should have assessed impacts on macro-invertebrates, fish and other wetlands organisms in or near Hundred Acre Pond. No VOCs were detected in either sediment or surface water of Hundred Acre Pond, indicating that these organisms are not exposed to site contaminants. To be conservative, an additional analysis for terrestrial receptors was undertaken on the assumption that groundwater discharging into Hundred Acre Pond might pool along the water's edge, and that these pools might contain contamination equal to the contamination in the deep porewater in Hundred Acre Pond (even though in fact such pools would be subject to

18 As Audubon acknowledges in its comment letter, given the reactions of TCE and PCE in "aerated conditions," "significant impacts to shallow surface water or wetland wildlife seem unlikely."

diminution in contamination due to biodegradation, dilution, or volatilization). And it is true that, as Audubon notes, this additional, conservative analysis focused solely on impacts to riparian mammals that might consume water from these pools, and not on impacts to receptors such as fish or macro-invertebrates. However, EPA believes that extending the analysis to other receptors was unnecessary, because (a) the analysis was based on so many conservative assumptions that doing the analysis was not strictly necessary with respect to *any* receptor, (b) riparian mammals would be more likely to consume water pooled at the water's edge than at least some of the other receptors (such as fish), and (c) the porewater concentrations of PCE and TCE in Hundred Acre Pond were comparable to the concentrations of PCE and TCE in URI Pond surface water, where impacts were assessed with respect to invertebrates, amphibians, and waterfowl – and no significant impact was found there. For these reasons EPA believes it was unnecessary to undertake the additional analysis suggested by Audubon.

2. The Oral Comment

The oral comment, also by a representative of the Audubon Society of Rhode Island, can be divided into two parts.

Oral Comment Part 1: Audubon expressed concern about "what will happen" to Hundred Acre Pond if it becomes a repository for the TCE and PCE plume, and also suggested the plume is "dense in the water [and is] probably going to sink to the bottom."

Response: Under the selected remedy, the volume of contamination reaching Hundred Acre Pond is expected to diminish as a result of (a) oxidation of VOCs in source area soil and source area groundwater, and (b) monitored natural attenuation throughout the VOC plume. As stated above, even under baseline conditions, the impact of PCE and TCE on Hundred Acre Pond is relatively low: although low levels of PCE and TCE were found in Hundred Acre Pond deep porewater, no PCE or TCE was found in Hundred Acre Pond surface waters or sediments. Testing also showed that the VOC plume is in a dissolved phase, rather than in a non-aqueous phase liquid which would be denser than water, and thus VOCs would not "sink to the bottom" of the pond.

Oral Comment Part 2: Audubon also expressed concern about "what other things might be sinking and in what toxicity," and specifically about the impact these substances might have on aquatic macro invertebrates such as dragon flies. Referring to the fact that the ecological risk assessment focused on threats to mammals from drinking surface water at the pond's edge (assumed for purposes of conservatism to be as contaminated as the pore water), Audubon suggests the ecological risk assessment should have focused on invertebrates instead.

Response: For the reasons given in response to written comment 2b, EPA believes the ecological risk assessment was adequate. In particular, the deep porewater concentrations of PCE and TCE in Hundred Acre Pond were comparable to the concentrations of PCE and TCE in URI Pond surface water, where impacts were assessed with respect to aquatic invertebrates, amphibians, and waterfowl – and no significant impact was found there. In addition, the ecological risk assessment found that there was no significant risk to aquatic invertebrates from *any* substances in URI Pond. (See pp. 6-41 to 6-42 of the RI.) Since URI Pond is where the plume first reaches a surface water body, and is thus more likely to be contaminated by substances from the Site than Hundred Acre Pond, EPA believes it was unnecessary to undertake additional analysis on invertebrates at Hundred Acre Pond. In any event, EPA believes the selected remedy addresses any contamination reaching Hundred Acre Pond, by reducing contaminant mass in the source area soil and groundwater with oxidants while also subjecting the plume to monitored natural attenuation.

OVER 100 YEARS OF EDUCATION, CONSERVATION, & ADVOCACY
Audubon Society of Rhode Island

July 14, 2006

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Gary Jablonski, Project Manager
RIDEM, Office of Waste Management
235 Promenade Street
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Re: West Kingston Town Dump/URI Disposal Area
South Kingstown, Rhode Island

Dear Ms. Krasko and Mr. Jablonski:

I write on behalf of Audubon Society of Rhode Island, an independent state conservation organization, not administratively connected with the national organization of the same name. We own property on the east side of Hundred Acre Pond, and the plume of contamination from the above-captioned Superfund site is projected to pass through the groundwater under this property.

This letter will serve as our basic comment. However, additional comments may be made orally at the hearing by ASRI Senior Director for Conservation, Scott Ruhren, Ph.D. I am unable to attend the hearing. I have reviewed the Final Remedial Investigation (FRI) Report at DEM offices and offer the following comments.

Great uncertainty about the nature of the spill from drums of TCE/ PCE leaves questions about the nature of the plume and the fate of the material. The spill occurred at an uncertain date 30 – 38 years ago and whether it occurred by rupture of the drums' seals and a large amount of material being released or a slow drip as drums deteriorated seems uncertain. These two scenarios would provide different assumptions about the fate of the material.

Groundwater will continue to move through the site, despite capping certain areas and preventing rain leaching directly through remains of solid wastes. The glacial sand and

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email:audubon@asri.org

gravel deposits become deeper under the pond and Chipuxet River and they are part of a complex deposit pattern remaining from a glacial lake that extended a mile or more to the south.

We are not convinced that the permanganate treatment for TCE PCE, while effective for that remnant of contaminant that is upgradient of the proposed treatment, will remediate the entire TCE and PCE contamination, which remains uncertain.

1. We are concerned that the characterization of the fate of contamination may not be complete or adequately address future potential for exposure.
    a. The first investigations of the site in 1975 "concluded that a leachate plume approximately 1200 feet wide existing below and to the west of the site," (p. 1-8, FRI, Woodard & Curran, April 12, 2006) and in 1987 RI DOH found unacceptable levels of solvents in private wells 900 feet west of site.
    Our comment is that the plume has been traveling for 30 years, and consistent assumptions of groundwater movement, the forward edge of the plume may have traveled 10,950 feet along whatever slope the bedrock takes beneath the Chipuxet Valley.. Our property lies approximately 2,350 feet measured on the surface from the former drum storage area, reading maps provided in the FRI Report. Furthermore the proposed remediation of creating a slurry wall of permanganate(Remedial Alternative 4) may not be effective if the plume has moved down-gradient of the proposed remediation; however, concentrations remaining upgradient will be treated by this method, preventing further downstream contamination..
    b. In 1977 surface water from Hundred Acre Pond was sampled, and results were reported non-detect for VOCs (p. 1-8, FRI). TCE and PCE are known to be heavier than water and to sink to bedrock through the glacial overburden and move in groundwater along the surface of bedrock.
    Our comment is that we are not certain that the evidence supports the conclusion on page 5-4 of the FRI Report that "these contaminants … are migrating,…,and discharging to, Hundred Acre Pond." *We have read the discussion of the groundwater model (page 5-11). We are concerned that the MODFLOW 4 layer model may not reflect the complex delta layering in the northern reaches of the glacial lake. We ask for further review of hydrology regarding the molecular weight as well as the chemical characteristics discussed in the FRI of TCE, the continuing slope of the bedrock under Hundred Acre Pond, the layering and connectivity to other water bodies of glacial overburden as these factors affect the presumed recharge of Hundred Acre Pond.*
    c. There appears to be a lack of conclusion in the report about the fate of the TCE.
    Our comment: The discussion in the FRI (pp 5-4 ff.) pertaining to the fate of these DNAPLs concludes that "The results of this screening did not indicate the presence of a NAPL in either the Former Drum Storage Area

or **any downgradient** location." *(boldface added). The next paragraph concludes* "However, it is possible residual mass may be present directly downgradient of the Former Drum Storage Area."
On page 5-10 a table shows the VOC Mass Estimate for the Dissolved Plume to range between 52 and 89 pounds.
Concentrations of PCE and TCE are not in respective agreement from MW-1R and MW-2R in tables on Pages 5 – 11 and 5 – 15.
Furthermore the lack of discussion of groundwater recharge to overcome the molecular weight of TCE and PCE leaves the question, whether surface and sediment sampling would adequately characterize the fate of the TCE.

d. In the *Guidebook to field Trips in Rhode Island and Adjacent Regions of Connecticut and Massachusetts, 1998 New England Intercollegiate Geological Conference, 90th Annual Meeting,* edited by Daniel P. Murray, Dept. Of Geology, University of Rhode Island, (figure 4, p. C5-6), seems to indicate a glacial deposit above bedrock of approximately 100 feet or greater depth in the valley where Hundred Acre Pond exists. The Site Plan of the FRI indicates from seismic conductivity data a 145-foot overburden between Plains Road and the railroad, with 125 feet of saturated material.
Our comment is that sampling wells at Hundred Acre Pond wetlands and knoll did not extend to potential fate area of TCE, given the characteristics of movement above bedrock.

e. Page 5-16 of the RIF discusses the Overburden Groundwater and acknowledges the depth of the PCE plume at 135 – 165 feet below ground surface. It concludes that a layer of "clean water" exists over 40 feet above the plume in this area, but asserts that the plume moves toward and discharges to Hundred Acre Pond.
Our comment is that we do not find evidence in the FRI that the groundwater quality is attributable to dilution and discharge as opposed to sequestration at deeper depths than have been sampled.

2. Concerns about impacts to wildlife
   a. In public meeting on June 28, 2006, samples taken from Audubon Society of Rhode Island property (porewater sampling event in 2004), the results were characterized verbally as non-detect, as is written on page 5-17 of the FRI (p. 5-17, line 5). Yet in section 4.3.1.3.2 "Hundred Acre Pond Porewater Sampling Results" of the FRI, it is stated "The only VOCs detected above the laboratory reporting limits were TCE and PCE. TCE was detected in three of the sample locations (PW-28, PW-39, and PW-41) at concentrations ranging from 5 ug/L to 8ug/L. PCE was detected at PW-28 at 9 ug/L.
   These results indicate the contaminated groundwater from the Site is discharging to Hundred Acre Pond."

Our comment is that these sampling sites exist on Audubon property and they are not non-detect. They are at very dilute concentrations, but not N-D.

b. No amphibians, whose skin permits transmission of ambient solvents, were modeled for exposure to TCE and PCE.
Our comment is that the only study we found showed a threshold effect level on wood frogs at 12 mg/L, far above the microgram concentrations found in sampling on the wetland on Audubon property. Concentrations of TCE PCE in groundwater near the URI Pond close to the dump site were 352ug/L and 317ug/L, well below the effect level on wood frogs found in literature. However, we do not find analysis of what original concentrations may have been, may have been in groundwater at intersection with bedrock, or may be currently given 30 years in groundwater with no volatilization potential. Although we recognize that volatilization occurs in surface water and in the vadose area of ground, the question remains what degree of certainty that PCE TCE may not occur in groundwater just above the bedrock.

No aquatic macro-invertebrates, were analyzed as receptors.

No fish were analyzed as receptors.

Our comment is that considering only riparian mammals is inadequate. In the SLERA, the characterization of habitats at Hundred Acre Pond is inadequate because it does not consider the wetland habitats and their organisms.

In conclusion, we find ultimate fate of the TCE and PCE inadequately supported. We ask that U. S. EPA review pages 5-6 through 5-8 to ascertain the validity of assumptions about volatilization specific to conditions at this site. We ask that the VOC Mass Estimate-Dissolved Plume on page 5-10 be reviewed in consideration of 30 years of groundwater movement since original contamination. We ask for a review of the potential that significant concentrations remain deep along the bedrock of the Chipuxet Valley and whether, if they exist, they could provide a risk for drinking water withdrawn from the aquifer.

We understand that given the concentrations of TCE PCE exhibited in the FRI and the reactions of TCE PCE in aerated conditions that significant impacts to shallow surface water or wetland wildlife seem unlikely.

We agree that Alternative 4 appears to provide the most timely cleanup to appropriate levels.

Eugenia Marks, Policy Director, Audubon Society of RI

Eugenia Marks

STATE OF RHODE ISLAND

AND PROVIDENCE PLANTATIONS

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

DIVISION OF WASTE MANAGEMENT

HEARING IN RE:

WEST KINGSTON SUPERFUND SITE

-----------------------------------/

JULY 26, 2006
7:00 P.M.
210 FLAGG ROAD
KINGSTON, RHODE ISLAND

BEFORE

MATT DESTEFINO

ORIGINAL

WEDNESDAY, JULY 26, 2006

(COMMENCING AT 7:06 P.M.)

MR. DESTEFINO: Good evening, and welcome to the public hearing for the West Kingston/URI Superfund site. My name is Matt DeStefino. I'm the supervising engineer and head of the Rhode Island Superfund section up at DEM in Providence.

The purpose of tonight's meeting is to formally accept your oral comments on RIDEM's and EPA's proposed early cleanup plan for the West Kingston site. We will not be responding orally to your comments tonight; however, all of your oral comments will be received during the formal portion of tonight's hearing, and we'll respond to them in writing. This response summary will be made available to the public at the various information depositories; one at the South Kingstown Public Library. You can also get them at RIDEM's office in Providence and EPA's office in Boston. Also, written responses to any significant public comments will be placed in the record of rescission, our rescission document for the site, that outlines the remedy, so that's in the rescission document.

I'd like to ask the people that we have here tonight to introduce themselves quickly. We have some people from the town and the state.

MR. JABLONSKI: Gary Jablonski, Rhode Island DEM, project manager.

MR. KERN: William Kern. I work for the town.

MR. SCHOCK: Jon Schock, public service director for South Kingstown.

MS. KRASKO: Anna Krasco, EPA.

MS. WHITE: Sara White. I work for the community affairs office at EPA.

MR. DESTEFINO: Now I'd like to describe the formal public meeting. Basically, it's going to be in two parts. First, I'm going to ask if anyone has any clarifying questions on what I've said tonight, oral comment about the site, or anything like that, and then I will open the formal public hearing and accept formal public comments for the record from anyone wishing to make a statement. Please try to limit your oral comments to ten minutes or less. If you're going to be longer, if you can summarize them to around ten minutes and give us a written version of the comments. You can give it to Gary or I, and we'll make sure that it gets into the record. After all the oral comments and questions tonight, I'm going to close the formal hearing. Are there any questions?

I'm going to formally open the hearing. As I call on you to make a statement, please come up to the podium and tell us who you are and what your relation to the site is.

MR. KUHREN: My name is Scott Kuhren. I'm the director of conservation at the Audubon Society of Rhode Island. I'm here instead of Jeannie Marx, who is on vacation. Jeannie Marx did submit written comments to this project, and I just wanted to come to address some other issues since I'm a biologist. We own a refuge, which is right down plume of the site, along the Conrail area, between Conrail and the pond; and our concern is what will happen to the pond if that becomes a repository for -- the plumes seems to be moving that way, and PCEs and TCEs, which are dense in the water are probably going to sink to the bottom. We also have some other concerns. I'm going to try to avoid repeating anything Jeannie said in her letter. We're also concerned about what other things might be sinking and in what toxicity. The concern for us was primarily with aquatic macroinvertebrate, indicator species like dragon flies, which are also indicators of water quality. The other thing that was said, according to the report, was it was assumed that toxicity is the greatest hazard was for mammals that might come down to drink water, and we had some questions, is that going to be a valid test for concern? As we said, the invertebrates are probably greater affected. That's the end of my comments and questions. Thank you.

MR. DESTEFINO: Thank you. Anyone else that wants to make formal comments for the record? That concludes the formal portion of the hearing. I'd like to remind you, if you do have written comments for the record, you have to get them into Gary Jablonski at DEM by July 31st. You can send them to Anna Krasko in Boston as well, if you have any.

MR. JABLONSKI: There's a card with my address, my phone comment line, so if you want to pick it up, fill it out, and send it to me, they are available right at the door.

MR. DESTEFINO: If you would like to do that, we'll make sure we respond to it. With that, I guess, does anyone have any informal questions they'd like to ask while we have people here? It's an informal basis. If you want to come up and just talk to us, we'll be here for a little while and, again, I thank you for your participation and for coming tonight.

(HEARING CONCLUDED AT 7:13 P.M.)

C E R T I F I C A T E

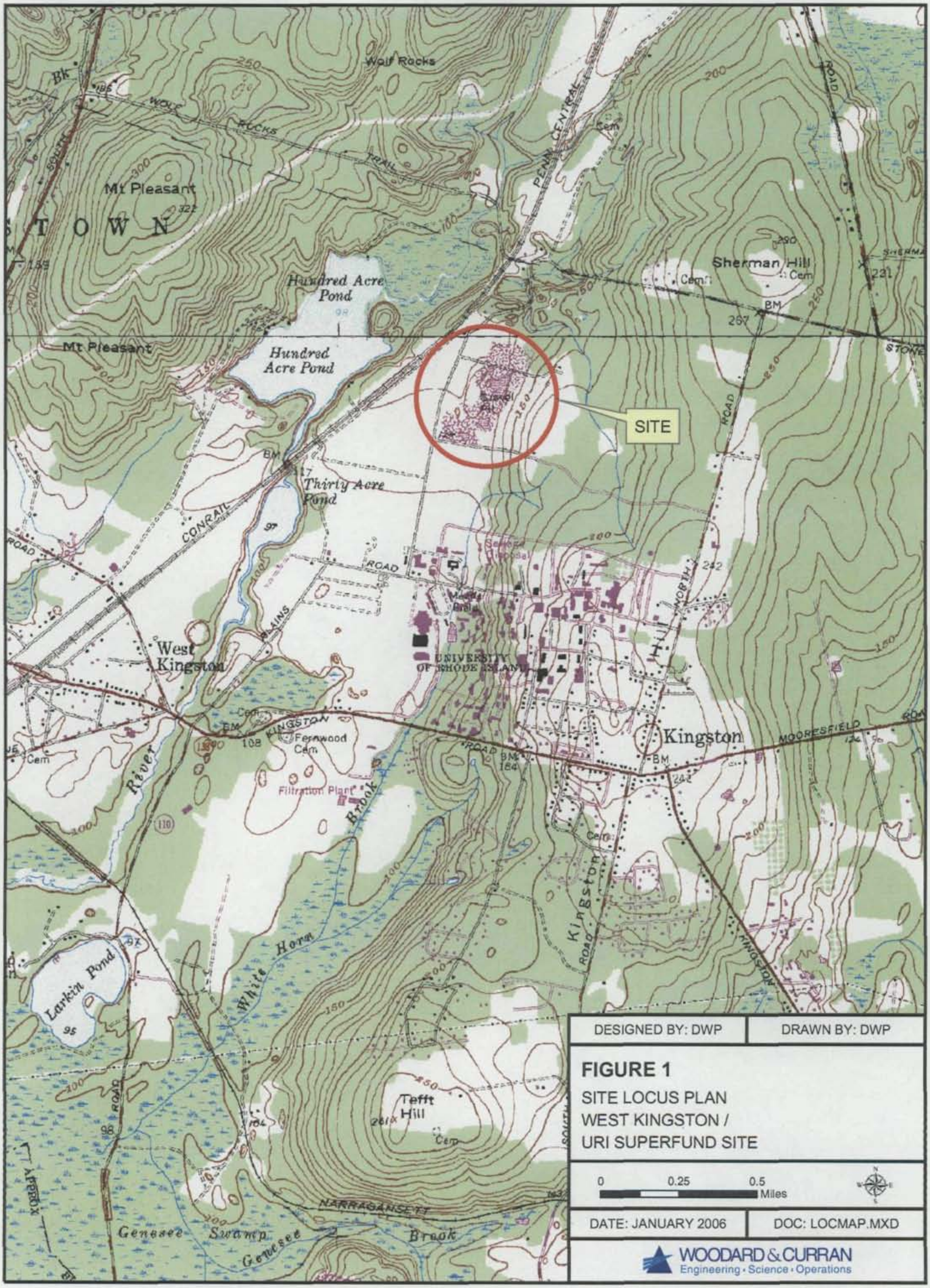
I, Dianne M. Dillon, do hereby certify that the following is a true, accurate, and complete transcript taken to the best of my ability of the hearing taken before the Rhode Island Department of Environmental Management, Division of Waste Management, on July 26, 2006, at 7:00 p.m.

DIANNE M. DILLON, CSR
NOTARY PUBLIC, STATE OF RHODE ISLAND

(My commission expires September 2, 2006)

APPENDIX A

FIGURES



DESIGNED BY: DWP	DRAWN BY: DWP

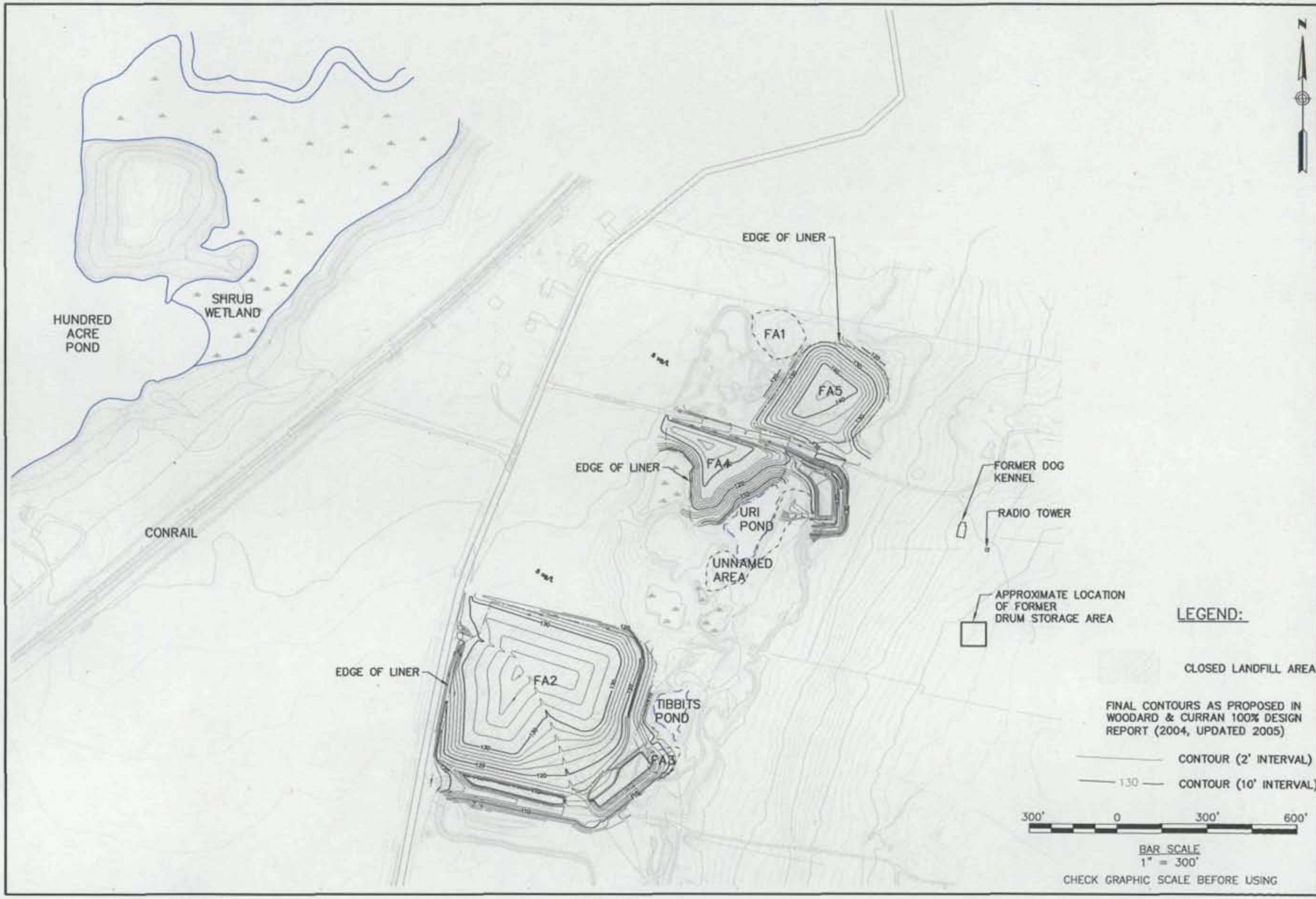
FIGURE 1

SITE LOCUS PLAN
WEST KINGSTON /
URI SUPERFUND SITE

0 0.25 0.5 Miles

DATE: JANUARY 2006	DOC: LOCMAP.MXD

WOODARD & CURRAN
Engineering · Science · Operations



WOODARD & CURRAN
Engineering · Science · Operations

GRADING PLAN

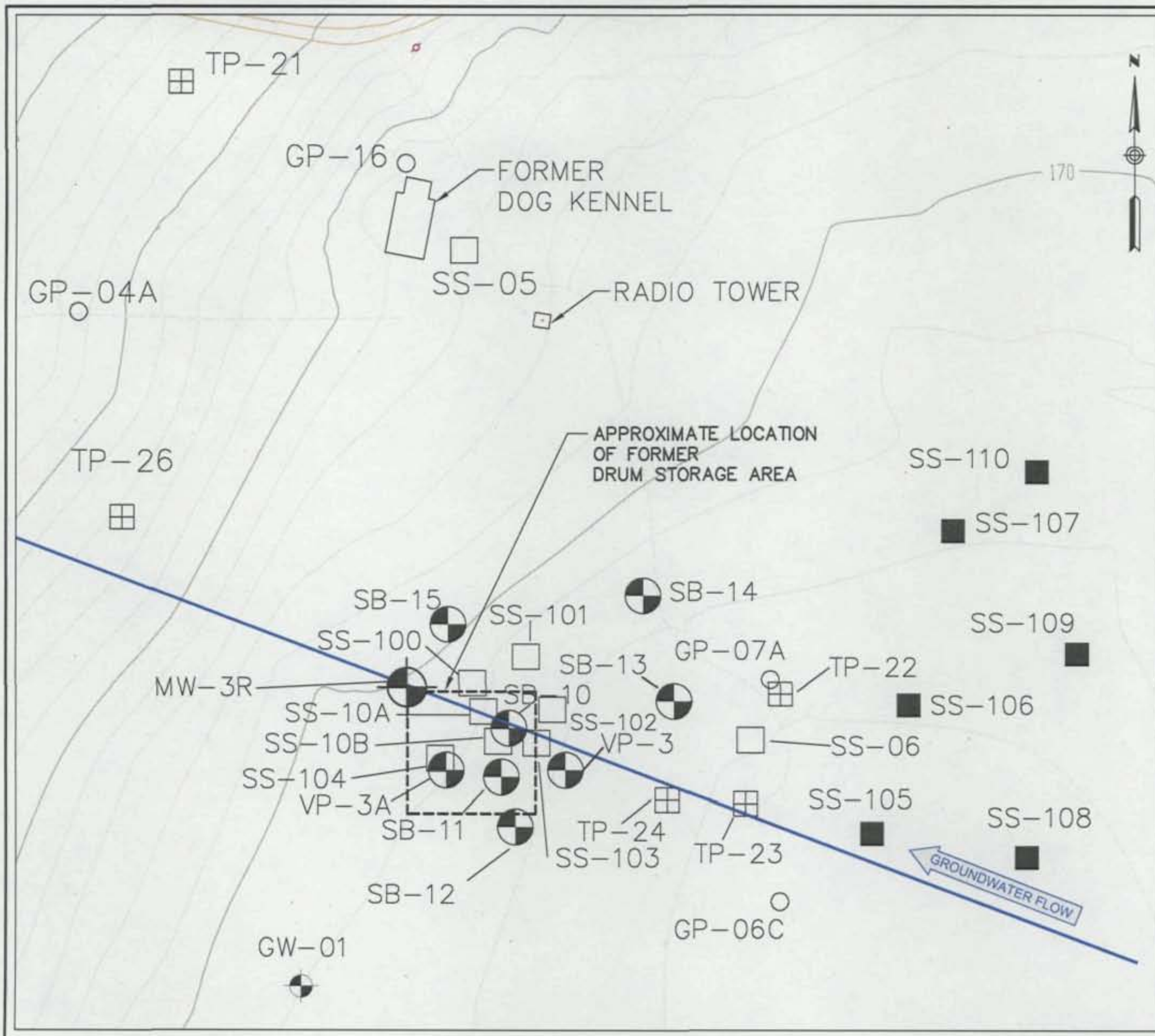
DESIGNED BY: EOF
DRAWN BY: PFF
CHECKED BY: KDK
20554004U1-2_1-3.dwg

WK/URI SUPERFUND SITE
SOUTH KINGSTOWN, RI

REMEDIAL INVESTIGATION REPORT

JOB NO: 205540.04
DATE: JANUARY 2006
SCALE: AS NOTED

FIGURE 2



LEGEND:

BEDROCK GROUNDWATER MONITORING WELL

TP-19 TEST PIT SAMPLING LOCATION

SS-04 SURFACE SOIL SAMPLING LOCATION

SS-105 BACKGROUND SURFACE SOIL SAMPLING LOCATION

SB-11 SOIL BORING SAMPLING LOCATION

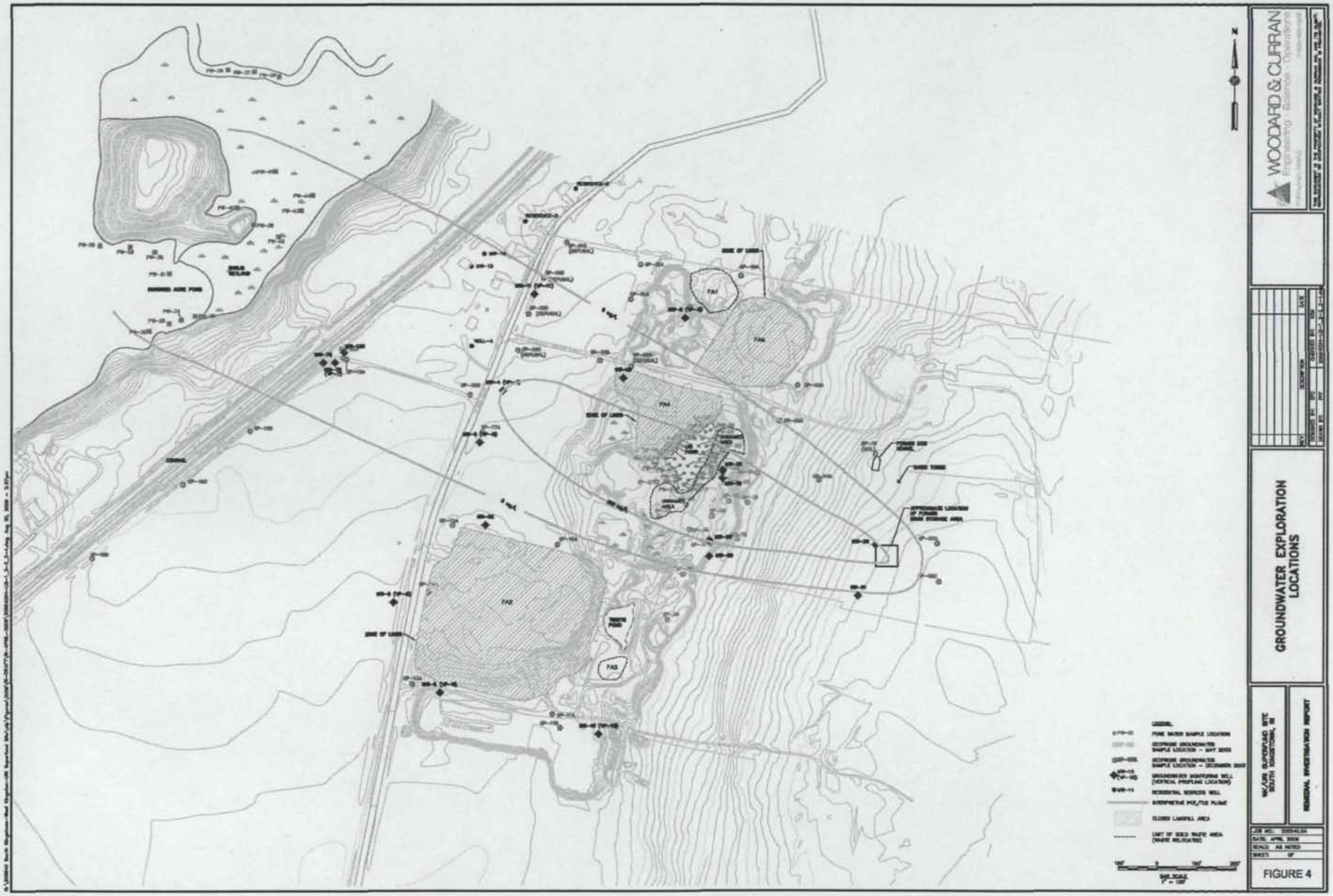
GP-06C GEOPROBE SAMPLING LOCATION

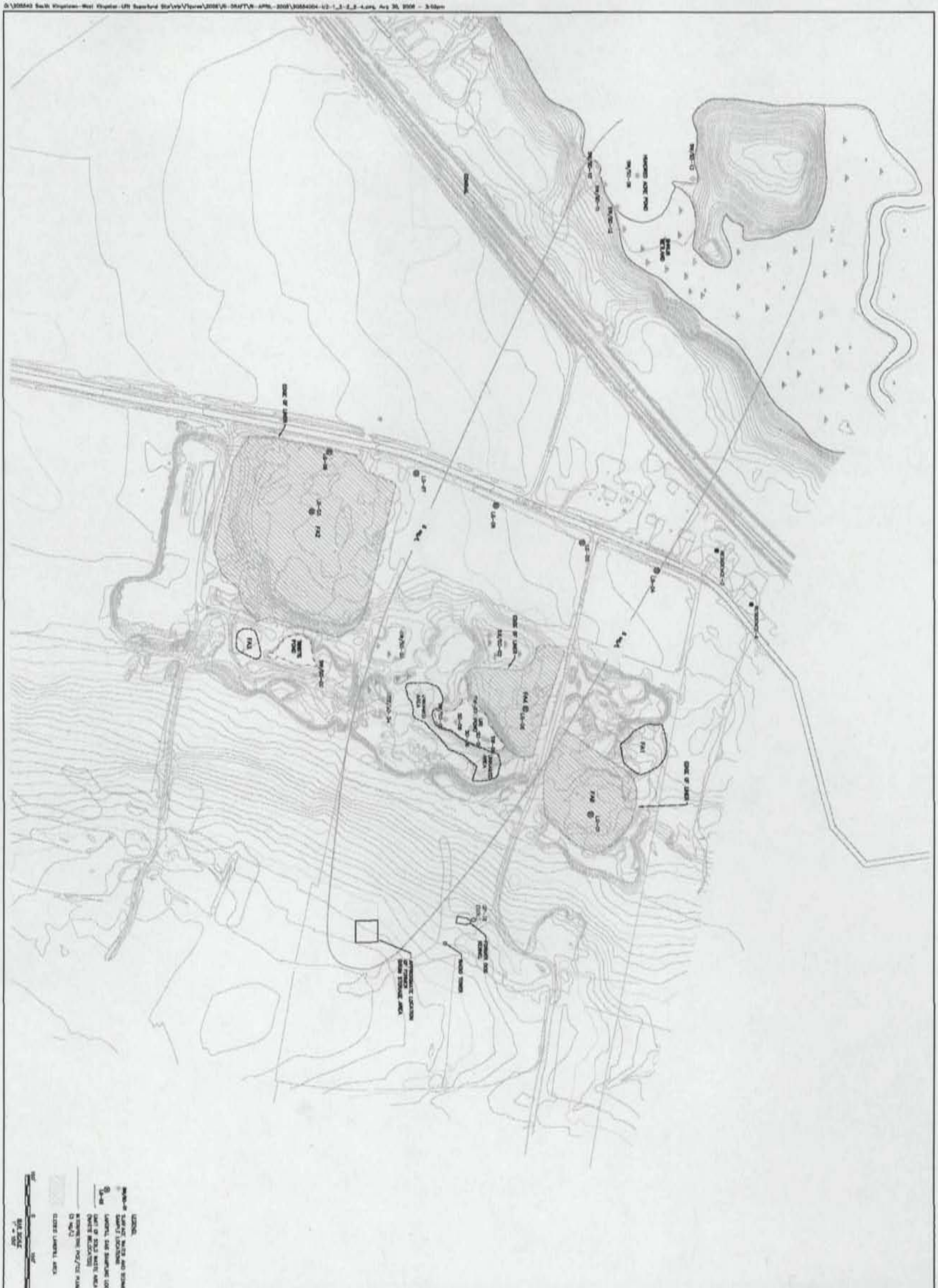
100' 0 100' 200'

BAR SCALE
1" = 100'

WOODARD & CURRAN Engineering · Science · Operations PORTLAND, MAINE 1-800-426-4262	SAMPLING LOCATIONS FORMER DRUM STORAGE AREA	WEST KINGSTON/URI SUPERFUND SITE	JOB NO: 205540.04 DATE: JANUARY 2006 SCALE: AS NOTED
	DESIGNED BY: KDK CHECKED BY: KDK DRAWN BY: PFF/DRJ 205540014U2-1AB-B'-LOC.dwg	REMEDIAL INVESTIGATION REPORT	FIGURE 3

205540/wip/U/2006/ri


WOODARD & CURRAN
Engineering · Science · Operations
GROUNDWATER EXPLORATION LOCATIONS
FIGURE 4



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SURFACE WATER, SEDIMENT, AND LANDFILL GAS EXPLORATION LOCATIONS

WK/URI SUPERFUND SITE
SOUTH KINGSTOWN, RI

REMEDIAL INVESTIGATION REPORT

FIGURE 5

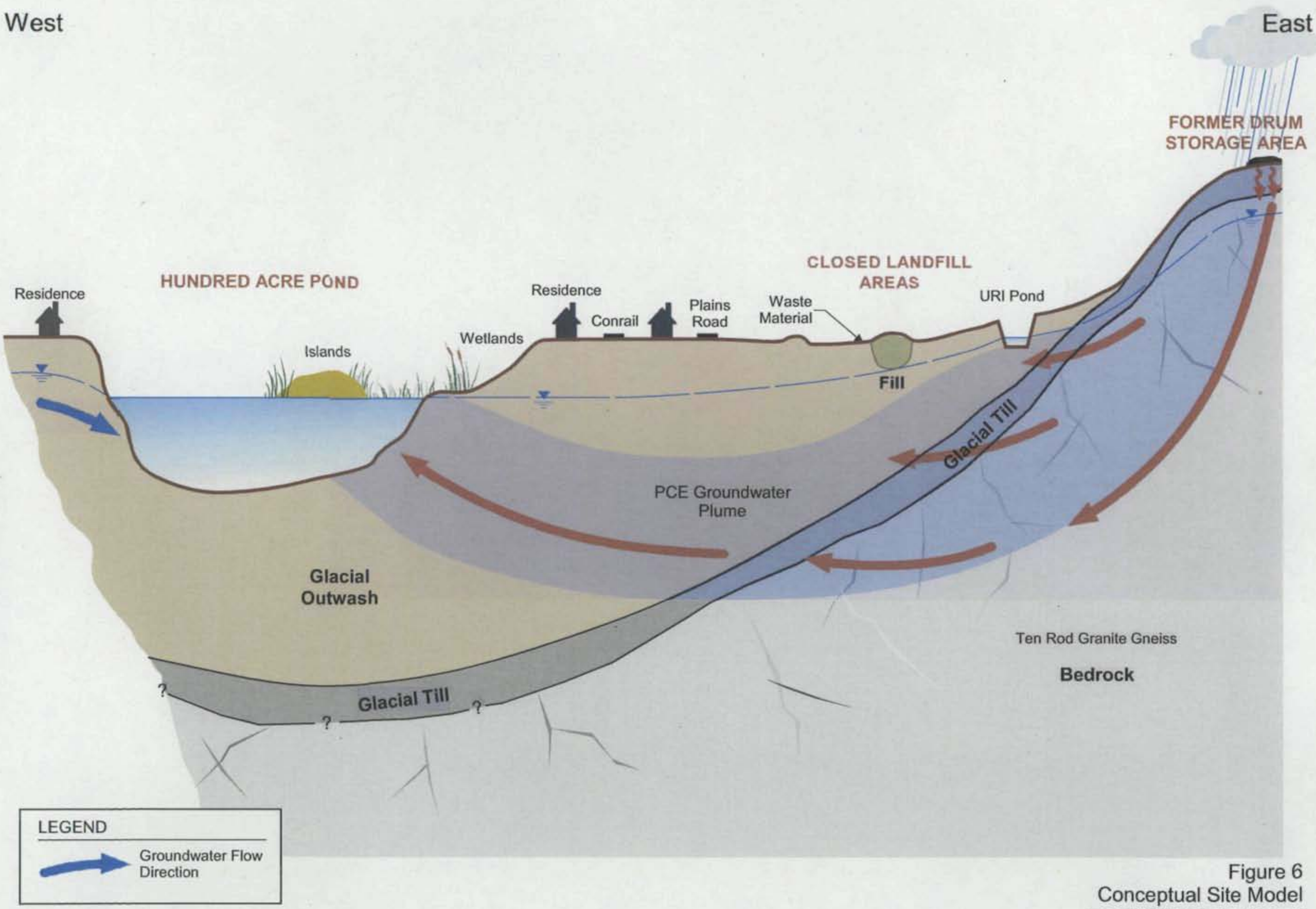
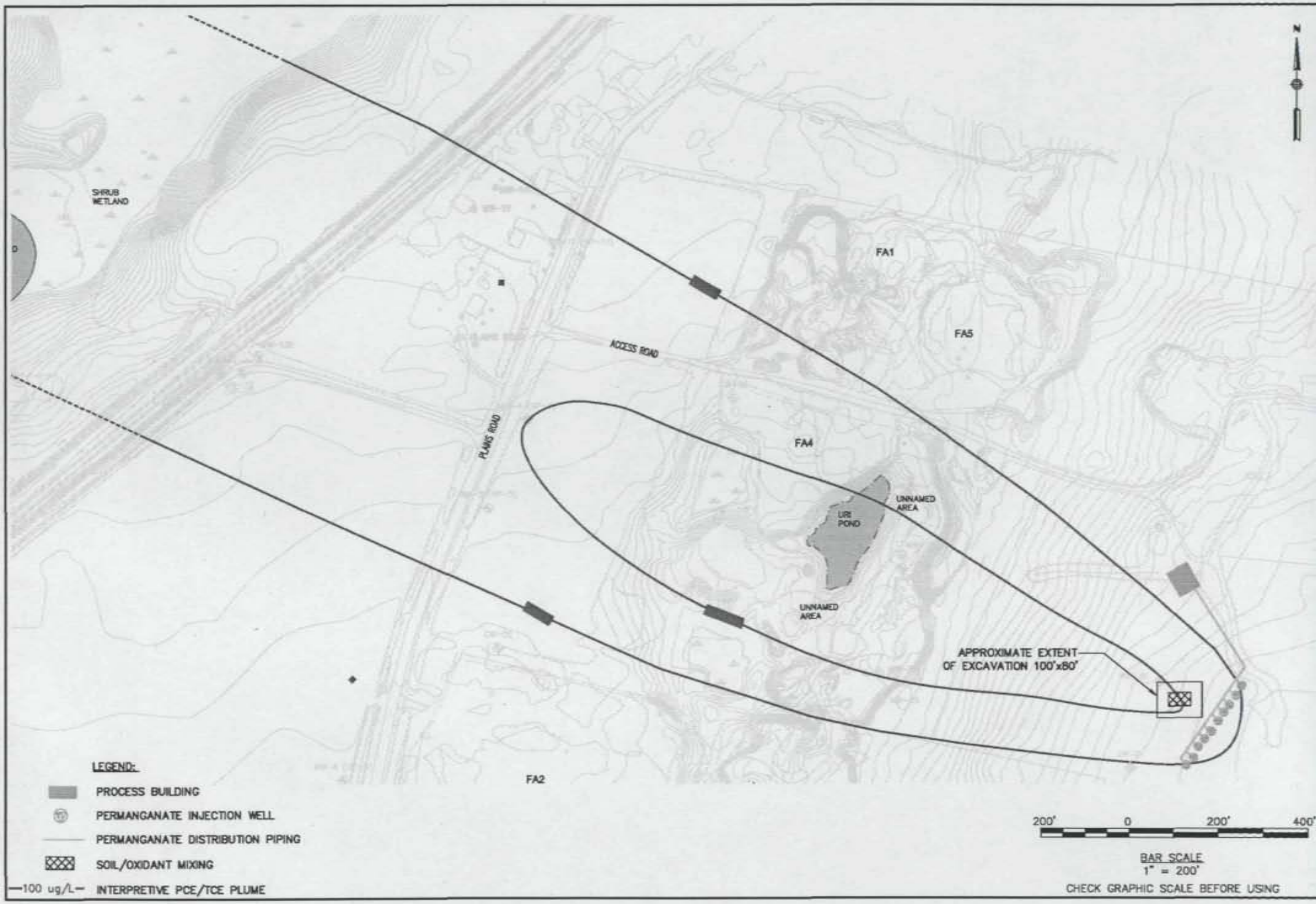


Figure 6
Conceptual Site Model
Feasibility Study Report
West Kingston Town Dump/URI Disposal Area Site

WOODARD& CURRAN

205540.04\gcw\model-xs.cnv



WOODARD & CURRAN
Engineering · Science · Operations

SITE PLAN FOR ALTERNATIVE 4
CHEMICAL OXIDATION

DESIGNED BY: LO
DRAWN BY: PFF
CHECKED BY: KJK

WK/URI SUPERFUND SITE
SOUTH KINGSTOWN, RI

FEASIBILITY STUDY

JOB NO: 205540.05
DATE: JUNE 2006
SCALE: AS NOTED

FIGURE 7

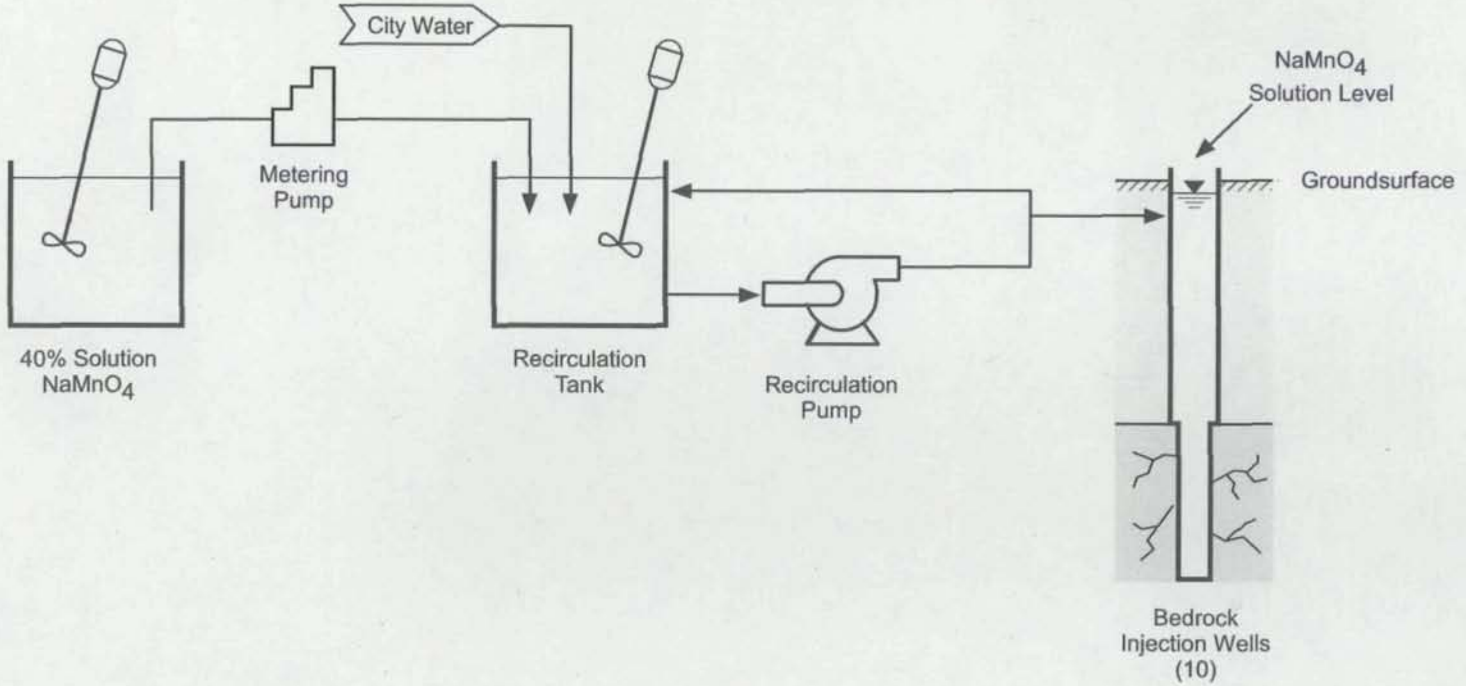


Figure 8
Alternative 4 - Chemical Oxidation
Process Flow Diagram

WOODARD& CURRAN

205540.05\gcw\process flow diagrams.cnv A

APPENDIX B

TABLES

Table 1
Identification of Chemical-Specific ARARs
West Kingston Town/URI Disposal Area Superfund Site – Record of Decision

Requirement	Status	Summary of Requirement	Action to be Taken to Comply with ARARs
Groundwater			
Federal Regulatory Requirements			
Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) (40 CFR Parts 141.60-66)	Relevant and Appropriate	MCLs have been promulgated for a number of common organic and inorganic contaminants. These levels regulate the concentrations of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers that potentially could be used as a source of drinking water.	The selected remedy will comply with this ARAR. MCLs were used as the basis for groundwater cleanup levels. Treatment of source area groundwater is expected to reduce volatile organic compound (VOC) concentrations there. Additional reductions down to MCLs are expected to occur throughout the plume through monitored natural attenuation.
Non-Zero SDWA Maximum Contaminant Level Goals (MCLGs) (40 CFR Parts 141.50-55)	Relevant and Appropriate	MCLGs are health-based criteria at which no known or anticipated adverse health effects are expected. MCLGs are available for several organic and inorganic contaminants. Under the National Contingency Plan (NCP), an MCLG is relevant and appropriate with respect to a given contaminant only if the MCLG is above zero for that contaminant.	The selected remedy will comply with this ARAR. As part of the selected remedy, monitoring will ensure that there are no exceedances of any non-zero MCLGs. (The MCLGs for tetrachloroethene and trichloroethene are zero and therefore would not be an ARAR for these contaminants.)
U.S. Environmental Protection Agency Health Advisories (HAs)	To Be Considered	HAs are issued as non-regulatory guidance. HA values represent the concentration of contaminants in drinking water at which adverse health effects would not be expected to occur. HAs are established for one-day and ten-day exposure durations.	HAs were used during the risk assessment to evaluate non-carcinogenic effects for oral exposures of shorter durations and will be used, as appropriate, in any future risk evaluations for this Site.
Guidelines for Carcinogen Risk Assessment (March 2005) and Supplemental Guidance for Assessing Early-Life Exposure to Carcinogens (March 2005) (EPA/630/P-03/001B & EPA/630/R-03/003F)	To Be Considered	Provides guidance on conducting risk assessments involving carcinogens.	Until updated or replaced, these guidances will be used by EPA to evaluate all risk assessments on carcinogenicity conducted in the future at the Site.
State Regulatory Requirements			
Rhode Island Rules and Regulations for Groundwater Quality	Applicable	These rules set numerical criteria for contaminants in certain aquifers classified as potential drinking water sources (such as the aquifer at the Site), and require that such groundwater be maintained at a quality that does not have any reasonable potential to cause a violation of surface water quality standards. See Rule 11.2.	The selected remedy will comply with this ARAR. For PCE and TCE, the numerical criteria are identical to MCLs. Treatment of source area groundwater is expected to reduce volatile organic compound (VOC) concentrations there. Additional reductions down to MCLs are expected to occur throughout the plume through monitored natural attenuation.

Table 1
Identification of Chemical-Specific ARARs
West Kingston Town/URI Disposal Area Superfund Site – Record of Decision

Soil/Sediments			
Federal Regulatory Requirements			
EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are non-regulatory estimates of a daily exposure concentration that is likely to be without appreciable risk of deleterious effects during a lifetime exposure.	RfDs were used in developing the risk assessment and are cited as TBCs. They should be useful in future risk assessments of the Site.
EPA Carcinogen Assessment Group Cancer Slope Factors (CSFs)	To Be Considered	CSFs are non-regulatory estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	CSFs were used in developing the risk assessment and are cited as TBCs. They should be useful in future risk assessments of the Site.
State Regulatory Requirements			
RI Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases, Section 8.02.B.i and .ii – Soil Objectives	Applicable	These rules establish direct exposure and leachability criteria for cleanup of soil contamination caused by of a release of hazardous material.	The selected remedy will comply with this ARAR. Treatment of source-area subsurface soil is expected to reduce contaminant concentrations there below the relevant criteria.

Table 2
Identification of Location-Specific ARARs
West Kingston Town/URI Disposal Area Superfund Site – Record of Decision

Requirement	Status	Summary of Requirement	Action to be Taken to Comply With ARARs
Wetlands/Flood Plains			
Federal Regulatory Requirements			
Wetlands Executive Order (Executive Order 11990, at 42 Fed. Reg. 26961); Statement of Procedures on Floodplains Management and Wetlands Protection (40 CFR Part 6, Appendix A)	Applicable	The Wetlands Executive Order and accompanying statement of procedures require federal agencies to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance natural and beneficial values of wetlands.	The selected remedy will comply with this ARAR. The selected remedy is not expected to have any negative impact on wetlands; however, area wetlands will be monitored to ensure no negative impacts occur as a result of soil or groundwater treatment.
State Regulatory Requirements			
Rhode Island Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act	Applicable	These rules require that all wetlands and wetland functions be protected to the maximum extent possible, including by preventing pollutants, sediment, direct discharges of stormwater runoff, or any material foreign to a wetland or hazardous to life from entering any wetland. The rules also require that hazardous material remediations fully protect, replace, restore and/or mitigate harm to any affected wetlands. See Rules 6, 7 and 10.	The selected remedy will comply with this ARAR. The selected remedy is not expected to have any negative impact on wetlands; however, area wetlands will be monitored to ensure no negative impacts occur as a result of soil or groundwater treatment.

Table 3
Identification of Action-Specific ARARs
West Kingston Town/URI Disposal Area Superfund Site – Record of Decision

Requirement	Status	Summary of Requirement	Actions to be Taken to Comply with ARARs
Groundwater			
Federal Regulatory Requirements			
Underground Injection Control Regulations (40 CFR Part 144, Subpart G)	Applicable	These regulations forbid injections of fluids that allow movement of contaminants into certain potential drinking water aquifers, if the presence of these contaminants may cause a violation of certain drinking water standards and health-based standards, or may otherwise adversely affect the health of persons.	The selected remedy will comply with this ARAR. The aquifer already contains contaminants. Injections are expected to help eliminate rather than cause a violation of primary drinking water standards (MCLs), and byproducts are expected to be innocuous. Injection wells will be installed, operated and monitored consistent with the substantive requirements of this rule.
Resource Conservation and Recovery Act – Groundwater Monitoring Requirements (40 CFR part 264, subpart F)	Relevant and appropriate	Sets requirements for groundwater monitoring at facilities that treat, store or dispose of hazardous waste.	The selected remedy will comply with this ARAR. A groundwater monitoring plan consistent with these rules will be developed to ensure cleanup standards are met.
Final OSWER Monitored Natural Attenuation Policy (OSWER Dir.9200.4-17P) (4/99)	To Be Considered	Provides guidance on how EPA will implement policies on monitored natural attenuation.	This policy will be considered when designing and implementing MNA.
State Regulatory Requirements			
RI Underground Injection Control Program Rules and Regulations	Applicable	These rules forbid operation of injection wells that pollute or endanger groundwater quality. See Rule 5.03.	The selected remedy will comply with this ARAR. The injection of oxidants will improve rather than pollute or endanger groundwater quality. Injection wells will be installed, operated and monitored consistent with any substantive requirements of these rules.
RI Rules and Regulations for Groundwater Quality	Relevant and Appropriate	These rules prescribe design requirements for construction of monitoring wells, how monitoring shall be undertaken, and how wells shall be abandoned once monitoring is complete. See Rules 5.5 and 12 and Appendix 1.	The selected remedy will comply with this ARAR. A groundwater monitoring plan consistent with the substantive requirements of these rules will be developed to ensure cleanup standards are met. Monitoring wells will be installed and abandoned pursuant to the substantive requirements of these rules.

Table 3
Identification of Action-Specific ARARs
West Kingston Town/URI Disposal Area Superfund Site – Record of Decision

Soil/Sediments			
State Regulatory Requirements			
RI Rules and Regulations for Hazardous Waste Management; R.I. Gen L. 23-18.9-5; R.I. Gen. L. 23-19.1-18	Applicable	These rules apply to generators and transporters of hazardous wastes. The statutes require disposal of solid waste and hazardous waste at licensed facilities.	The selected remedy will comply with this ARAR. All cuttings generated from construction of injection wells will be tested for hazardous characteristics and shipped off-site to the appropriate licensed facility, as necessary. Other excavations (e.g., construction of chemical feed system, soil removed preparatory to in-situ oxidation of contaminated soil) are expected to involve clean soil and will be regraded on site.
Surface Water			
Federal Regulatory Requirements			
Clean Water Act Ambient Water Quality Criteria (AWQC) (33 U.S.C. § 1251 *et seq.* and www.epa.gov/waterscience/criteria/ wqcriteria.html#C)	Relevant and Appropriate	CWA AWQCs are health- and ecological-based criteria developed for carcinogenic and non-carcinogenic compounds and water quality parameters. Health-based AWQC are set at levels protective of human health for two routes of exposure: (1) drinking water and consuming aquatic organisms; and (2) only consuming fish. Aquatic criteria are protective of aquatic life.	URI Pond will be monitored and AWQCs will be used as a means of measuring the performance of the groundwater remediation.
State Regulatory Requirements			
RI Water Quality Regulations	Relevant and Appropriate	These rules set ambient water quality criteria (AWQCs) applicable to surface waters in Rhode Island. These AWQCs may include numeric limits for chronic exposures to aquatic life, acute exposures to aquatic life, human consumption of water and aquatic organisms, and human consumption of aquatic organisms only. See Rule 8 They also forbid activities or discharges that would cause a violation of these criteria. See Rule 9.	Samples from URI Pond indicated an exceedance of the RI AWQC related to chronic PCE exposure to aquatic life. Although this exceedance does not pose an unacceptable risk at the Site, the Pond will be monitored and this AWQC will be used as a means of measuring the performance of the groundwater remediation. It is expected that the AWQC exceedance will be eliminated as the groundwater becomes cleaner.
Air			
Federal Regulatory Requirements			
Threshold Limit Values (TLVs)	To Be Considered	These are guidelines established by the American Conference of Governmental Industrial Hygienists.	TLVs may be used for assessing site inhalation risks for site remediation workers during construction activities conducted

Table 3
Identification of Action-Specific ARARs
West Kingston Town/URI Disposal Area Superfund Site – Record of Decision

		They estimate concentrations of particulate matter that may be safely inhaled by workers on a daily basis.	under this alternative.
State Regulatory Requirements			
RI Air Pollution Control Regulation No. 5 - Fugitive Dust	Applicable	Requires reasonable precautions to prevent airborne particulate matter from traveling beyond the property boundary line.	The selected remedy will comply with this ARAR. Invasive or construction activities with the potential for generating significant dust will be performed in accordance with these rules. Dust suppression measures will be used during excavation, backfilling, and well installation activities, as necessary.

APPENDIX C

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT LETTER OF CONCURRENCE

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
235 Promenade Street, Providence, RI 02908-5767 TDD 401-222-4462

26 September 2006

Ms. Susan Studlien, Director
U.S. EPA – New England Region
Office of Site Remediation and Restoration
One Congress Street
Suite 1100 (HBO)
Boston, MA 02114-2023

RE: Record of Decision for West Kingston Town Dump/University of Rhode Island Disposal Area Superfund Site, South Kingstown, RI

Dear Ms. Studlien:

The Department of Environmental Management (Department) has completed its review of the Record of Decision (ROD) for the West Kingston Town Dump/University of Rhode Island Disposal Area Superfund Site located in South Kingstown, RI. The U.S. Environmental Protection Agency's (EPA's) selected alternative for the Site, as presented in the ROD, is an in-situ chemical oxidation treatment of the source area soils and groundwater with monitored natural attenuation of downgradient groundwater to achieve restoration of the groundwater aquifer to drinking water standards.

The Department has worked on this Site with your Agency from the early investigatory stages up through this current decision milestone. Based upon this Department's review of this ROD and the results of the remedial investigation activities conducted to date, we offer our concurrence on the decision.

The Department wishes to emphasize the following aspects of the ROD:

- Three landfill areas have been capped under RIDEM oversight pursuant to state law. Although these caps are separate from the selected remedy, the selected remedy assumes that these caps will mitigate any future leaching of contaminants into the groundwater from the landfill areas. It is this Department's understanding that these three RCRA cover systems will be inspected and maintained by the Responsible Parties as part of the state regulated landfill closure, which includes institutional controls that will be used to protect the landfill caps from being disturbed;

- It is this Department's understanding that the Responsible Parties will implement deed restrictions on groundwater use and land development within the plume boundary on both property owned by the Town of South Kingstown and the University of Rhode Island and land not currently under their control. If the deed restrictions are not adopted or are subsequently repealed or amended, the permanency of the remedy may be compromised and it is the responsibility of the Responsible Parties to implement additional institutional controls or other applicable response actions;

- The Responsible Parties will initiate and maintain a long-term monitoring program of sampling and analysis of groundwater and surface water at the Site;

- EPA will conduct five-year reviews to ensure that the remedial actions for the Site continue to provide adequate protection of human health and the environment;

- It is this Department's understanding that the University of Rhode Island will continue to provide municipal water to the four residences along Plains Road. This will ensure that these four residences do not need to install a private well for potable water use in the future.

Thank you for providing us with an opportunity to review and concur with this important ROD.

Sincerely,

W. Michael Sullivan
Director

cc: Terrence Gray, RIDEM
Leo Hellested, RIDEM
Matthew DeStefano, RIDEM
Gary Jablonski, RIDEM
Michael Jasinski, USEPA
Anna Krasko, USEPA

ROD RIDEM Conc ltr

APPENDIX D

GLOSSARY OF TERMS AND ACRONYMS

Appendix D – Glossary of Terms and Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COCs	Chemicals of Concern
COPCs	Chemicals of Potential Concern
CSF	Cancer Slope Factor
CSGWPP	Comprehensive State Groundwater Protection Program
CSM	conceptual site model
CT	Central Tendency
DCA	dichloroethane
DCE	dichloroethylene
EPA	United States Environmental Protection Agency
EPCs	Exposure Point Concentrations
FS	Feasibility Study
ft	feet
GAC	granular activated carbon
HA	Health Advisory
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
L/day	liters per day
LOAEL	Lowest Observed Adverse Effect Level
MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	monitored natural attenuation
msl	mean sea level
MTBE	methyl-tertiary butyl ether
MW	monitoring well

NA	not applicable
NAPL	non-aqueous phase liquid
NCP	National Contingency Plan
NOAEL	no observable adverse effect level
NPL	National Priorities List
O&M	operation and maintenance
PAH	poly aromatic hydrocarbon
PCB	polychlorinated biphenyls
PCE	tetrachloroethene
PQL	practical quantitation limit
PRB	permeable reactive barrier
PRP	potentially responsible party
RAIS	Oak Ridge National Laboratory Risk Assessment Information System
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
RIDOH	Rhode Island Department of Health
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SLERA	screening-level ecological risk assessment
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SW	surface water
TAL	target analyte list
TBC	To Be Considered
TCA	trichloroethane
TCE	trichloroethene
UCL	Upper Confidence Limit
ug/kg	micrograms per kilogram
ug/L	micrograms per liter

ug/m^3	micrograms per cubic meter
URs	unit risk values
URI	University of Rhode Island
USGS	United States Geological Survey
VOCs	volatile organic compounds
WK/URI	West Kingston Town Dump/University of Rhode Island Disposal Area

APPENDIX E

ADMINISTRATIVE RECORD INDEX

03: REMEDIAL INVESTIGATION (RI)

244273 **REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) WORK PLAN, HEALTH AND SAFETY PLAN FOR THE REMEDIAL INVESTIGATION (RI), AND REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) QUALITY ASSURANCE PROJECT PLAN (QAPP)**

Author: WOODARD & CURRAN
Doc Date: 08/01/2002 **# of Pages:** 1338
Addressee:
File Break: 03.07
Doc Type: WORK PLAN

244269 **LONG-TERM MONITORING WELL NETWORK WORK PLAN**

Author: WOODWARD & CURRAN
Doc Date: 07/01/2004 **# of Pages:** 122
Addressee:
File Break: 03.07
Doc Type: WORK PLAN

251606 **VERTICAL PROFILING AND MONITORING WELL INSTALLATION REPORT**

Author: WOODARD & CURRAN
Doc Date: 05/15/2005 **# of Pages:** 408
Addressee:
File Break: 03.04
Doc Type: REPORT

244268 **PHASE 1B SCOPE OF WORK (SOW)**

Author: WOODWARD & CURRAN
Doc Date: 06/15/2005 **# of Pages:** 134
Addressee:
File Break: 03.03
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

244270 **RISK ASSESSMENT SCOPE OF WORK (SOW)**

Author: WOODWARD & CURRAN
Addressee:
Doc Type: REPORT

Doc Date: 07/21/2005 **# of Pages:** 92
File Break: 03.03

244299 **REMEDIAL INVESTIGATION (RI) REPORT - VOLUME 2 OF 2, APPENDICES**

Author: WOODARD & CURRAN
Addressee:
Doc Type: REPORT

Doc Date: 02/01/2006 **# of Pages:** 436
File Break: 03.06

244298 **REMEDIAL INVESTIGATION (RI) REPORT - VOLUME 1 OF 2**

Author: WOODARD & CURRAN
Addressee:
Doc Type: REPORT

Doc Date: 04/12/2006 **# of Pages:** 288
File Break: 03.06

04: FEASIBILITY STUDY (FS)

252926 **PROPOSED PLAN**

Author: US EPA REGION 1
Addressee:
Doc Date: 06/01/2006 **# of Pages:** 17
File Break: 04.09
Doc Type: FACT SHEET

252925 **FEASIBILITY STUDY (FS) REPORT**

Author: WOODARD & CURRAN
Addressee:
Doc Date: 06/16/2006 **# of Pages:** 252
File Break: 04.06
Doc Type: REPORT

05: RECORD OF DECISION (ROD)

252338 **COMMENTS ON FINAL REMEDIAL INVESTIGATION (RI) REPORT**

Author: EUGENIA MARKS AUDUBON SOCIETY OF RHODE ISLAND
Addressee: GARY JABLONSKI RI DEPT OF ENVIRONMENTAL MANAGEMENT
ANNA KRASKO US EPA REGION 1
Doc Date: 07/14/2006 **# of Pages:** 4
File Break: 05.03
Doc Type: LETTER

09: STATE COORDINATION

244283 **INITIATION OF INTERGOVERNMENTAL REVIEW**

Author: LARRY BRILL US EPA REGION 1
Addressee: DANIEL VARIAN RI DOA
Doc Type: LETTER
Doc Date: 06/26/2000 **# of Pages:** 4
File Break: 09.01

244266 **ENFORCEMENT AGREEMENT BETWEEN RI DEM AND THE US EPA NEW ENGLAND REGION**

Author: PATRICIA L MEANEY US EPA REGION 1
Addressee: JAN H REITSMA RI DEPT OF ENVIRONMENTAL MANAGEMENT
Doc Type: FORM
Doc Date: 08/13/2001 **# of Pages:** 10
File Break: 09.02

244285 **LETTERS OF RESPONSIBILITY**

Author: MATTHEW D DESTEFANO RI DEPT OF ENVIRONMENTAL MANAGEMENT
Addressee:
Doc Type: LETTER
Doc Date: 10/23/2001 **# of Pages:** 46
File Break: 09.01

10: ENFORCEMENT/NEGOTIATION

244280 **LIEN NOTICES MAILED TO ALICE TIBBETS**

Author: ALICE TIBBET
Addressee:
Doc Type: LETTER

Doc Date: 09/11/2000 **# of Pages:** 8
File Break: 10.01

11: POTENTIALLY RESPONSIBLE PARTY

244281 **FOUR GENERAL NOTICE LETTERS FOR JUNE 26 2000**

Author: EPA REGION 1
Addressee: STEPHEN A ALFRED SOUTH KINGSTOWN (RI) TOWN OF
ROBERT CAROTHERS
MAURICE J LOONTJENS NARRAGANSETT (RI) TOWN OF
ALICE TIBBETTS
Doc Type: LETTER

Doc Date: 06/19/2000 **# of Pages:** 24
File Break: 11.09

13: COMMUNITY RELATIONS

244267 **EPA WARNS SK OF LIABILITY FOR DUMP CLEANUP**

Author: CHRISTINE SMITH NARRAGANSETT TIMES
Addressee:
Doc Type: NEWS CLIPPING

Doc Date: 01/01/0001 **# of Pages:** 2
File Break: 13.03

13: COMMUNITY RELATIONS

253500 **WORK TO BEGIN AT LANDFILL SITE, TOWNS, URI, OWNER SHARE SUPERFUND RESPONSIBILITY**

Author: IAN MCNULTY SOUTH COUNTY INDEPENDENT **Doc Date:** 01/22/1998 **# of Pages:** 1
Addressee: **File Break:** 13.03
Doc Type: NEWS CLIPPING

253502 **DEM SEEKS ACCELERATED SUPERFUND SITE CLEANUP**

Author: JAMES MURDOCK NARRAGANSETT TIMES **Doc Date:** 07/08/1998 **# of Pages:** 1
Addressee: **File Break:** 13.03
Doc Type: NEWS CLIPPING

244284 **GROUPS AGREE TO CLEAN UP SUPERFUND SITE**

Author: JAMES MURDOCK NARRAGANSETT TIMES **Doc Date:** 07/29/1998 **# of Pages:** 1
Addressee: **File Break:** 13.03
Doc Type: NEWS CLIPPING

253501 **CHAFFEE VISITS URI SUPERFUND SITE**

Author: KATIE HAUGHEY GOOD 5c CIGAR, THE **Doc Date:** 02/08/2000 **# of Pages:** 1
Addressee: **File Break:** 13.03
Doc Type: NEWS CLIPPING

13: COMMUNITY RELATIONS

244279 **DEM PARTNERS TO HOLD PUBLIC MEETING ON DECEMBER 7 TO PRESENT REMEDIAL DESIGN FOR FORMER WEST KINGSTON TOWN DUMP/URI DISPOSAL AREA IN SOUTH KINGSTON**

Author: GARY JABLONSKI RI DEPT OF ENVIRONMENTAL MANAGEMENT
Doc Date: 11/29/2004 **# of Pages:** 8
Addressee: ANNA KRASKO US EPA REGION 1
File Break: 13.03
Doc Type: PRESS RELEASE

244278 **DEM TO PRESENT PLAN FOR SUPERFUND SITE**

Author:
Doc Date: 12/03/2004 **# of Pages:** 1
Addressee:
File Break: 13.03
Doc Type: NEWS CLIPPING

244276 **PUBLIC MEETING, OCTOBER 26 2005, SUPERFUND LANDFILL CLOSURE PROJECT IMPLEMENTATION OF REMEDIAL DESIGN**

Author: WOODARD & CURRAN
Doc Date: 10/26/2005 **# of Pages:** 2
Addressee:
File Break: 13.05
Doc Type: PUBLIC MEETING RECORD

244277 **DEM, PARTNERS TO HOLD OPEN HOUSE ON OCTOBER 26 TO ANSWER QUESTIONS IN REGARDS TO THE RA FOR FORMER WEST KINGSTON TOWN DUMP/URI DISPOSAL AREA IN SOUTH KINGSTON**

Author:
Doc Date: 10/26/2005 **# of Pages:** 1
Addressee:
File Break: 13.03
Doc Type: PRESS RELEASE

13: COMMUNITY RELATIONS

252387 **ENVIRONMENT: CLEANING UP POLLUTION, WHEY DOWN DEEP**

Author: SCIENCE NEWS
Addressee:
Doc Type: NEWS CLIPPING

Doc Date: 06/17/2006 **# of Pages:** 1
File Break: 13.03

252342 **THE RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT AND UNITED STATES ENVIRONMENTAL PROTECTION AGENCY ANNOUNCE A PLAN FOR THE WEST KINGSTON / URI DISPOSAL AREA SUPERFUND SITE (PUBLISHED IN THE NARRAGANSETT TIMES)**

Author: RI DEPT OF ENVIRONMENTAL MANAGEMENT
Addressee:
Doc Type: PRESS RELEASE

Doc Date: 06/21/2006 **# of Pages:** 1
File Break: 13.03

252339 **TOXIC GAS PLUME SPREADING FROM KINGSTON DUMP SITE**

Author: MARK SCHIELDRO SOUTH COUNTY INDEPENDENT
Addressee:
Doc Type: NEWS CLIPPING

Doc Date: 07/10/2006 **# of Pages:** 2
File Break: 13.03

252384 **HEARING IN RE: WEST KINGSTON SUPERFUND SITE**

Author: RI DEPT OF ENVIRONMENTAL MANAGEMENT
Addressee:
Doc Type: PUBLIC MEETING RECORD

Doc Date: 07/26/2006 **# of Pages:** 7
File Break: 13.04

13: COMMUNITY RELATIONS

252386 **EPA URGED TO RECONSIDER CANCER RISKS OF CONTAINMENT**

Author: JOHN HEILPRIN ASSOCIATED PRESS
Addressee: PROVIDENCE JOURNAL
Doc Type: NEWS CLIPPING
Doc Date: 07/28/2006 **# of Pages:** 1
File Break: 13.03

252385 **TRANSMITTAL OF TWO NEWS CLIPPINGS**

Author: EUGENIA MARKS AUDUBON SOCIETY OF RHODE ISLAND
Addressee: ANNA KRASKO US EPA REGION 1
Doc Type: LETTER
Doc Date: 08/22/2006 **# of Pages:** 1
File Break: 13.01

16: NATURAL RESOURCE TRUSTEE

244282 **TRUSTEE NOTIFICATION FORM AND LETTER**

Author: LARRY BRILL
Addressee: KENNETH FINKELSTEIN US NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
ANDREW RUDDANT US DEPT OF INTERIOR
Doc Type: FORM
Doc Type: LETTER
Doc Date: 06/26/2000 **# of Pages:** 5
File Break: 16.04

16: NATURAL RESOURCE TRUSTEE

252341 **COMMENTS ON REMEDIAL INVESTIGATION (RI) REPORT**

Author: KENNETH MUNNEY US DOI/US FISH & WILDLIFE SERVICE
Doc Date: 05/09/2006 **# of Pages:** 4
Addressee: ANNA KRASKO US EPA REGION 1
File Break: 16.01
Doc Type: LETTER

252340 **RESPONSE TO COMMENTS ON DRAFT REMEDIAL INVESTIGATION (RI) REPORT**

Author: ANNA KRASKO US EPA REGION 1
Doc Date: 07/05/2006 **# of Pages:** 36
Addressee: KENNETH MUNNEY US DOI/US FISH & WILDLIFE SERVICE
File Break: 16.01
Doc Type: LETTER

17: SITE MANAGEMENT RECORDS

244274 **PRESUMPTIVE REMEDY - REMEDIAL DESIGN (RD) LANDFILL CLOSURE PROJECT, 16 OVERSIZED FIGURES**

Author: WOODARD & CURRAN
Doc Date: 02/01/2005 **# of Pages:** 17
Addressee:
File Break: 17.08
Doc Type: MAP

17: SITE MANAGEMENT RECORDS

244286 **100% FINAL DESIGN SUBMISSION VOLUME 1 OF 2**

Author: WOODARD & CURRAN
Addressee:
Doc Type: REPORT

Doc Date: 02/01/2005 **# of Pages:** 1079
File Break: 17.08

244287 **100% FINAL DESIGN SUBMISSION VOLUME 2 OF 2**

Author: WOODARD & CURRAN
Addressee:
Doc Type: REPORT

Doc Date: 02/01/2005 **# of Pages:** 1008
File Break: 17.08

244271 **DESIGN MODIFICATION M-03**

Author: RONALD ST MICHEL WOODARD & CURRAN
Addressee: GARY JABLONSKI RI DEPT OF ENVIRONMENTAL MANAGEMENT
Doc Type: MEMO

Doc Date: 11/18/2005 **# of Pages:** 22
File Break: 17.08

17: SITE MANAGEMENT RECORDS

244297 DESIGN MODIFICATION M-04

Author: ALAN BENEVIDES WOODWARD & CURRAN
Addressee: GARY JABLONSKI RI DEPT OF ENVIRONMENTAL MANAGEMENT
Doc Type: MEMO

Doc Date: 04/28/2006 **# of Pages:** 3
File Break: 17.08

Number of Documents in Collection38

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
INTERIM FINAL GUIDANCE FOR CONDUCTING REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES UNDER CERCLA.

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/1/1988	OSWER #9355.3-01	2002

TITLE
GETTING READY - SCOPING THE RI/FS [QUICK REFERENCE FACT SHEET]

DOCDATE	OSWER/EPA ID	DOCNUMBER
11/1/1989	OSWER #9355.3-01FS1	2013

TITLE
FEASIBILITY STUDY - DEVELOPMENT AND SCREENING OF REMEDIAL ACTION ALTERNATIVES [QUICK REFERENCE FACT SHEET]

DOCDATE	OSWER/EPA ID	DOCNUMBER
11/1/1989	OSWER #9355.3-01FS3	2018

TITLE
FEASIBILITY STUDY: DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES [QUICK REFERENCE FACT SHEET]

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/1/1990	OSWER #9355.3-01FS4	2019

TITLE
GUIDELINES AND SPECIFICATIONS FOR PREPARING QUALITY ASSURANCE PROGRAM DOCUMENTATION

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/1987		2112

TITLE
LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING INORGANICS ANALYSES (DRAFT)

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1988		2113

TITLE
LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING ORGANICS ANALYSES (DRAFT)

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/1/1988		2114

TITLE
PRACTICAL GUIDE FOR GROUND-WATER SAMPLING

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/1985	EPA/600/2-85/104	2115

TITLE
SEDIMENT SAMPLING QUALITY ASSURANCE USER'S GUIDE

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1985	EPA/600/4-85/048	2116

TITLE
TEST METHODS FOR EVALUATING SOLID WASTE, LABORATORY MANUAL PHYSICAL/CHEMICAL METHODS, THIRD EDITION (VOLUMES IA, IB, IC, AND II)

DOCDATE	OSWER/EPA ID	DOCNUMBER
11/1/1986		2118

TITLE
TECHNOLOGY SCREENING GUIDE FOR TREATMENT OF CERCLA SOILS AND SLUDGES

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/1988	EPA 540/2-88/004	2319

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
TREATMENT TECHNOLOGY BRIEFS: ALTERNATIVES TO HAZARDOUS WASTE LANDFILLS

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1986	EPA/600/8-86/017	2320

TITLE
ADVANCING THE USE OF TREATMENT TECHNOLOGIES FOR SUPERFUND REMEDIES

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/21/1989	OSWER #9355.0-26	2321

TITLE
GUIDE TO TREATMENT TECHNOLOGIES FOR HAZARDOUS WASTES AT SUPERFUND SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/1/1989	EPA/540/2-89/052	2322

TITLE
GUIDE ON REMEDIAL ACTIONS FOR CONTAMINATED GROUND WATER [QUICK REFERENCE FACT SHEET]

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/1/1989	OSWER #9283.1-2FS	2409

TITLE
CONSIDERATIONS IN GROUND WATER REMEDIATION AT SUPERFUND SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/18/1989	OSWER #9355.4-03	2410

TITLE
GUIDANCE ON REMEDIAL ACTIONS FOR CONTAMINATED GROUND WATER AT SUPERFUND SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1988	OSWER #9283.1-2	2413

TITLE
CERCLA COMPLIANCE WITH OTHER ENVIRONMENTAL STATUTES

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/2/1985	OSWER #9234.0-2	3001

TITLE
CERCLA COMPLIANCE WITH OTHER LAWS MANUAL (DRAFT)

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/8/1988	OSWER #9234.1-01	3002

TITLE
EPA'S IMPLEMENTATION OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/21/1987		3003

TITLE
ARARs Q'S & A'S [QUICK REFERENCE FACT SHEET]

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/1/1989	OSWER #9234.2-01FS	3006

TITLE
CERCLA COMPLIANCE WITH OTHER LAWS MANUAL - CERCLA COMPLIANCE WITH STATE REQUIREMENTS [QUICK REFERENCE FACT SHEET]

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1989	OSWER #9234.2-05FS	3009

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
CERCLA COMPLIANCE WITH OTHER LAWS MANUAL - CERCLA COMPLIANCE WITH THE CWA AND SDWA [QUICK REFERENCE FACT SHEET]

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/1/1990	OSWER #9234.2-06FS	3010

TITLE
CERCLA COMPLIANCE WITH OTHER LAWS MANUAL - OVERVIEW OF ARARs - FOCUS ON ARAR WAIVERS [QUICK REFERENCE FACT SHEET]

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1989	OSWER #9234.2-03FS	3011

TITLE
CERCLA COMPLIANCE WITH OTHER LAWS MANUAL - SUMMARY OF PART II - CAA, TSCA, AND OTHER STATUTES [QUICK REFERENCE FACT SHEET]

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/1/1990	OSWER #9234.2-07FS	3012

TITLE
CERCLA COMPLIANCE WITH OTHER LAWS MANUAL PART II: CLEAN AIR ACT AND OTHER ENVIRONMENTAL STATUTES AND STATE REQUIREMENTS

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/1/1989	OSWER #9234.1-02	3013

TITLE
GUIDELINES FOR CARCINOGEN RISK ASSESSMENT (FEDERAL REGISTER, SEPTEMBER 24, 1986, p. 33992)

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/24/1986		5003

TITLE
GUIDELINES FOR EXPOSURE ASSESSMENT (FEDERAL REGISTER, SEPTEMBER 24, 1986, p. 34042)

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/24/1986		5004

TITLE
GUIDELINES FOR HEALTH ASSESSMENT OF SUSPECT DEVELOPMENTAL TOXICANTS (FEDERAL REGISTER, SEPTEMBER 24, 1986, p. 34028)

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/24/1986		5005

TITLE
GUIDELINES FOR MUTAGENICITY RISK ASSESSMENT (FEDERAL REGISTER, SEPTEMBER, 24, p. 34006)

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/24/1986		5006

TITLE
GUIDELINES FOR THE HEALTH RISK ASSESSMENT OF CHEMICAL MIXTURES (FEDERAL REGISTER, SEPTEMBER 24, 1986, p. 34014)

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/24/1986		5007

TITLE
INTEGRATED RISK INFORMATION SYSTEM (IRIS) [A COMPUTER-BASED HEALTH RISK INFORMATION SYSTEM AVAILABLE THROUGH E-MAIL--BROCHURE ON ACCESS IS INCLUDED]

DOCDATE	OSWER/EPA ID	DOCNUMBER
		5009

TITLE
SUPERFUND EXPOSURE ASSESSMENT MANUAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/1/1988	OSWER #9285.5-1	5013

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
SUPERFUND PUBLIC HEALTH EVALUATION MANUAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/1/1986	OSWER #9285.4-1	5014

TITLE
TOXICOLOGY HANDBOOK

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/1/1985	OSWER #9850.2	5015

TITLE
EXPOSURE FACTORS HANDBOOK

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1989	EPA/600/8-89/043	5020

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME I, HUMAN HEALTH EVALUATION MANUAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/29/1989	OSWER #9285.7-01a	5023

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME II, ENVIRONMENTAL EVALUATION MANUAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/1/1989	EPA/540/1-89/001	5024

TITLE
REMEDIAL INVESTIGATION - SITE CHARACTERIZATION AND TREATABILITY STUDIES [QUICK REFERENCE FACT SHEET]

DOCDATE	OSWER/EPA ID	DOCNUMBER
11/1/1989	OSWER #9355.3-01FS2	5025

TITLE
COMMUNITY RELATIONS IN SUPERFUND: A HANDBOOK (INTERIM VERSION). INCLUDES CHAPTER 6, DATED 11/03/88.

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/1988	OSWER #9230.0-03B	7000

TITLE
INTERIM GUIDANCE ON SUPERFUND SELECTION OF REMEDY

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/24/1986	OSWER #9355.0-19	9000

TITLE
GUIDE TO SELECTING SUPERFUND REMEDIAL ACTIONS

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/1/1990	OSWER #9355.0-27FS	9002

TITLE
COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980. AMENDED BY PL 99-499, 10/17/86.

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/17/1986		C018

TITLE
GUIDANCE ON FEASIBILITY STUDIES UNDER CERCLA.

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/1985	EPA 540/G-85-003	C034

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
GUIDANCE ON REMEDIAL INVESTIGATIONS UNDER CERCLA.

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/1985	EPA 540/G-85/002	C035

TITLE
INTERIM GUIDANCE ON COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS.

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/9/1987	OSWER 9234.0-05	C055

TITLE
NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN.

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1992	OSWER 9200.2-14	C063

TITLE
INTERIM FINAL GUIDANCE ON SOIL INGESTION RATES.

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/9/1989	OSWER 9850.4	C099

TITLE
SUPPLEMENTAL RISK ASSESSMENT GUIDANCE FOR THE SUPERFUND PROGRAM. DRAFT FINAL.

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/1989	EPA 901/5-89-001	C104

TITLE
PUBLIC INVOLVEMENT IN THE SUPERFUND PROGRAM. FALL 1987.

DOCDATE	OSWER/EPA ID	DOCNUMBER
	WH/FS-87-004R	C113

TITLE
ARARS Q'S & A'S. GENERAL POLICY: RCRA, CWA & SDWA. SUPERFUND FACT SHEET. DUPLICATE OF 3006.

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/1/1989	OSWER 9234.2-01/FS-A	C122

TITLE
PRESUMPTIVE REMEDIES: POLICY AND PROCEDURES.

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/1993	OSWER 9355.0-47FS	C143

TITLE
REQUIREMENTS FOR HAZARDOUS WASTE LANDFILL DESIGN, CONSTRUCTION, AND CLOSURE.

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/1/1989	EPA 625/4-89/022	C171

TITLE
FINAL COVERS ON HAZARDOUS WASTE LANDFILLS AND SURFACE IMPOUNDMENTS. TECHNICAL GUIDANCE DOCUMENT.

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1989	EPA 530-SW-89-047	C172

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND. VOLUME I. HUMAN HEALTH EVALUATION MANUAL (PART A). INTERIM FINAL.

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1989	EPA 540/1-89/002	C174

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
STREAMLINING THE RI/FS FOR CERCLA MUNICIPAL LANDFILL SITES.

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/1990	OSWER 9355.3-11FS	C176

TITLE
CONDUCTING REMEDIAL INVESTIGATIONS/FEASIBILITY STUDIES FOR CERCLA MUNICIPAL LANDFILL SITES.

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/1/1991	OSWER 9355.3-11	C177

TITLE
DRAFT GUIDANCE ON CERCLA COMPLIANCE WITH OTHER LAWS MANUAL.

DOCDATE	OSWER/EPA ID	DOCNUMBER
11/25/1987	OSWER 9234.1-01	C178

TITLE
GUIDANCE ON PREPARING SUPERFUND DECISION DOCUMENTS: THE PROPOSED PLAN, THE RECORD OF DECISION, E.S.D.'S, R.O.D. AMENDMENT. INTERIM FINAL.

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1989	OSWER 9355.3-02	C179

TITLE
NATIONAL PRIMARY AND SECONDARY DRINKING WATER REGULATIONS; PROPOSED RULE. 40 CFR PARTS 141, 142 & 143.

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/22/1989		C211

TITLE
REMEDIAL ACTION AT WASTE DISPOSAL SITES. HANDBOOK.

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/1982	EPA 625/6-82-006	C212

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND. VOL 1. HUMAN HEALTH EVALUATION MANUAL SUPPLEMENTAL GUIDANCE: STANDARD DEFAULT EXPOSURE FACTORS. INTERIM FINAL.

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/25/1991	OSWER 9285.6-03	C219

TITLE
FINAL GUIDELINES FOR EXPOSURE ASSESSMENT. PGS. 22888 - 22938.

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/29/1992	57 FR 22888	C220

TITLE
DERMAL EXPOSURE ASSESSMENT: PRINCIPLES AND APPLICATIONS. INTERIM REPORT.

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1992	EPA 600/8-91/011B	C227

TITLE
ECO UPDATE. ECOLOGICAL SIGNIFICANCE AND SELECTION OF CANDIDATE ASSESSMENT ENDPOINTS. INTERMITTENT BULLETIN VOLUME 3, NUMBER 1

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1996	OSWER 9345.0-11FSI	C268

TITLE
ECO UPDATE. ECOTOX THRESHOLDS. INTERMITTENT BULLETIN VOLUME 3, NUMBER 2

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1996	OSWER 9345.0-12FSI	C269

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
ROLE OF THE BASELINE RISK ASSESSMENT IN SUPERFUND REMEDY SELECTION DECISIONS

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/22/1991	OSWER 9355.0-30	C276

TITLE
FINAL GROUND WATER USE AND VALUE DETERMINATION GUIDANCE

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/4/1996		C278

TITLE
SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986

DOCDATE	OSWER/EPA ID	DOCNUMBER
	PL 99-499	C282

TITLE
LAND USE IN THE CERCLA REMEDY SELECTION PROCESS

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1995	OSWER 9355.7-04	C317

TITLE
EXPOSURE FACTORS HANDBOOK; GENERAL FACTORS, VOLUME I

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/1/1997	EPA 600/P-95/002FA	C356

TITLE
ECOLOGICAL RISK ASSESSMENT GUIDANCE FOR SUPERFUND PROCESS FOR DESIGNING AND CONDUCTING ECOLOGICAL RISK ASSESSMENTS (EPA 540-R-97-006)

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/2/1997		C361

TITLE
FRAMEWORK FOR ECOLOGICAL RISK ASSESSMENT (EPA/630/R-92/001)

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/1/1992	EPA 630/R-92-001	C364

TITLE
TOXICOLOGICAL BENCHMARKS FOR WILDLIFE: 1996 REVISION

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/1996		C368

TITLE
TOXICOLOGICAL BENCHMARKS FOR SCREENING POTENTIAL CONTAMINANTS OF CONCERN FOR EFFECTS ON AQUATIC BIOTA: 1994 REVISION

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1994		C376

TITLE
FRAMEWORK FOR ECOLOGICAL RISK ASSESSMENT AT THE EPA

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1992		C396

TITLE
HEALTH EFFECTS ASSESSMENT SUMMARY TABLES - FY 1997 UPDATE

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1997	EPA 540/R-97-036	C468

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
EXECUTIVE ORDER 11988 - FLOODPLAIN MANAGEMENT

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/24/1977		C471

TITLE
EXECUTIVE ORDER 11990 - PROTECTION OF WETLANDS

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/24/1977		C472

TITLE
COMMUNITY RELATIONS IN SUPERFUND: A HANDBOOK

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1992	EPA 540/R-92/009	C488

TITLE
FEDERAL REGISTER, PART II, 40 CFR PART 300 NATIONAL OIL AND HAZARDOUS SUBSTANCES CONTINGENCY PLAN, FINAL RULE, VOL. 55, NO. 46

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/8/1990	NCP PDF or FR	C496

TITLE
NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTIGENCY PLAN; CODE OF FEDERAL REGULATIONS (TITLE 40, PART 300)

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1998		C503

TITLE
FINAL OSWER DIRECTIVE "USE OF MONITORED NATURAL ATTENUATION AT SUPERFUND, RCRA CORRECTIVE ACTION, AND UNDERGROUND STORAGE TANK SITES"

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/21/1999	OSWER 9200.4-17P	C512

TITLE
NATIONAL PRIMARY DRINKING WATER REGULATIONS: ARSENIC AND CLARIFICATIONS TO COMPLIANCE AND NEW SOURCE CONTAMINANTS MONITORING. (CFR, VOL. 65, NO. 121)

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/22/2000		C519

TITLE
REVISED ALTERNATIVE CAP DESIGN GUIDANCE PROPOSED FOR UNLINED HAZARDOUS WASTE LANDFILLS IN THE EPA REGION I

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/5/2001		C524

TITLE
GUIDE TO PREPARING SUPERFUND PROPOSED PLANS RECORDS OF DECISION AND OTHER REMEDY SELECTION DECISION DOCUMENTS

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1999	OSWER 9200.1-23P	C525

TITLE
INSTITUTIONAL CONTROLS: A SITE MANAGER'S GUIDE TO IDENTIFYING, EVALUATING AND SELECTING INSTITUTIONAL CONTROLS AT SUPERFUND AND RCRA CORRECTIVE ACTION CLEANUPS.

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/2000	OSWER 9355.0-74 FS-P	C531

TITLE
GROUND-WATER SAMPLING GUIDELINES FOR SUPERFUND AND RCRA PROJECT MANAGERS, GROUND WATER FORUM ISSUE PAPER

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/1/2002	EPA 542-S-02-001	C544

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
HANDBOOK, GROUND WATER, VOLUME 1: GROUND WATER AND CONTAMINATION

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/1990	EPA 625/6-90/016A	C559

TITLE
HANDBOOK, GROUND WATER, VOLUME 2: METHODOLOGY

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1991	EPA 625/6-90/016B	C560

TITLE
GUIDANCE FOR MONITORING AT HAZARDOUS WASTE SITES: FRAMEWORK FOR MONITORING PLAN DEVELOPMENT AND IMPLEMENTATION

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/2004	OSWER 9355.4-28	C561

TITLE
ECOLOGICAL RISK ASSESSMENT AND RISK MANAGEMENT PRINCIPLES FOR SUPERFUND SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/7/1999	OSWER 9285.7-28 P	C563

TITLE
ROLE OF THE ECOLOGICAL RISK ASSESSMENT IN THE BASELINE RISK ASSESSMENT

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/12/1994	OSWER 9285.7-17	C564

TITLE
STRATEGY TO ENSURE INSTITUTIONAL CONTROL IMPLEMENTATION AT SUPERFUND SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/2004	OSWER NO. 9355.0-106	C575

TITLE
FINAL GUIDANCE ON ADMINISTRATIVE RECORDS FOR SELECTING CERCLA RESPONSE ACTIONS

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/1/1989	OSWER NO. 9833.3A-1	C576

TITLE
SOIL SCREENING GUIDANCE: USER'S GUIDE

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1996	OSWER NO. 9355.4-23	C577

TITLE
A GUIDE TO DEVELOPING AND DOCUMENTING COST ESTIMATES DURING THE FEASIBILITY STUDY

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/2000	OSWER 9355.0-75	C582

TITLE
REGION I, EPA-NE DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING ENVIRONMENTAL ANALYSES

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1996		C584

TITLE
DRINKING WATER STANDARS

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/2003		C586

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
SUPPLEMENTAL GUIDANCE TO RAGS: CALCULATIING THE CONCENTRATION TERM

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/1/1992		C587

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND VOLUME I: HUMAN HEALTH EVALUATION MANUAL PART D. STANDARDIZED PLANNING, REPORTING, AND REVIEW OF SUPERFUND RISK ASSESSMENTS. FINAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/2001		C593

TITLE
PRELIMINARY REMEDIATION GOALS TABLE REGION 9 TECHNICAL SUPPORT TEAM

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/1/2002		C594

TITLE
RISK-BASED CONCENTRATION TABLE REGION III TECHNICAL GUIDANCE MANUAL RISK ASSESSMENT

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/14/2004		C600

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND VOLUME I: HUMAN HEALTH EVALUATION MANUAL (PART E SUPPLEMENTAL GUIDANCE FOR DERMAL RISK ASSESSMENT) FINAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/2004		C602

TITLE
GUIDELINES FOR ECOLOGICAL RISK ASSESSMENT

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/1/1998		C614

TITLE
A GUIDE TO PRINCIPLE THREAT AND LOW LEVEL THREAT WASTES

DOCDATE	OSWER/EPA ID	DOCNUMBER
11/1/1991	9380.3-06FS	C622