SUPERFUND

PROPOSED PLAN

Landfill & Resource Recovery Superfund Site North Smithfield, RI

U.S. EPA | HAZARDOUS WASTE PROGRAM AT EPA NEW ENGLAND

THE SUPERFUND PROGRAM protects human health and the environment by locating, investigating, and cleaning up abandoned hazardous waste sites and engaging communities throughout the process. Many of these sites are complex and need long-term cleanup actions. Those responsible for contamination are held liable for cleanup costs. EPA strives to return previously contaminated land and ground-water to productive use.

YOUR OPINION COUNTS: OPPORTUNITIES TO COMMENT ON THE PLAN

The U.S. Environmental Protection Agency (EPA) will be accepting public comments on this proposed cleanup plan from July 29, 2020 through August 28, 2020. EPA is seeking input on all the alternatives and the rationale for the preferred alternative. Additionally, new information or arguments the lead agency learns during the public comment period could result in the selection of a final remedial action that differs from the preferred alternative. You do not have to be a technical expert to comment. If you have a concern, suggestion, or preference regarding this Proposed Plan, EPA wants to hear from you before making a final decision on how to protect your community. Comments can be sent by mail, email, or fax. People also can offer oral comments at the virtual formal public hearing or by using the dedicated voicemail box at (617) 918-1910.

continued on next page >

HOW TO PARTICIPATE

A virtual public meeting will be held prior to the public hearing to further explain the cleanup plan. Representatives from EPA will be available to answer questions.

INFORMATIONAL MEETING FOLLOWED BY A HEARING

WEDNESDAY • AUG 12, 2020 BEGINNING AT 7 P.M.

Go to **www.epa.gov/superfund/lrr** Click on the "Join EPA Skype meeting" or

You may also join by phone: 1-857-299-6148 PIN: 616539680#

Copies of EPA's presentation and Proposed Plan may be viewed at: www.epa.gov/superfund/lrr or obtained by contacting Sarah White.

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July 2020

In accordance with Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the law that established the Superfund program, this document summarizes EPA's cleanup proposal. For detailed information on the cleanup options evaluated for use at the Site, see the L&RR Feasibility Study and other documents contained in the site's Administrative Record available for review online at www.epa.gov/superfund/lrr or via computer at the Site information repositories at:

Municipal Annex Building
575 Smithfield Road
North Smithfield, RI 02896

EPA New England Records Center
5 Post Office Sq, First Floor
Boston, MA

(Note: Call in advance; locations may be closed to public at this time)

CLEANUP PROPOSAL SNAPSHOT

The Proposed Plan for the cleanup of groundwater migrating from the landfill at the L&RR Superfund Site generally includes:

- *In situ* (below ground) treatment and sequestration of groundwater contaminants using a two-stage reactive treatment zone;
- Land use restrictions (called "Institutional Controls" or ICs) to prohibit the use of contaminated groundwater until cleanup levels are met and to require evaluation of the vapor intrusion pathway as part of new building construction;
- Contingency implementation of active groundwater extraction and *ex situ* (above ground) treatment, if results from treatability studies indicate that the proposed remedy will not be effective in attaining cleanup levels at the Site;
- Restoration with native vegetation of any wetland habitat altered by the remedial action;
- Long-term groundwater, surface water, and residential well monitoring; and
- Periodic reviews, at a minimum of every five years, to assess the protectiveness of the remedy.

EPA's proposed remedy for the Site is estimated to cost approximately $11.7 million and is estimated to take approximately two to three years to design and implement. Groundwater is estimated to achieve cleanup standards downgradient of the remedy within approximately 20 years, and throughout the Site within approximately 55-119 years. A more detailed description of this proposal is outlined below and in the Feasibility Study Report (FS) dated June 2020.

A CLOSER LOOK AT EPA'S PROPOSED CLEANUP APPROACH

In September 1988, EPA issued a Record of Decision ("ROD") for the first operable unit (Operable Unit 1 or "OU1") of the Site, addressing the closure of the landfill at the Site. This proposed plan is for Operable Unit 2 (OU2), which consists of the groundwater and other environmental media outside the boundary of the waste management area (OU1) associated with the closed landfill. OU1 and OU2 together comprise the L&RR Superfund Site.

The April 2020 L&RR OU2 Remedial Investigation Report summarized the nature and extent of contamination in groundwater migrating from the landfill at the Site and was used to prepare a June 2020 OU2 Feasibility

Study which identified all of the options EPA considered for cleanup. The study evaluated different combinations of cleanup alternatives to restrict access to, contain, remove, and/or treat contamination to protect human health and the environment by preventing unacceptable risk of exposure from site-related contaminants in groundwater.

Based upon the alternatives evaluated in the Feasibility Study, EPA's preferred alternative for the groundwater cleanup is **Alternative 4: Two-Stage Reactive Treatment Zone, Institutional Controls, and Monitoring** (See Figure 4), which consists generally of *in situ* groundwater treatment and sequestration using two technologies together in a two-stage reactive treatment zone to address Site contaminants. The two stages include 1) *in situ* chemical oxidation (ISCO) with potassium persulfate to address chlorinated volatile organic compounds (CVOCs), 1,4-dioxane, and some per- and polyfluoroalkyl substances (PFAS); and 2) sequestration/stabilization with injectable activated carbon (AC) for PFAS that are not susceptible to ISCO. Alternative 4 includes the following components:

Treatability/Pilot Testing: Treatability testing is underway and will be completed to determine the effectiveness of the proposed innovative technologies to treat Site-specific conditions. Treatability testing would also provide information to design the pilot test and the full-scale remedy. Pilot testing would be performed to provide additional information for implementation (such as, injection volumes, radius of influence, field-scale solubility/longevity of the reagents, and the Site-specific method(s) for injection).

Pre-design Investigations: Pre-design investigations would likely include steps to refine the extent of horizontal and vertical impacts in the vicinity of the proposed footprint of the two-stage reactive zone, understand contrasts in overburden permeabilities, and identify target treatment zones.

In-situ Chemical Oxidation (ISCO) Treatment Zone: A preliminary conceptual design of this alternative uses a combination of potassium persulfate and sodium persulfate as the first step to treat the contaminant mass and non-target oxidant demand, respectively. The proposed conceptual design also uses an iron activator to facilitate oxidative processes. The conceptual design includes approximately 100 injection points. Approximately 225,000 pounds of potassium persulfate will be injected during the first year. Additional injections will be completed based on performance monitoring results. The conceptual design conservatively includes three additional injections in the first 10 years, two additional injections in years 10 through 20, and one additional injection in years 20 through 30.

ISCO Injections: In addition to the ISCO treatment zone, the conceptual design includes targeted ISCO injections in areas downgradient of the ISCO treatment zone in areas of elevated 1,4-dioxane concentrations. The targeted areas include MW-303 and MW-302 as shown on Figure 3.

Activated Carbon (AC) Injections: The conceptual design includes a second step consisting of an activated carbon barrier extending approximately 5 to 60 feet below ground surface and 750 feet across. The activated carbon would be injected at approximately 150 locations. Approximately 100,000 pounds of media or 350,000 gallons of slurry would be injected. The barrier is expected to be effective for an extended period of time and it is assumed that it will not need to be replaced in the 30-year period.

Wetland Restoration: *In situ* treatment zones may need to be constructed within a wetland because groundwater impacts extend below the wetlands adjacent to Trout Brook. The remedy will be designed to minimize wetland and floodplain impacts. Wetlands that are disturbed as part of construction will be restored and impacts to any wetlands is expected to be temporary.

Monitoring: Monitoring would include groundwater and surface water monitoring. The conceptual monitoring program includes the current Post Closure Site Monitoring (PCSM) program, monitoring of wells more recently installed as part of OU2 Remedial Investigation activities, and monitoring of new wells intended to enhance the Site-wide network to evaluate if contaminant concentrations are decreasing by natural processes. Surface water monitoring is included in the PCSM and long-term monitoring (LTM) programs. Monitoring of residential drinking water wells is also included in this alternative. Remedy performance monitoring would also include the installation and sampling of additional performance monitoring wells upgradient of the ISCO injections, between the two stages, and downgradient of the AC zone to monitor remedy performance.

Institutional Controls: Institutional Controls (ICs) would be implemented for groundwater use in all areas necessary to prevent exposure. These ICs will include provisions to maintain current use of water consumption, but will limit or prevent expanded, modified, or increased use beyond current demand. ICs may also include a prohibition of certain uses (e.g., future drinking water wells) or require pre-treatment of water (engineering control) prior to use. ICs will also require a vapor intrusion assessment and/or a vapor barrier for new building construction.

Five-Year Reviews: The Site will be reviewed at a minimum of every five years to assess protectiveness of the remedy.

If, after reviewing the treatability study results, pilot test results, or other data collected during the design phase, EPA determines that the proposed alternative will not be effective in attaining cleanup levels identified for the Site and no longer achieves the best balance among EPA's required evaluation criteria, EPA's contingency alternative for the groundwater cleanup is **Alternative 3: Groundwater Extraction with *Ex Situ* Treatment, Institutional Controls, and Monitoring** (See Figure 3), which includes the following components:

Pre-design Investigation: Pre-design investigations would include an additional groundwater investigation to determine optimal extraction well placement. Pumping tests and other studies would be conducted to assist in determining pumping rates, locations, and depths of extraction wells. Sampling and analysis of extracted groundwater would be used to assist in the development of the groundwater treatment system design. Infiltration tests and hydraulic modeling would be needed to support the infiltration of treated groundwater.

Treatability/Pilot Testing: Treatability and pilot testing would be used to optimize treatment components and finalize treatment design based on the results from pre-design studies.

Extraction and Injection System: The groundwater extraction system would consist of a series of extraction wells that would capture contaminated portions of the aquifer while minimizing extraction of uncontaminated groundwater and impacts to the wetlands. A preliminary conceptual design uses four extraction wells (with sumps) pumping at rates between 15 and 25

gallons per minute (gpm) for a total extraction rate of approximately 90 gpm. The extraction system would also include pumps, electronic controls, and a network of underground piping that would convey extracted groundwater to a central treatment location. Treated water would be conveyed to infiltration basins constructed outside the treatment area. The infiltration basins allow the treated groundwater to slowly seep into the ground.
Treatment Plant: The treatment system would occupy an approximate 60 by 60 square foot footprint on the landfill property. Extracted groundwater would be treated by a series of processes. The pre-treatment elements would focus on metals and suspended solids removal. These pre-treatment processes would be followed by contaminant-specific treatment processes including advanced oxidation (AO) for 1,4-dioxane treatment and granular activated carbon (GAC) treatment for PFAS removal.

Operation and Maintenance of the Treatment System: Operation and Maintenance (O&M) would include monitoring to evaluate that all parts of the extraction and treatment system are operating properly. Equipment replacement and repair would be completed in accordance with an O&M plan approved by EPA.

Wetland Restoration: Treatment system piping will likely be constructed within a wetland because groundwater impacts extend below the wetlands adjacent to Trout Brook. The remedy will be designed to minimize wetland and floodplain impacts. Wetlands that are disturbed as part of construction will be restored, and any impacts to wetlands are expected to be temporary.

Monitoring: Monitoring would include groundwater and surface water monitoring. The conceptual monitoring program includes the current Post Closure Site Monitoring, monitoring of more recently installed wells as part of OU2 Remedial Investigation activities, and monitoring of new wells intended to enhance the Site-wide network to evaluate if contaminant concentrations are decreasing by natural processes. Surface water monitoring is included in the PCSM and LTM programs. Monitoring of residential drinking water wells is also included in this alternative. Remedy performance monitoring would include the installation and sampling of additional performance monitoring wells and the four extraction wells to evaluate remedy performance.

Institutional Controls: Institutional Controls (ICs) would be implemented for groundwater use in all areas necessary to prevent exposure. These ICs will include provisions to maintain current use of water consumption, but will limit or prevent expanded, modified, or increased use beyond current demand. ICs may also include a prohibition of certain uses (e.g., future drinking water wells) or require pre-treatment of water (engineering control) prior to use. ICs will also require a vapor intrusion assessment and/or a vapor barrier for new building construction.

EPA will publish the final results of the treatability study for Alternative 4. If, after reviewing the treatability study results, pilot test results, or other data collected during the design phase, EPA determines that Alternative 4 will not be effective in attaining cleanup levels identified for the Site and no longer achieves the best balance among EPA's required evaluation criteria, EPA will provide notice to the public of its intention to implement its contingency alternative.

Estimated Cost of the Proposed Cleanup

The estimated total present value1 of the proposed cleanup approach, including construction, operation and maintenance, and long-term monitoring is approximately $11.7 million. The estimated total present value of the contingency cleanup approach is approximately $14.6 million. Each component of the proposed and contingency cleanup approaches is outlined below and discussed in greater detail in the Feasibility Study.

Potential Community Impacts

Impacts to the community are expected to be limited, but design and implementation of Alternative 3 or 4 may require communication with surrounding landowners and utility companies. Potential impacts to site workers would be temporary and will be mitigated for workers during remedial actions through proper health and safety precautions (e.g., personal protective equipment). The cleanup work will be performed during typical work hours to minimize noise disturbances in nearby residential areas.

EPA IS REQUESTING PUBLIC COMMENTS ON THE FOLLOWING PROPOSED DETERMINATIONS

Impacts to Wetlands

Section 404 of the Clean Water Act (CWA), federal regulations at 44 C.F.R. Part 9, and Executive Order 11990 (Protection of Wetlands) require a determination that there is no practicable alternative to taking federal actions in waters of the United States or wetlands. Should there be no alternative, the federal actions should minimize the destruction, loss, or degradation of these resources and preserve and enhance their natural and beneficial values. Through analysis of the alternatives (See FS, Section 5.0), EPA has determined that because of the existence of wetlands at the Site and the levels of Site-related contamination that exists in these wetlands and underlying groundwater there is no practicable alternative to conducting work in these areas. As required by the CWA, EPA has determined, through its analysis of the various alternatives, that the proposed cleanup alternatives which impact wetland areas are the least environmentally damaging practicable alternatives for protecting wetland resources. EPA will minimize potential harm and avoid adverse impacts to wetlands by using best management practices to minimize harmful impacts on the wetlands, wildlife or their habitat, and by restoring these areas consistent with federal and state wetlands protection laws. Any wetlands affected by remedial work will be restored with native vegetation as a wetland area and such restoration will be monitored until the wetland vegetation becomes re-established. Other mitigation measures will be used to protect wildlife and aquatic life during remediation and restoration, as necessary.

Impacts to Floodplains

Before EPA can select a cleanup alternative, Executive Order 11988 (Floodplain Management) and federal regulations at 44 C.F.R. Part 9 require EPA to make a determination that there is no practicable alternative to activities that affect or result in the occupancy and modification of the 100- and 500-year floodplain. Through its analysis of alternatives (see FS, Section 5), EPA has determined that the proposed and contingency cleanups will cause temporary impacts but will not result in the occupancy and modification of floodplains.

While injections (under the preferred Alternative 4) or trenching for treatment system piping (under contingency Alternative 3) are proposed for areas of the Site located in the floodplain, only temporary impacts

[1] "Present value" is the amount of money set aside today to ensure that enough money is available over the expected life of the project, assuming certain economic conditions (e.g., inflation).

to the floodplains are anticipated. Best management practices will be used during injections, which will include erosion control measures, proper regrading, and restoration and monitoring of impacted areas. More detail regarding wetland and floodplain management can be found in the FS.

Through this Proposed Plan, EPA is specifically soliciting public comments concerning its determination that the alternatives chosen are the least environmentally damaging practicable alternatives for protecting the Site wetland resources and that EPA's proposed cleanup plan is protective of floodplain resources.

BACKGROUND

Site Description

The L&RR Superfund Site includes a 28-acre closed/capped landfill in a mostly undeveloped portion of North Smithfield, Rhode Island (See Figure 1). The landfill is bounded to the west by a gravel road referred to as Old Oxford Turnpike, which is part of a network of gravel roads maintained for truck use by the Holliston Sand Corporation located farther to the north. An extensive wetland complex associated with Trout Brook is located east of the landfill (See Figure 2). Trout Brook flows north toward Trout Brook Pond located farther to the north and east of the landfill. The north, south, and eastern edges of the landfill are bounded by high voltage electric transmission lines. A photovoltaic solar array was recently constructed on a large undeveloped land parcel south of the landfill. Another solar developer has obtained construction permits for a solar array to be located on the parcels to the northwest of the landfill. A series of single-family residential homes are located approximately one quarter mile to the east along Pound Hill Road. These residences utilize private drinking water wells for household consumption and use.

Site History

The L&RR Superfund Site was initially used as a sand and gravel pit given the extensive glacially derived materials within this portion of Rhode Island. The volume of sand and gravel mined remains unknown. It is estimated that most of the sand and gravel was excavated to the elevation at which groundwater was encountered. Acceptance of waste for disposal began in 1927 and continued until 1969 when the facility became a solid waste disposal area. In 1974, the waste management area was sold to L&RR, Inc. and operations expanded to include acceptance of commercial, domestic, and industrial waste, in addition to solid waste.

L&RR, Inc. obtained a solid waste management facility license issued by the Rhode Island Department of Environmental Management (RIDEM) in December 1976. Acceptance of hazardous waste began in November 1977 and ceased by September 1979.

Operable Unit 1 (OU1)

In December 1979, an area referred to as a "hazardous waste area" was covered with a 20-mil polyvinyl choride (PVC) liner by L&RR, Inc. to reduce the potential for hazardous waste leachate (liquid that drains or 'leaches' from a landfill) generation. In 1986, under the direction of RIDEM, this interim cover system was supplemented with an additional 20-mil PVC geomembrane, and the cap was reshaped and regraded to enhance landfill drainage. The cap was designed to be compatible with the landfill gas extraction system. A landfill gas collection system was installed following issuance of the OU1 ROD in 1988.

Numerous subsurface investigations were undertaken for OU1 beginning in 1977 when RIDEM required the past owner of the landfill to submit copies of waste manifests. A preliminary assessment report was issued in

April 1981 by EPA. This report was followed by RIDEM's initial site assessment that also included review of landfill closure plans.

The L&RR Superfund Site was added to the National Priorities List (NPL) in December 1982. In January 1987, EPA began implementation of the Remedial Investigation and Feasibility Study (RI/FS) for OU1. The RI included extensive subsurface investigations to characterize the nature and extent of past landfill-related activities along with a landfill closure assessment. Data obtained during the RI were used to support screening and selection of a remedial alternative for OU1 as part of the ROD.

The OU1 ROD was issued on September 29, 1988 and subsequently modified by two Explanations of Significant Differences (ESD) on March 8, 1991 and September 16, 1996. The selected remedy, as modified by the ESDs, included the following components:

- Landfill closure upgrades including installation of a perimeter fence, development of a post-closure monitoring plan, surface water management improvements, slope stability improvements, covering of the uncovered northeast portion of the landfill, and soil cover/vegetation establishment;
- Installation of a landfill gas collection system (using 18 gas extraction wells) and thermal destruction system;
- Remediation of nearby wetlands (removed in 1991 via ESD);
- Periodic environmental monitoring for a period of 30 years; and
- Implementation of institutional controls for land and water use adjacent to OU1 (added in 1997 via settlement agreement).

Following a remedial design period from March 1993 to September 1993, implementation of Remedial Action activities began in May 1994. These activities included placing a new PVC cover system over previously uncovered areas, extending the eastern slope, and constructing a gas collection system. The 18 gas extraction wells were connected using a series of pipes (headers) for conveyance of landfill gas to a 40-foot high enclosed flare unit for treatment by thermal destruction. The gas collection system began operation in February 1995. The gas collection and treatment system has successfully operated to reduce landfill gas emissions and control methane levels since 1996. The flare currently operates on a part-time basis, as approved by EPA, due to low methane concentrations typical of aging landfills.

The ESD issued by EPA on September 16, 1996 clarified that the groundwater standards referenced in the ROD are to be used to judge the performance of the landfill cap and closure and are not, by themselves, cleanup or performance standards for groundwater. At the time of the initial ROD, air quality emissions were the primary risk driver for which remedial actions were implemented. EPA stated in the ROD (and restated in the 1996 ESD) its reservation of the right to address groundwater in the future if the EPA determined that groundwater poses a threat to human health or the environment.

Operable Unit 2 (OU2)

Following closure of the landfill, annual environmental monitoring was conducted, which included collection of groundwater and surface water samples to evaluate water quality. Select volatile organic compounds (VOCs) and metals were detected at concentrations above regulatory standards at select locations along the perimeter of the landfill. These standard comparisons took into consideration the 1996 ESD which clarified that Maximum Contaminant Levels (MCLs) were intended to evaluate changes in water quality as part of post-closure monitoring activities.

To support institutional control efforts, field investigation activities began in July and August 2013. The results from the 2013 groundwater profiling confirmed the presence of a limited subset of VOCs (including 1,4-dioxane) and metals in the overburden aquifer at concentrations that in some cases were above MCLs.

A second phase of investigation was initiated in March and April 2014 to further evaluate groundwater and surface water hydraulics and bedrock aquifer conditions. Multiple VOCs (including 1,4-dioxane) and metals were detected in samples from these events with only concentrations of tetrachloroethene (PCE) and trichloroethene (TCE) detected above MCLs.

Residential drinking water samples were collected from residences to the east and south of the Site along Pound Hill Road in April 2014. These samples were used to evaluate current drinking water conditions. Concentrations of VOCs including 1,4-dioxane were not detected above the laboratory's minimum reporting limit. These residences continue to be sampled on a semi-annual basis and concentrations of Site-related constituents (VOCs and 1,4-dioxane) remain undetected.

Recent analysis of PFAS from residential samples identified very low detections of a subset of PFAS, well below EPA guidelines and RIDEM's standards. Monitoring activities of residential wells will continue to include PFAS, along with VOCs and 1,4-dioxane, on a semi-annual basis.

The Fourth Five-Year Review (FYR) in 2014 determined that the OU1 remedy currently remains protective of human health and the environment. However, to support the long-term protectiveness of the remedy, EPA concluded that 1) institutional controls are still required, and 2) on-going assessments of groundwater quality need to continue to determine the nature and extent of subsurface impacts and evaluate the need for additional response actions. Implementation of RI/FS field activities for OU2 began in June 2016 and were completed in September 2018.

OU2, the subject of this Proposed Plan, consists of the groundwater and other environmental media outside the boundary of the waste management area (OU1) associated with the closed landfill.

Current & Future Land Use

The L&RR Superfund Site is located in a mostly undeveloped portion of North Smithfield, Rhode Island. The landfill is bounded by gravel service roads and high voltage electric transmission lines. A photovoltaic solar array is located south of the landfill, and land northwest of the landfill has been purchased by another solar developer, with construction of an additional solar array slated to begin in 2020.

Undeveloped land and an extensive wetland complex are located east of the landfill. The wetland complex surrounds Trout Brook, which flows north toward Trout Brook Pond and the Slatersville Reservoir. Trout Brook, Trout Brook Pond, and the Slatersville Reservoir are designated as Class B water bodies by RIDEM, which indicates that they are suitable for fishing, swimming, and other recreational activities, but are not suitable for drinking water.

Groundwater in the vicinity of the Site is part of the Branch River watershed which includes the Slatersville Reservoir Aquifer which has been designated as a drinking water source by the State of Rhode Island. A series of single-family residential homes, which utilize private drinking water wells, are located approximately one quarter mile to the east of the landfill along Pound Hill Road.

Environmental Investigations and Cleanup Actions

Landfill & Resource Recovery (L&RR) Site Timeline	
1927	Acceptance of waste for disposal began.
1974	L&RR, Inc. purchased the Site and operations expanded to include acceptance of commercial, domestic, and industrial waste, in addition to solid waste.
December 1976	L&RR, Inc. obtained a solid waste management facility license issued by the Rhode Island Department of Environmental Management (RIDEM).
November 1977	Acceptance of hazardous waste began.
1977 - 1980	Numerous subsurface investigations were undertaken beginning in 1977 when RIDEM required the landfill facility to submit copies of waste manifests.
September 1979	RIDEM ordered L&RR to stop accepting hazardous wastes for disposal.
December 1979	The hazardous waste area at the Site was covered with a 20-mil PVC liner by L&RR, Inc. to reduce the potential for hazardous waste leachate generation.
April 1981	A preliminary assessment report was issued by EPA. This report was followed by RIDEM's initial site assessment that also included review of landfill closure plans.
September 8, 1983	EPA finalized the listing of the Site on the EPA National Priorities List.
1985	Landfill closure activities began.
1986	Under the direction of RIDEM, the interim cover system on the hazardous waste area was supplemented with an additional 20-mil PVC geomembrane, and the cap was reshaped and regraded to enhance landfill drainage.
June 1988	OU1 Remedial Investigation/Feasibility Study was completed.
September 29, 1988	OU1 Record of Decision (ROD) was signed.
1995	OU1 Landfill closure upgrades are completed in accordance with OU1 Remedy.
1996	Post-Closure Operation and Maintenance Plan established a groundwater monitoring program and monitoring network.
Spring 2007	Groundwater monitoring frequency was transitioned from semi-annual to annual.
July/August 2013	Settling Defendants conducted additional IC-related groundwater investigations for Lots 15 and 23.
March/April 2014	Settling Defendants conducted additional IC-related investigations into Trout Brook and bedrock aquifer.
April 2014	Settling Defendants performed first round of residential well sampling. Residential wells continue to be sampled semi-annually.
August 2015	EPA and Settling Defendants entered into Administrative Settlement Agreement and Order on Consent for RI/FS
May 2016	OU2 Remedial Investigation/Feasibility Study work plan was finalized.
June 2016 – September 2018	Settling Defendants conducted Remedial Investigation field activities.
September 2018	Settling Defendants submitted and EPA approved the OU2 Screening Level Ecological Risk Assessment (SLERA), including refinement step.
November 2019	Settling Defendants submitted and EPA approved the OU2 Human Health Risk Assessment.
December 2019 – January 2020	Settling Defendants collect groundwater and soil samples for use in Treatability Study for sequential treatment using *in situ* chemical oxidation and sequestration.
April 2020	Settling Defendants submitted and EPA approved the Treatability Study Work Plan for sequential treatment using *in situ* chemical oxidation and sequestration.
April 2020	Settling Defendants submitted and EPA approved the OU2 Remedial Investigation Report.
June 2020	Settling Defendants submitted and EPA approved the OU2 Feasibility Study Report.
July 2020	EPA released the OU2 proposed cleanup plan.

WHY CLEANUP IS NEEDED

EPA has determined that there are future potential threats to human health at the Site due to uncontrolled migration of contaminated groundwater from the landfill. The presence of VOCs (including 1,4-dioxane), metals, PFAS and other contaminants have been identified throughout the Site at levels that present an unacceptable risk to human health and the environment.

Site Contaminants

The main contaminants of concern (COCs) at the Site include, but are not limited to:

Volatile Organic Compounds (VOCs): Include a variety of chemicals which are used as ingredients in many products and materials such as glue, paint, and solvents. Volatile organic compounds, or VOCs, are organic chemical compounds that easily evaporate. VOCs found in groundwater at the L&RR Site include benzene, naphthalene, trichloroethene (TCE), and vinyl chloride.

1,4-Dioxane: 1,4-dioxane is a synthetic industrial chemical that was widely used as a stabilizer of chlorinated solvents. 1,4-dioxane is completely miscible in water, is highly mobile, and does not readily biodegrade in the environment. 1,4-Dioxane has been detected in groundwater at the L&RR Site.

Metals: Metals occur in all ecosystems, although natural concentrations vary according to local geology. Human activities and land disturbance can redistribute or concentrate metals in areas where they may not have been present or mobilize metals into groundwater and streams. While some metals are essential as nutrients, all metals can be toxic at some level. Some metals are toxic in minute amounts. Metals found in groundwater at the L&RR Site include antimony, arsenic, chromium, iron, and manganese.

Per- and Polyfluoroalkyl Substances (PFAS): Per- and polyfluoroalkyl substances (PFAS) are a group of human-made chemicals found in a wide range of consumer products such as non-stick products (e.g., Teflon cookware), pizza boxes, stain- and water-repellent fabrics, polishes, waxes, paints, and cleaning products. Another major source of PFAS in the environment is fire-fighting foams. PFAS compounds are very persistent in the environment– meaning they do not break down and can accumulate over time. PFAS compounds detected in groundwater include perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). Recent data on leachate contaminant concentrations indicate that PFOAs are the predominant PFAS component.

HOW ARE RISKS TO HUMAN HEALTH EXPRESSED?

Every person has a baseline (non-site related) risk from exposure to the numerous naturally occurring and human-made chemicals that are inherent in modern society. For example, the American Cancer Society estimates that 1 in 2 men, and 1 in 3 women, will develop cancer over a lifetime (Cancer Facts and Figures for 2020, American Cancer Society). While people also have baseline exposure to non-carcinogens through naturally occuring and human made chemicals that are inherent in modern society, these chemicals can result in toxic effects which are organ-specific, and therefore cannot be expressed in terms of probability.

In evaluating chemical exposure risk to humans, estimates for risk from carcinogens and non-carcinogens (chemicals that may cause adverse effects other than cancer) are expressed differently. EPA also considers the cumulative carcinogenic and non-carcinogenic effects when multiple chemical exposures with similar target endpoints are present.

For carcinogens, risk estimates are expressed in terms of probability. For example, exposure to a particular site-related carcinogenic chemical may present a 1 in 1,000,000 increased chance of causing cancer over an estimated lifetime of 70 years. This can also be expressed as one-in-a-million or 1×10^{-6} excess lifetime cancer risk. The EPA acceptable risk range for carcinogens is 1×10^{-6} (1 in 1,000,000) to 1×10^{-4} (1 in 10,000) over a 70-year lifetime. In general, site-related risks higher than this range would require consideration of cleanup alternatives.

For non-carcinogens, exposures are first estimated and then compared to a reference dose (RfD). RfDs are developed by EPA scientists to estimate the amount of a chemical a person (including the most sensitive person) could be exposed to over a lifetime without an appreciable risk of developing adverse health effects. The exposure dose is divided by the RfD to calculate the ratio known as a hazard index (HI) to determine whether non-cancer adverse health effects would likely occur or not. An HI greater than 1 suggests that adverse effects may be possible and would require consideration of cleanup alternatives.

Exposure Pathways & Potential Risk

Exposure occurs when humans or other living organisms eat, drink, breathe or have direct skin contact with a hazardous substance or waste material. Further, if there is no exposure to a hazardous substance, there is no potential risk.

Based on existing or reasonably anticipated future land use at a site, EPA develops possible exposure scenarios to determine potential risk, appropriate cleanup levels for contaminants, and potential cleanup approaches, all of which are documented in the Feasibility Study.

Human health and ecological risk assessments have been prepared for the Site (detailed risk summaries can be found in the March 2020 Final Baseline Human Health Risk Assessment (HHRA) and the September 2018 Screening level Ecological Risk Assessment (SLERA), and Appendices C and D of the RI). These conservative assessments use site-specific exposure scenarios to determine if and where there are current or potential future unacceptable risks to humans and/or the environment.

Human Health Risks

People have the potential for exposure to Site contaminants through the following exposure pathways: drinking and direct contact with groundwater, and inhalation of vapors emanating from groundwater contamination. Further discussion of the exposure pathways is presented below.

Exposure Assessment

The exposure assessment characterizes the physical setting of the Site and evaluates the exposures that may be experienced by a receptor population. To have an exposure, several factors must be present: a source of contamination, a mechanism through which a receptor can come into contact with the contaminants in that medium, and a potential or actual receptor present at the point of contact.

Health risks were evaluated for possible current and future uses of the Site, including residential use and recreational use. Residential use assumes the use of groundwater as both a drinking water and non-drinking water source (e.g. for showering or watering plants). The residential use scenario evaluated young children and adults who were assumed to spend the majority of their time each day in the residential dwelling at their property. Recreational use refers to leisure and sporting activities such as walking, boating, swimming, or wading. The recreational use scenario evaluated young children and adults who were assumed to be exposed to surface water and sediment through swimming and wading activities.
The following routes of exposure were evaluated in the BHHRA:

- dermal contact, direct ingestion, and non-drinking water usage (washing, cooking, and irrigation) of groundwater by current and future residents;
- inhalation of vapors from groundwater (through use of groundwater for showering or from vapor intrusion) by current and future residents;
- dermal contact and incidental ingestion (during swimming) of surface water by recreational users of Trout Brook, Trout Brook Pond, and related tributaries;
- dermal contact and incidental ingestion of sediment (during wading) by recreational users of Trout Brook, Trout Brook Pond, and related tributaries; and
- consumption of fish by recreational users of Trout Brook, Trout Brook Pond, and related tributaries.

Based on the results of the HHRA, EPA found that the calculated risks exceed EPA's acceptable cancer risk range of 10^{-6} to 10^{-4}, and/or the non-cancer Hazard Index of 1 for future residents who may use groundwater for drinking water or other uses. The primary risk drivers included chlorinated VOCs, 1,4-dioxane, arsenic, iron, manganese, chromium (hexavalent), and PFOA.

Vapor intrusion was also identified as a potentially complete pathway for occupants of future buildings where VOCs could migrate into buildings from shallow groundwater. To address this potential pathway, EPA's preferred remedy will also require vapor intrusion assessment and/or vapor barrier for new construction. Additionally, the fish consumption pathway was qualitatively evaluated in the BHHRA through the screening of surface water results against surface water criteria using the National Recommended Water Quality Criteria (NRWQC). Based on arsenic and 1,4-dioxane surface water exceedances of the NRWQC for fish consumption, additional evaluations will be performed during the remedial design phase of the remedy to assess risks from fish consumption.

The detailed evaluation of the potential human health risks is presented in the Final Baseline Human Health Risk Assessment, dated March 2020. This was used to develop the cleanup alternatives presented in the Final FS.

Risk Summary

Future Resident

Exposure Medium	Exposure Point	Carcinogenic Risk	Non-Carcinogenic Risk (HI)
Groundwater	Overburden Groundwater	3.7×10^{-3}	52
	Bedrock Groundwater	8.0×10^{-4}	15

Current Resident

Exposure Medium	Exposure Point [2]	Carcinogenic Risk	Non-Carcinogenic Risk
Groundwater	Resident 1 Groundwater	9.5 x 10-5	2.5 [3]
	Resident 2 Groundwater	3.8 x 10-4 [4]	0.48

Current/Future Recreator

Exposure Medium	Exposure Point	Carcinogenic Risk	Non-Carcinogenic Risk
Surface Water	Trout Brook (Wading)	7.1×10^{-6}	0.017
Sediment		2.0×10^{-5}	0.23
TOTAL		2.7×10^{-5}	0.25

Exposure Medium	Exposure Point	Carcinogenic Risk	Non-Carcinogenic Risk
Surface Water	Trout Brook Pond (Swimming)	6.1×10^{-6}	0.018
Sediment		2.7×10^{-5}	0.065
TOTAL		3.3×10^{-5}	0.083

Exposure Medium	Exposure Point	Carcinogenic Risk	Non-Carcinogenic Risk
Surface Water	Trout Brook Pond (Wading)	2.8×10^{-6}	0.003
Sediment		4.7×10^{-5}	0.11
TOTAL		5.0×10^{-5}	0.11

Exposure Medium	Exposure Point	Carcinogenic Risk	Non-Carcinogenic Risk
Surface Water	Tributaries Area (Wading)	2.6×10^{-5}	0.035
Sediment		3.4×10^{-5}	0.56
TOTAL		6.0×10^{-5}	0.59

[2] Detections occurred at two separate residences.
[3] Risks exceeding EPA's acceptable risk range are solely attributable to napthalene which has been detected in 1 out of 9 samples. Residential wells continue to be monitored semi-annually.
[4] Risks exceeding an HI of 1 are solely attributable to chloroform, which is related to well disinfection activities performed by homeowner and is not Site-related.

Threats to the Environment

A screening-level ecological risk assessment (SLERA) was conducted to evaluate the risk to ecological receptors from the Site. The SLERA process included: an assessment of habitat; identification of ecological receptors; identification of complete or potentially complete exposure pathways; and a comparison of detected chemical concentrations to ecotoxicity screening criteria. Potential ecological risk was evaluated through calculation of a hazard quotient (HQ) for each contaminant; contaminants with an HQ of one or greater were labeled as contaminants of potential ecological concern (COPECs).

The SLERA was then expanded to include a "Refinement" step which involved a more detailed evaluation of COPECs. COPECs were evaluated using Site-specific information and toxicity data to reduce uncertainty associated with the use of conservative exposure and screening-level toxicity assumptions. This evaluation determined that there were two COPECs for pore water (1,4-dichlorobenzene and lead) and two COPECs in sediment (arsenic and selenium). Although COPECs were identified, the SLERA concluded that there was no indication of ecological risk from the COPECs for which remedial action would be required.

Details of the ecological risk assessment can be found in the SLERA and Refinement dated September 2018, and EPA memorandum of concurrence dated September 12, 2018.

Basis for Taking Action

It is EPA's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of pollutants or contaminants from this site which may present an imminent and substantial endangerment to public health or welfare.

CLEANUP ALTERNATIVES CONSIDERED

Once possible exposure pathways and potential risks have been identified at a site, cleanup alternatives are developed to reduce and/or mitigate the identified unacceptable risks and achieve the site-specific Remedial Action Objectives (RAOs), which are also known as the cleanup objectives. The RAOs for L&RR are as follows:

- Prevent exposure by current and future area residents to groundwater containing site contaminants that exceed ARARs or would result in a total excess lifetime cancer risk greater than the target risk range of 10^{-4} to 10^{-6}, and/or a non-cancer Hazard Index greater than 1.
- Prevent exposure by future building occupants to indoor air vapors emanating from shallow groundwater containing site contaminants that would result in a total excess lifetime cancer risk greater than the target risk range of 10^{-4} to 10^{-6}, and/or a non-cancer Hazard Index greater than 1.
- Restore groundwater containing site contaminants to its beneficial use as a potential future drinking water source by reducing concentrations of contaminants so that they do not exceed ARARs or result in a total excess lifetime cancer risk greater than the target risk range of 10^{-4} to 10^{-6}, and/or a noncancer Hazard Index greater than 1.

- Prevent or minimize migration of site contaminants in groundwater in excess of cleanup levels to Trout Brook, Trout Brook Pond, and related wetlands and tributaries.
- Prevent or minimize migration of site contaminants in groundwater in excess of cleanup levels to the residential drinking water wells along Pound Hill Road.

Table 2-4 of the FS presents the proposed site contaminant cleanup levels, or Preliminary Remediation Goals (PRGs), and the basis for selection. These proposed groundwater cleanup levels are shown in Table 1, attached.

Once cleanup objectives have been determined, response actions to meet these objectives are then identified, and those actions are grouped into potential alternatives for remediation. The remedial alternatives developed for the Site in the FS are listed below. Alternative 4 is EPA's preferred alternative with Alternative 3 as a contingency remedy if, based on treatability studies, EPA determines Alternative 4 will not meet the Site's cleanup objectives.

Alternative 1: No Action

Alternative 1 was developed as a baseline alternative, as required by the National Contingency Plan (NCP), to which all other alternatives may be compared. Under this alternative, no action would be taken to address contamination in groundwater and RAOs would not be achieved. As required by CERCLA, a review of Site conditions and risks would be conducted every five years.

Alternative 2: Limited Action – Institutional Controls and Monitoring

Alternative 2 was developed as a limited action alternative, which provides no active treatment and relies on institutional controls to protect human health by preventing potential exposures to contaminated groundwater. Institutional controls would also be used to require a vapor intrusion assessment and/or vapor barrier for new building construction. Under this alternative, no action would be taken to address contamination in groundwater and RAOs would not be achieved. Environmental monitoring would be conducted on a periodic basis to provide information to evaluate whether additional actions are needed. As required by CERCLA, a review of Site conditions and risks would be conducted every five years.

Alternative 3: Groundwater Extraction with *Ex Situ* Treatment, Institutional Controls, and Monitoring (EPA's Proposed Contingency)

Alternative 3 consists of active groundwater extraction and treatment, institutional controls, and monitoring. Under this alternative, a groundwater extraction system would be installed to intercept, collect, and treat contaminated groundwater. Treated water would then be injected in rapid infiltration basins outside the treatment area. Groundwater extraction and treatment is an effective remediation technology recognized as a well-proven means of containment and treatment of impacted groundwater across an established target capture zone.

Alternative 3 would reduce contaminant mass in groundwater and surface water impacted by the landfill (the wetlands, Trout Brook, and nearby residential wells) through the use of hydraulic containment and treatment. The extraction wells would be designed and located (based on pre-design studies) to hydraulically contain areas upgradient of Trout Brook where 1,4-dioxane and PFAS exceed PRGs. The extraction wells would be designed to extract groundwater across a large overburden area and to increase the upward flow of groundwater from bedrock to reduce or eliminate the flow of contaminants from overburden to bedrock groundwater. Extracted groundwater would be treated to remove contaminants prior to infiltration into the ground. The treatment system would treat COCs by various processes that would be determined during the remedial design phase;

these could include filtration, advanced oxidation, and/or use of activated carbon as described in Section 4.3 of the FS and Appendix C of the FS. VOCs and 1,4-dioxane would likely be destroyed *ex situ* through irreversible treatment, while metals and PFAS would be removed through separation and adsorption, respectively.

Concentrations of COCs (including 1,4-dioxane, CVOCs, and metals) beyond the capture area of the extraction wells are expected to attenuate within 20 years of implementation of the upgradient remedy through advection, dispersion, sorption, biodegradation (CVOCs), and groundwater recharge. This would be evaluated as part of a groundwater monitoring program.

The restoration timeframe in the downgradient portion of the aquifer is estimated to be 11 to 19 years. The time to conservatively achieve RAOs throughout the entire OU2 portion of the Site is estimated to take 40 to 92 years. More details about the assumptions and methods used to calculate restoration timeframes can be found in Section 4.3.2 and Appendix D of the FS.

Institutional controls would prevent exposure to COCs in groundwater while concentrations remain above PRGs. Groundwater monitoring would be conducted to provide information to evaluate whether additional actions are needed. ICs will also require a vapor intrusion assessment and/or a vapor barrier for new building construction.

The activities that would be conducted under this alternative include pre-design investigations; bench and pilot testing; treatment system design, construction, and operation and maintenance; institutional controls; long-term monitoring of groundwater and surface water to evaluate contaminant status and migration; and a review of Site conditions and risks every five years.

Alternative 4: Two-Stage Reactive Treatment Zone, Institutional Controls, and Monitoring (EPA's Preferred Alternative)

Alternative 4 consists of *in situ* (below the ground) treatment and sequestration of site COCs, institutional controls, and monitoring. Two technologies would be used together to create a two-stage reactive treatment zone in the ground. The two technologies are: (i) ISCO (*in situ* chemical oxidation) with potassium persulfate or another form of slow-release chemical oxidant to address CVOCs, 1,4-dioxane, and some PFAS; and (ii) sequestration/stabilization with injectable activated carbon(AC) for PFAS that are not susceptible to ISCO, primarily those PFAS associated with the sulfonic acid/sulfonate sub-group.

Alternative 4 would be designed to sequester and/or break down site COCs as contaminated groundwater flows through the treatment area; the treated water would then continue to flow along its existing flowpath into the wetlands, Trout Brook, and past nearby residential wells. ISCO and AC amendments would be injected downgradient from locations where PFAS concentrations exceed PRGs. Additional targeted ISCO injections would occur in areas downgradient of the persulfate barrier where contaminant mass persists. This treatment is not reversible. Organic compounds that are not treated by the ISCO would be sequestered within the AC zone, which would prevent further transport of the compounds towards the downgradient receptors. Amendment injections would be designed to focus distribution across the zone where overburden groundwater impacts are elevated. Additional reagent, placed at the deep overburden and upper bedrock interface, would enhance treatment of the underlying bedrock zones. Metals are expected to become less mobile in the subsurface as groundwater shifts towards oxidizing conditions following ISCO injections; this would be confirmed through pre-design bench- and pilot-scale activities as well as continued performance monitoring.

Alternative 4 has the potential to destroy most of the dissolved-phase contaminant mass *in situ* through ISCO and sequester any untreated residual fractions through adsorption using AC. The application of these two technologies in succession has not been performed at other Superfund sites; however, both technologies have been successfully implemented at the full-scale level independently for some site contaminants. A treatability study is currently underway to evaluate the viability of this alternative for this Site. More information about the Treatability Study can be found in the Treatability Study Work Plan for ISCO and AC in Appendix E of the FS, which includes information to support the proposed technologies and Site-specific application.

Concentrations of COCs (including 1,4-dioxane, chlorinated VOCs, and metals) beyond the treatment zones are expected to attenuate within 20 years of implementation of the upgradient remedy through advection, dispersion, sorption, biodegradation (CVOCs), and groundwater recharge. This would be evaluated as part of a groundwater monitoring program.

The restoration timeframe in the downgradient portion of the aquifer is estimated to be 8 to 19 years. The time to conservatively achieve RAOs throughout the entire OU2 portion of the Site is estimated to be 55 to 119 years. More details about the assumptions and methods used to calculate restoration timeframes can be found in Section 4.4.2 and Appendix D of the FS.

Institutional controls would prevent exposure to COCs in groundwater while concentrations remain above PRGs. Groundwater monitoring would be conducted to provide information to evaluate whether additional actions are needed. ICs will also require a vapor intrusion assessment and/or a vapor barrier for new building construction.

The activities that would be conducted under this alternative include pre-design investigations; bench and pilot testing; ISCO and AC injections; institutional controls; long-term monitoring of groundwater and surface water to evaluate contaminant status and migration; and a review of Site conditions and risks every five years.

Nine Criteria for Choosing a Cleanup

EPA uses nine criteria to evaluate cleanup alternatives and select a final cleanup plan. EPA has already evaluated how well each of the cleanup alternatives developed for the L&RR Superfund Site meet the first seven criteria in the Feasibility Study. Once comments from the community and state are received and considered, EPA will select the final cleanup plan and document its selection in the Record of Decision (ROD) for the Site.

1. **Overall protection of human health and the environment:** Will it protect you and the plant and animal life on and near the site? EPA will not choose a cleanup plan that does not meet this basic criterion.

2. **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs):** Does the alternative meet all federal environmental and state environmental and facility siting statutes and regulations that are either applicable or relevant and appropriate to the selected cleanup plan? The cleanup plan must meet this criterion.

3. **Long-term effectiveness and permanence:** Will the effects of the cleanup plan last or could contamination cause future risk?

4. **Reduction of toxicity, mobility, or volume through treatment:** Using treatment, does the alternative reduce the harmful effects of the contaminants, the spread of contaminants, and the amount of contaminated material?

5. **Short-term effectiveness:** How soon will site risks be adequately reduced? Could the cleanup cause short-term hazards to workers, residents, or the environment?

6. **Implementability**: Is the alternative technically feasible? Are the right goods and services (i.e. treatment equipment, space at an approved disposal facility) available?

7. **Cost:** What is the total cost of an alternative over time? EPA must select a cleanup plan that provides necessary protection for a reasonable cost.

8. **State acceptance:** Do state environmental agencies agree with EPA's proposal?

9. **Community acceptance:** What support, objections, suggestions, or modifications did the public offer during the comment period?

CLEANUP ALTERNATIVES COMPARISON

The alternatives considered for groundwater were compared to each other to identify how well each alternative meets EPA's evaluation criteria. The State and Community Acceptance criteria will be evaluated once feedback is received during the public comment period. The following discussion and Table 2 present a general and cost comparison summary of the alternatives against EPA evaluation criteria. Detailed evaluations and comparisons of alternatives can also be found in Sections 5.0 and 6.0 of the FS.

Overall Protection of Human Health and the Environment

Alternative 1 does not provide overall protection of human health and the environment. The unacceptable future risks to human health are not reduced, controlled, or eliminated. Alternatives 2, 3, and 4 are protective of human health because institutional controls would prevent exposure to COCs in groundwater while concentrations remain above cleanup levels. Additionally, Alternatives 3 and 4 are protective of human health and the environment through treatment and remediation of the groundwater. Both alternatives 3 and 4 are expected to reduce contaminant levels in downgradient groundwater to levels below PRGs within approximately 20 years, eliminating the potential risk to human health and the environment. Groundwater is estimated to achieve cleanup standards throughout the Site within approximately 55-119 years for Alternative 4 and within approximately 40-92 years for Alternative 3.

Compliance with ARARs

Alternative 1 and Alternative 2 would not comply with chemical-specific ARARs within a reasonable timeframe. For Alternatives 3 and 4, ARARs are judged to be attainable and under either alternative the remedy would be designed to comply with all ARARs. Additional evaluation of ARARs and other criteria for each alternative is presented in Appendix F of the FS.

Long-term Effectiveness and Permanence

Alternative 1 does not address the unacceptable future risks due to the Site and provides no long-term effectiveness or permanence. Alternatives 2, 3, and 4 protect human health through the use of institutional controls, which are effective over the long-term if adequately monitored and enforced. Additionally, Alternatives 3 and 4 are expected to reduce contaminant levels in groundwater to levels below PRGs within approximately 20 years downgradient of the remedy, permanently eliminating the potential risk to human health and the environment. The time to conservatively achieve RAOs throughout the entire OU2 portion of the Site is estimated to take 40 to 92 years under Alternative 3 and 55 to 119 years under Alternative 4. Alternatives 3 and 4 have similar clean up timeframes, and therefore similar long-term effectiveness.

Under Alternative 3, long-term management of the treatment system components would be required to maintain effectiveness. O&M would include process control activities, maintenance of extraction wells and treatment equipment, periodic inspections to perform preventative maintenance, change-out or regeneration of treatment media, and process water sampling to verify treatment system effectiveness. Long term monitoring of groundwater would be required to evaluate contaminant levels in the aquifer and to assess containment and the effectiveness of the treatment system.

Under Alternative 4, long term monitoring would be required to evaluate performance over time and additional ISCO injections would likely be required to maintain effectiveness. The timeframe between additional injections would be determined based on monitoring. The AC treatment zone has a predicted life span of over 25 years.

Based on these expectations Alternatives 3 and 4 have similar long-term effectiveness; however Alternative 4 has fewer long-term operation and maintenance requirements. Results from the Treatability Study will assist in the determination of overall long-term effectiveness of Alternative 4.

Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment

Alternatives 1 and 2 provide no reduction in toxicity, mobility, or volume through treatment. Alternative 3 would reduce mobility of all COCs through containment by extraction wells and would also reduce contaminant toxicity through *ex situ* treatment. Alternative 4 would reduce toxicity of some COCs (CVOCs, 1,4-dioxane, and some PFAS) through ISCO treatment, and would reduce the mobility of the remaining organic COCs through sequestration to *in situ* activated carbon. Mobility of inorganic COCs is also expected to be reduced following persulfate injections as groundwater shifts towards oxidizing conditions. Both Alternative 3 and Alternative 4 are expected to provide similar overall reduction in toxicity, mobility, and volume.

Short-term Effectiveness

Alternative 1 does not address the unacceptable future risks due to the Site, and thus it provides no short-term effectiveness. Alternatives 2, 3, and 4 protect human health through the use of institutional controls, which could be implemented shortly after remedy selection.

Alternatives 1 and 2 do not involve any activities that would create any additional short-term risks to workers, the community or the environment. Alternatives 3 and 4 would both involve activities that may create short term risks to workers, the community, or the environment.

During implementation of Alternative 3, risks to the community are expected to be low. Risks to the environment include temporary disturbance to approximately 1,600 square feet of forested wetland cause by construction of conveyance piping for the treatment system. Temporary impacts to the 100-year floodplain are similar in scale and involve an approximate 1,800 square foot area, with no permanent compensatory storage loss or impacts to the 500-year floodplain. These risks would be mitigated by using best management practices and all work would be done in accordance with ARARs. Impacted wetlands would be fully restored after construction. Impacts to workers involved in construction and implementation of the groundwater extraction and treatment are minimal and are anticipated to be manageable through use of PPE (personal protective equipment), implementation of an appropriate health and safety program, and the use of qualified contractors. Treatment chemicals will need continual management and secondary containment. Treated water would infiltrate into the ground and would need to be monitored to evaluate potential impacts to the environment; there is a risk of adverse effects on sensitive biotic receptors in the wetlands or Trout Brook due to alteration of the local water balance by the groundwater extraction system. There would be minimal disruption to neighboring land parcels during extraction well construction, trenching, treatment building construction, and connection to a power supply source for system operation. These construction-related activities will require some degree of coordination with surrounding landowners and utility companies.

During implementation of Alternative 4, risks to the community are expected to be low. Risks to the environment include temporary disturbance to approximately 2600 square feet of forested wetland caused by injections for the ISCO treatment zone. Temporary impacts to the 100-year floodplain involve an approximate 8,600 square foot area, with no permanent compensatory storage loss or impacts to the 500-year floodplain. These risks would be mitigated by using temporary mats to minimize impacts from the equipment, best management practices, and all work would be done in accordance with ARARs. Impacted wetlands would be fully restored after construction. Impacts to the workers implementing the remedy include physical hazards from the equipment required for injections and the potential exposure to the materials being injected. The selected chemicals for the ISCO injections are corrosive. AC can form a combustible dust and can be an eye or respiratory irritant. These risks are anticipated to be manageable through use of PPE, implementation of an appropriate health and safety program, decontamination procedures, and the use of qualified contractors. There would be minimal disruption to neighboring land parcels during implementation of the remedy. Design and implementation of the alternative may require some degree of coordination with surrounding landowners and utility companies.

Based on these expectations Alternatives 3 and 4 have similar short-term effectiveness as well as similar-short term risks.

Implementability

Alternative 1 is the most implementable as it requires no activities. Alternative 2 follows, as the only activities required are implementation of institutional controls and monitoring.

Alternative 3, groundwater extraction and treatment, is a well-developed technology and is expected to be readily implementable under current conditions. Significant delays to schedule are not likely to result from technical concerns; however, bench or pilot testing would be required to optimize treatment design. Treatment system operation is subject to intermittent shutdowns from power failures, treatment complication, media changeouts, and well rehabilitation due to fouling. These shutdowns are anticipated to be short-lived and would not result in extended periods of insufficient hydraulic control. Offsite treatment and/or disposal would be required for sludges that accumulate. Spent carbon from PFAS treatment would require incineration. It is anticipated that there would be capacity for these materials at an appropriate facility. The technologies proposed in the treatment system should be readily available. Construction of the groundwater extraction and treatment system could be completed within 6 to 12 months of a final design.

Alternative 4 utilizes two technologies that have both been implemented individually at the full-scale level and are available through commercial vendors. Amendments would be injected using readily available technologies. Bench and pilot scale testing will be conducted to confirm effectiveness and optimize design. A treatability study is currently underway to further refine this alternative; refer to the Treatability Study Work Plan for ISCO and AC in Appendix E of the FS. Application of the oxidants and PAC to the subsurface in a manner that promotes adequate contact time with contaminated groundwater will also be confirmed through pilot testing. Injection methods are flexible and supplementary injections, if required, would also use readily available and minimally disruptive injection methods. Implementation of the treatment zone could be completed within 6 to 9 months of final design.

Based on these expectations Alternatives 4 is somewhat more easily implementable than Alternative 3 as it does not require building construction or connection to power; however, neither Alternative is prohibitively difficult to implement.

Costs

There is no cost associated with Alternative 1 other than the cost of five-year reviews. The cost for Alternative 2 is estimated to be $2.3 million, the cost for Alternative 3 is estimated to be $14.6 million, and the cost for Alternative 4 is estimated to be $11.7 million. The costs for the alternatives are presented in Table 2.

WHY EPA RECOMMENDS THIS PROPOSED CLEANUP PLAN

Based on the results of the Remedial Investigations, human health and ecological risk evaluations, and the Feasibility Study for the Site, EPA recommends this proposed cleanup plan. EPA believes it achieves the best balance among EPA's required criteria used to evaluate various alternatives. The proposed cleanup plan meets the cleanup objectives or Remedial Action Objections (RAOs) for the Site. This Proposed Plan includes a summary in general terms of why EPA recommends the cleanup plan for the Site. For more detail, refer to the Feasibility Study Report.

Alternative 4, Two-Stage Reactive Treatment Zone, Institutional Controls, and Monitoring, is EPA's preferred alternative for the following reasons:

- Alternative 4 is expected to be able to reduce contaminant levels downgradient of the treatment area to below PRG levels within approximately 20 years of implementation of the remedy and throughout the Site within approximately 55-119 years;
- Alternative 4 would include institutional controls to prohibit use of contaminated groundwater until cleanup levels are met and to require evaluation of the vapor intrusion pathway as part of new building construction;
- Alternative 4 is more readily implementable based on the relative ease of amendment injections using readily available direct-push drilling equipment compared with construction of a groundwater treatment system;
- Alternative 4 has significantly lower O&M obligations; and
- Alternative 4 is an innovative approach, with very limited remedy infrastructure following amendment injections, that takes advantage of developing *in situ* technologies for PFAS, with a significantly smaller environmental impact and lower capital and long-term cost obligations.

If, after reviewing the treatability study results, pilot test results, or other data collected during the design phase, EPA determines that the proposed alternative will not be effective in attaining cleanup levels identified for the Site and no longer achieves the best balance among EPA's required evaluation criteria, EPA's contingency alternative for the groundwater cleanup is **Alternative 3: Groundwater Extraction with *Ex Situ* Treatment, Institutional Controls, and Monitoring.** Alternative 3 is the recommended contingency alternative for the following reasons:

Alternative 3 is expected to be able to reduce contaminant levels downgradient of the treatment area to below PRG levels within approximately 20 years of implementation of the remedy and throughout the Site within approximately 40-92 years;

- Alternative 3 would include institutional controls to prohibit use of contaminated groundwater until cleanup levels are met and to require evaluation of the vapor intrusion pathway as part of new building construction;

- Alternative 3 is readily implementable; and
- Alternative 3 is a proven technology.

EPA believes the proposed cleanup plan for the L&RR Superfund Site achieves the best overall balance among EPA's nine criteria (excluding State and community acceptance which will be considered following public comment) used to evaluate the various alternatives presented in the Feasibility Study. This cleanup approach provides both short- and long-term protection of human health and the environment; attains applicable federal environmental and state environmental and facility siting laws and regulations; reduces the toxicity, mobility, and volume of contaminants through treatment to the extent practicable; utilizes permanent solutions; and uses land use restrictions to prevent unacceptable exposures in the future to any remaining site-related contamination. While the approach may result in adverse impacts to floodplain and wetland areas, these impacts will be minimized to the extent practicable with restoration of unavoidable damages.

EPA believes that this proposed cleanup approach is protective of human health and the environment through the use of innovative and proven cleanup technologies such as *in situ* groundwater treatment and use or access restrictions, and is cost-effective, while achieving the site-specific cleanup objectives within a reasonable timeframe.

EPA will publish the final results of the treatability study for Alternative 4. If, after reviewing the treatability study results, pilot test results, or other data collected during the design phase, EPA determines that Alternative 4 will not be effective in attaining cleanup levels identified for the Site and no longer achieves the best balance among EPA's required evaluation criteria, EPA will provide notice to the public of its intention to implement its contingency alternative.

NEXT STEPS

After the public comment period, described below, EPA will review and evaluate all comments received on this proposal and issue a Record of Decision (ROD) for OU2 of the Site. The ROD will be a written document that describes the chosen cleanup plan and includes a summary of responses to any public comments received during the comment period (the Responsiveness Summary). Once signed, the ROD will be made available to the public on the EPA Website for the L&RR Site as well as via computer at the Municipal Annex Building and at the EPA Records Center (see addresses below). EPA will announce the final decision on the cleanup plan through the local media and on EPA's website.

WHAT IS A FORMAL COMMENT?

EPA will accept public comments during a 30-day formal comment period, which runs from July 29, 2020 to August 28, 2020. EPA considers and uses these comments to improve its cleanup approach. During the formal comment period, EPA will accept written comments via mail, email, and fax. Additionally, oral comments may be made during the formal Virtual Public Hearing on August 12, 2020 immediately following the virtual informational meeting at 7 pm or by using the dedicated voicemail box at (617) 918-1910. All comments offered during the hearing will be recorded. EPA will not respond to your comments during the formal Public Hearing but will respond to them in writing in a Responsiveness Summary, described below.

EPA will review the transcript of all formal comments received during the hearing and during the formal comment period before making a final cleanup decision. EPA will then prepare a written response to all the formal written and oral comments received. Your formal comment will become part of the official public record.

HOW TO PARTICIPATE

A virtual public meeting will be held prior to the public hearing to further explain the cleanup plan. Representatives from EPA will be available to answer questions.

INFORMATIONAL MEETING FOLLOWED BY A HEARING
WEDNESDAY • AUG 12, 2020 BEGINNING AT 7 P.M.

Go to **www.epa.gov/superfund/lrr**   Click on "Join EPA Skype meeting" or

You may also join by phone: 1-857-299-6148   PIN: 616539680#

Copies of EPA's presentation and Proposed Plan may be viewed at: www.epa.gov/superfund/lrr or obtained by contacting EPA's Community Involvement Coordinator, Sarah White at 617-918-1026 or email: white.sarah@epa.gov

SEND US YOUR COMMENTS

Provide EPA with your written or oral comments about the Proposed Plan for the L&RR Superfund Site. EPA has established a dedicated voice mailbox at 617-918-1910 to receive oral comments during the comment period. Please email, fax, or mail comments, **dated or postmarked no later than August 28, 2020** to:

barczynski.hoshaiah@epa.gov

FAX: 617-918-0275

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ACRONYMS

AC	Activated Carbon
ARAR	Applicable or Relevant and Appropriate Requirement
BHHRA	Baseline Human Health Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminant of Concern
COPEC	Contaminant of Potential Ecological Concern
CVOC	Chlorinated Volatile Organic Compound
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	Feasibility Study
FYR	Five-Year Review
GAC	Granular Activated Carbon
gpm	Gallons Per Minute
GQR	Groundwater Quality Rules
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IC	Institutional Control
ILCR	Incremental Lifetime Cancer Risk
ISCO	*In Situ* Chemical Oxidation
L&RR	Landfill & Resource Recovery
LTM	Long-Term Monitoring
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PAC	Powdered Activated Carbon
PCSM	Post-Closure Site Monitoring
PFAS	Per- And Polyfluorinated Alkyl Substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
PVC	Polyvinyl Chloride
RAO	Remedial Action Objective
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
ROD	Record of Decision
RSL	Regional Screening Level
SLERA	Screening-level Ecological Risk Assessment
VOC	Volatile Organic Compound

Table 1: Preliminary Remediation Goals (PRGs)

Chemical of Potential Concern	Selected PRGs	Basis for PRG
Antimony	6.0	MCL
Arsenic	10	MCL
Benzene	5.0	MCL
Bis(2-ethylhexyl)phthalate	6.0	MCL
Total Chromium*	100	MCL
Chromium(VI)	0.035	ILCR = 10^{-6}
Dichlorobenzene, 1,4-	75	MCL
Dichloroethane, 1,1-	2.8	ILCR = 10^{-6}
Dichloroethane, 1,2-	5.0	MCL
Dichloroethene, 1,2-cis-	70	MCL
Dichloropropane, 1,2-	5.0	MCL
Dioxane, 1,4-	0.46	ILCR = 10^{-6}
Iron	14000	HQ = 1
Manganese	430	HQ = 1
Naphthalene	0.17	ILCR = 10^{-6}
Perfluorooctanoic acid (PFOA)	0.070	RIDEM-GQR
Perfluorooctane sulfonic acid (PFOS)	0.070	RIDEM-GQR
Total PFOA + PFOS	0.070	RIDEM-GQR
Tetrachloroethene	5.0	MCL
Trichloroethene	5.0	MCL
Vinyl Chloride	2.0	MCL

Notes:

1. Groundwater concentrations are presented in units of micrograms per liter (µg/L).
2. Risk based concentrations are the EPA Regional Screening Levels (RSL), November 2019.
   The lower of the carcinogenic (Incremental Lifetime Cancer Risk; ILCR) and noncarcinogenic (Hazard Quotient; HQ) groundwater RBCs are presented. Non-cancer values are based on a target hazard index of one; cancer values are based on a target cancer risk of one in one million. The RSLs for PFOA and PFOS were calculated using the EPA RSL Calculator.
   *Non-cancer risk-based value for total chromium is based on trivalent chromium value.
3. EPA MCLs: National Primary Drinking Water Regulations (EPA 816-F-09-004; MAY 2009), where MCL = "maximum contaminant level".
4. RIDEM GQR: Groundwater Quality Rules, RIDEM Office of Water Resources (250-RICR-150-05-3; effective 1/09/2019).
5. The Preliminary Remediation Goal (PRG) was selected according to the following hierarchy:
   (a) MCL, if available.
   (b) If MCL is not available, then the lowest value among risk-based concentrations (ILCR 10-6 or HQ = 1) and RIDEM Groundwater Quality Rules were selected.

Table 2: Comparative Analysis of Alternatives

Evaluation Criteria	Alternative 1: No Action	Alternative 2: Limited Action – Institutional Controls and Monitoring	Alternative 3: Groundwater Extraction with *Ex Situ* Treatment and Institutional Controls	Alternative 4: Two-Stage Reactive Treatment Zone and Institutional Controls
Overall Protection of Human Health and the Environment				
Overall Protection of Human Health	Fails	Passes	Passes	Passes
Overall Protection of the Environment	NA[1]	NA[1]	NA[1]	NA[1]
Compliance with ARARs				
Chemical-Specific ARARs	Fails	Fails	Passes	Passes
Location-Specific ARARs	NA	Passes	Passes	Passes
Action-Specific ARARs	NA	Passes	Passes	Passes
Other Criteria, Advisories, and Guidance	Uncertain	Uncertain	Passes	Passes
Long-Term Effectiveness and Permanence				
Long-Term Effectiveness and Permanence	●	●●	●●●	●●●
Reduction of Toxicity, Mobility, or Volume through Treatment				
Reduction of Toxicity, Mobility, or Volume through Treatment	●	●	●●●	●●●
Short-Term Effectiveness				
Short-Term Effectiveness	●	●●	●●	●●
Implementability				
Implementability	●●●	●●●	●●	●●●
Cost				
Capital	$0	$315,000	$7,580,000	$6,250,000
Total NPV	$430,000	$2,300,000	$14,600,000	$11,700,000
Overall Cost Rating	●●●	●●●	●	●●

Notes:

1. The results of the SLERA and Refinement did not identify unacceptable risks to ecological receptors from exposure to groundwater.

● Low rating in comparison to other alternatives for specified criterion (less favorable outcome for criteria)

●● Mid-range rating in comparison to other alternatives for specified criterion

●●● High rating in comparison to other alternatives for specified criterion (most favorable outcome for criteria

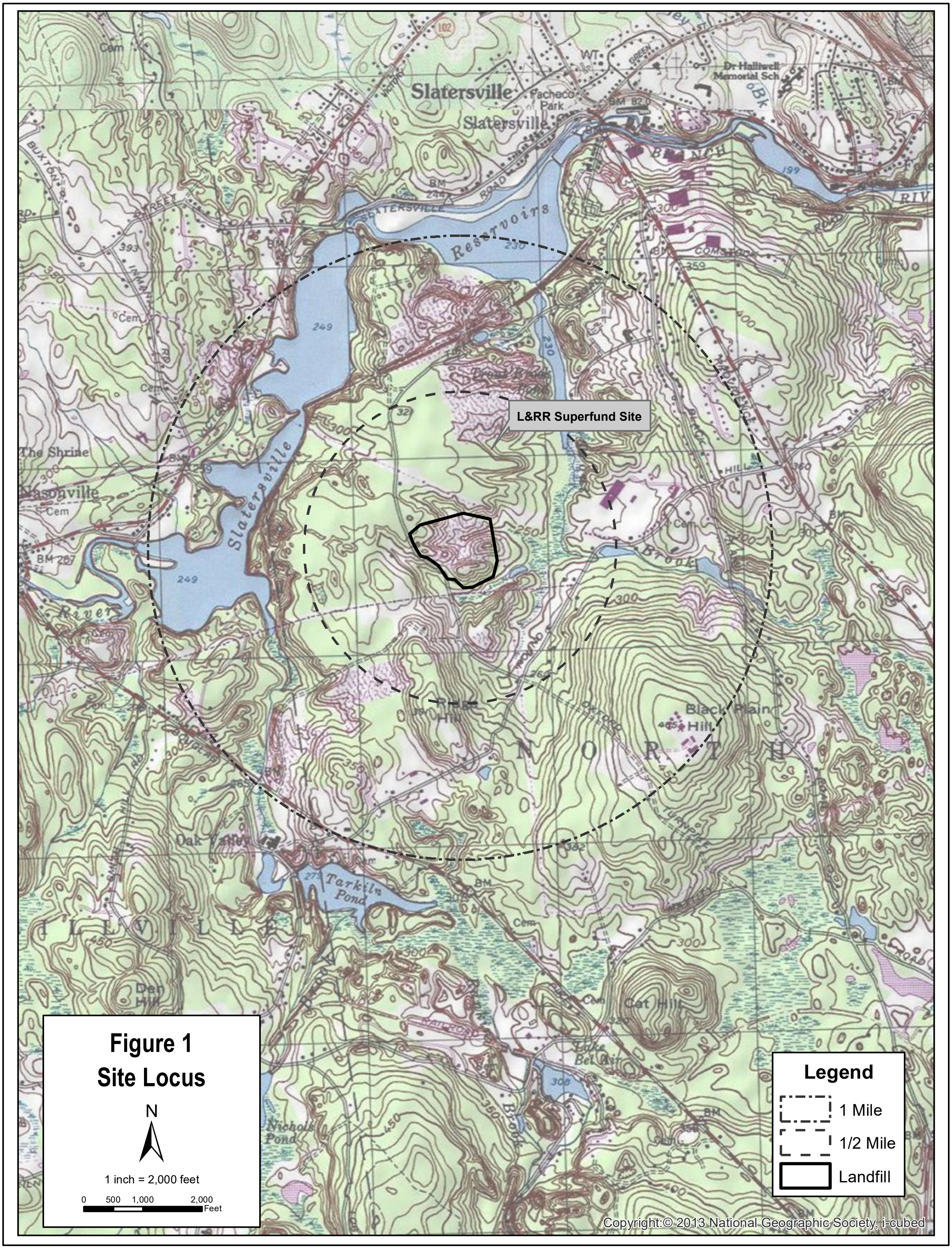
Figure 1
Site Locus
N
1 inch = 2,000 feet
0 500 1,000 2,000 Feet
Legend
1 Mile
1/2 Mile
Landfill
L&RR Superfund Site
Slatersville
Reservoirs
Nasonville
The Shrine
Oak Valley
Tarkiln Pond
Black Plain Hill
Cat Hill
Den Hill
Nichols Pond
Lake Bel Air
Dr Halliwell Memorial Sch
Pacheco Park
N O R T H
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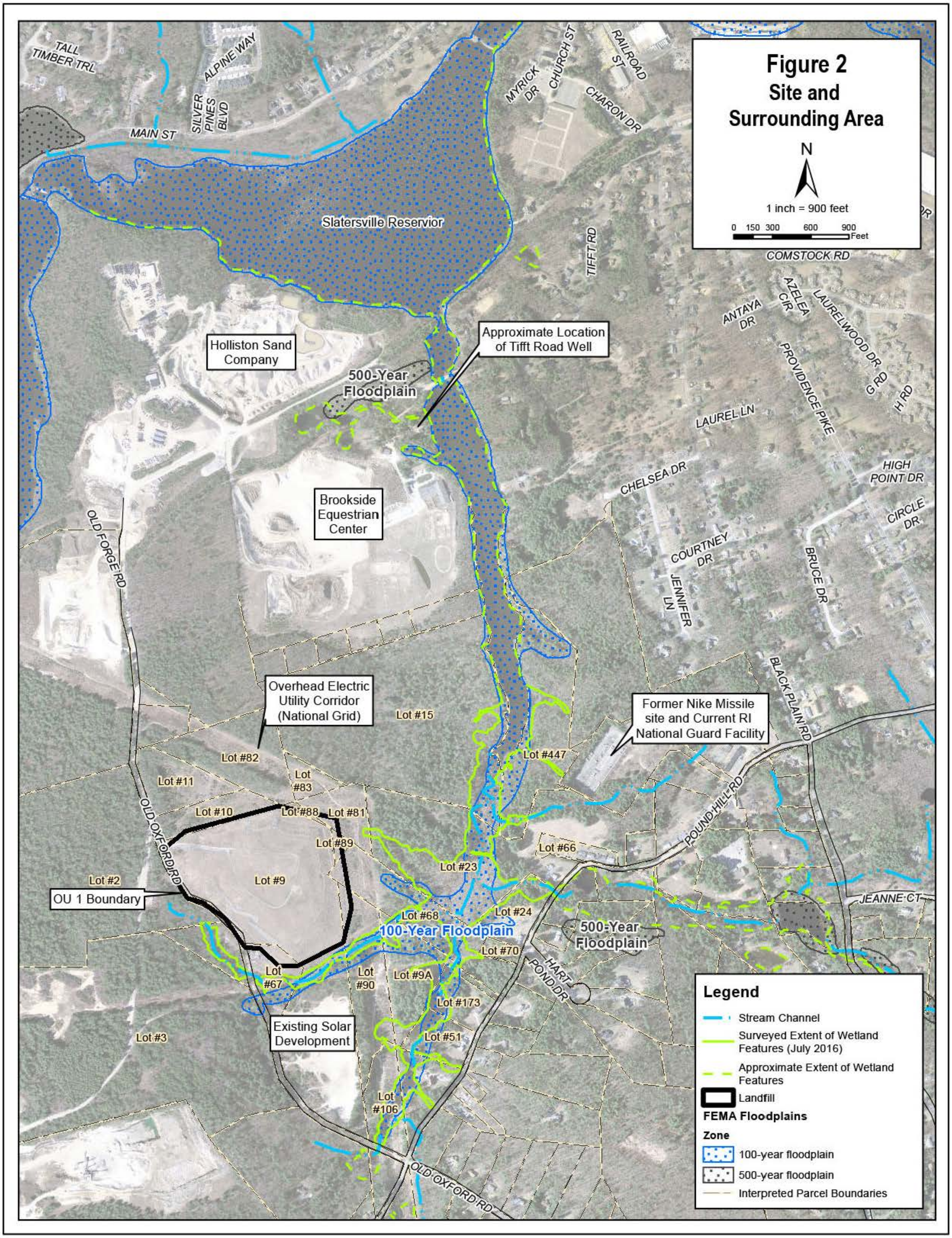

Figure 2
Site and Surrounding Area
N
1 inch = 900 feet
0 150 300 600 900 Feet
TALL TIMBER TRL
ALPINE WAY
SILVER PINES BLVD
MAIN ST
MYRICK DR
CHURCH ST
RAILROAD ST
CHARON DR
Slatersville Reservior
TIFFT RD
COMSTOCK RD
ANTAYA DR
AZELEA CIR
LAURELWOOD DR
PROVIDENCE PIKE
G RD
H RD
LAUREL LN
Holliston Sand Company
500-Year Floodplain
Approximate Location of Tifft Road Well
HIGH POINT DR
CHELSEA DR
CIRCLE DR
Brookside Equestrian Center
OLD FORGE RD
COURTNEY DR
JENNIFER LN
BRUCE DR
BLACK PLAIN RD
Overhead Electric Utility Corridor (National Grid)
Lot #15
Former Nike Missile site and Current RI National Guard Facility
Lot #82
Lot #83
Lot #447
Lot #11
Lot #10
Lot #88
Lot #81
POUND HILL RD
Lot #89
Lot #66
OLD OXFORD RD
Lot #23
Lot #2
Lot #9
OU 1 Boundary
JEANNE CT
Lot #68
Lot #24
100-Year Floodplain
500-Year Floodplain
Lot #70
Lot #67
Lot #90
Lot #9A
HART POND DR
Lot #173
Existing Solar Development
Lot #3
Lot #51
Lot #106
OLD OXFORD RD
Legend
Stream Channel
Surveyed Extent of Wetland Features (July 2016)
Approximate Extent of Wetland Features
Landfill
FEMA Floodplains
Zone
100-year floodplain
500-year floodplain
Interpreted Parcel Boundaries

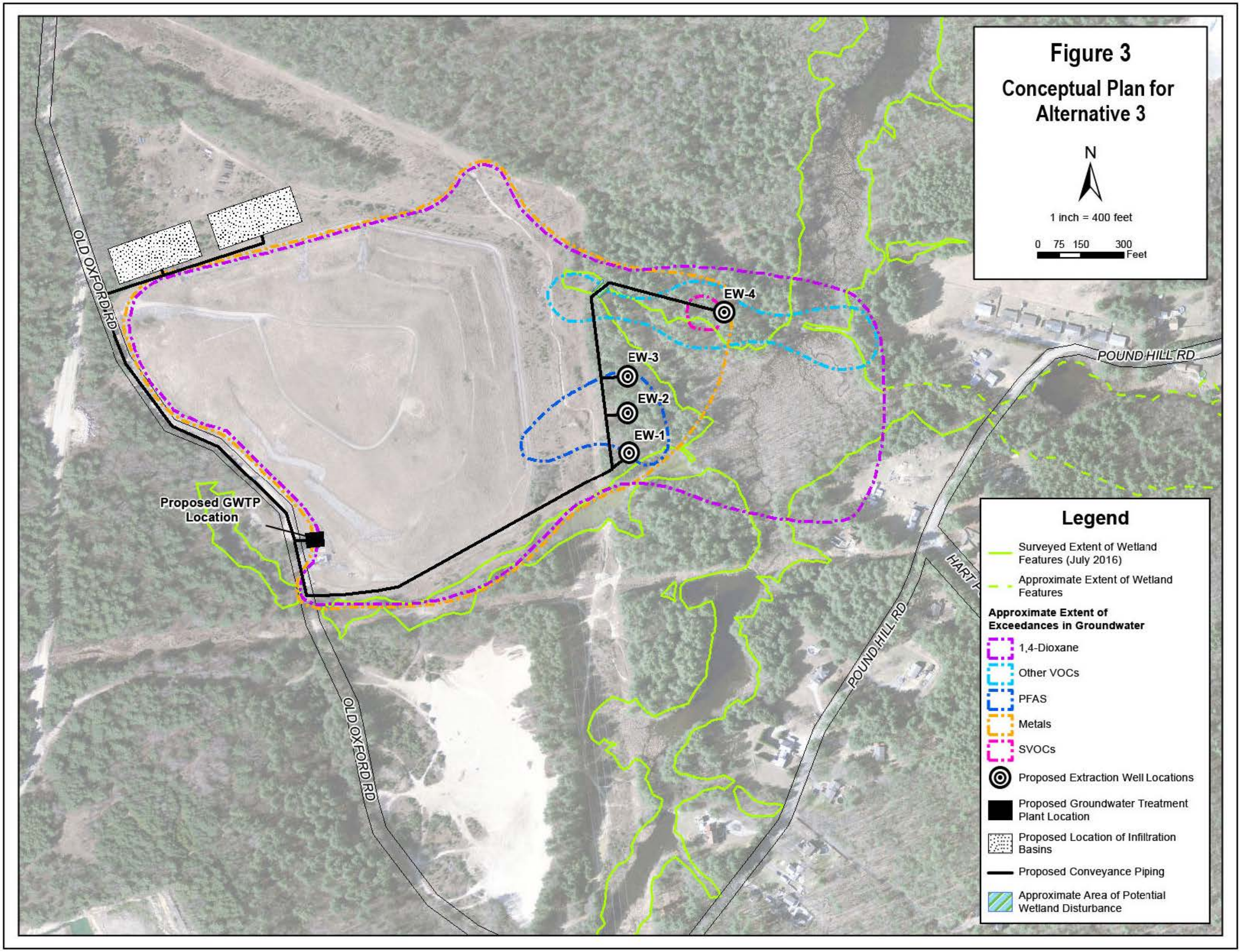

Figure 3
Conceptual Plan for Alternative 3
N
1 inch = 400 feet
0 75 150 300 Feet
OLD OXFORD RD
OLD OXFORD RD
POUND HILL RD
POUND HILL RD
EW-1
EW-2
EW-3
EW-4
Proposed GWTP Location
Legend
Surveyed Extent of Wetland Features (July 2016)
Approximate Extent of Wetland Features
Approximate Extent of Exceedances in Groundwater
1,4-Dioxane
Other VOCs
PFAS
Metals
SVOCs
Proposed Extraction Well Locations
Proposed Groundwater Treatment Plant Location
Proposed Location of Infiltration Basins
Proposed Conveyance Piping
Approximate Area of Potential Wetland Disturbance

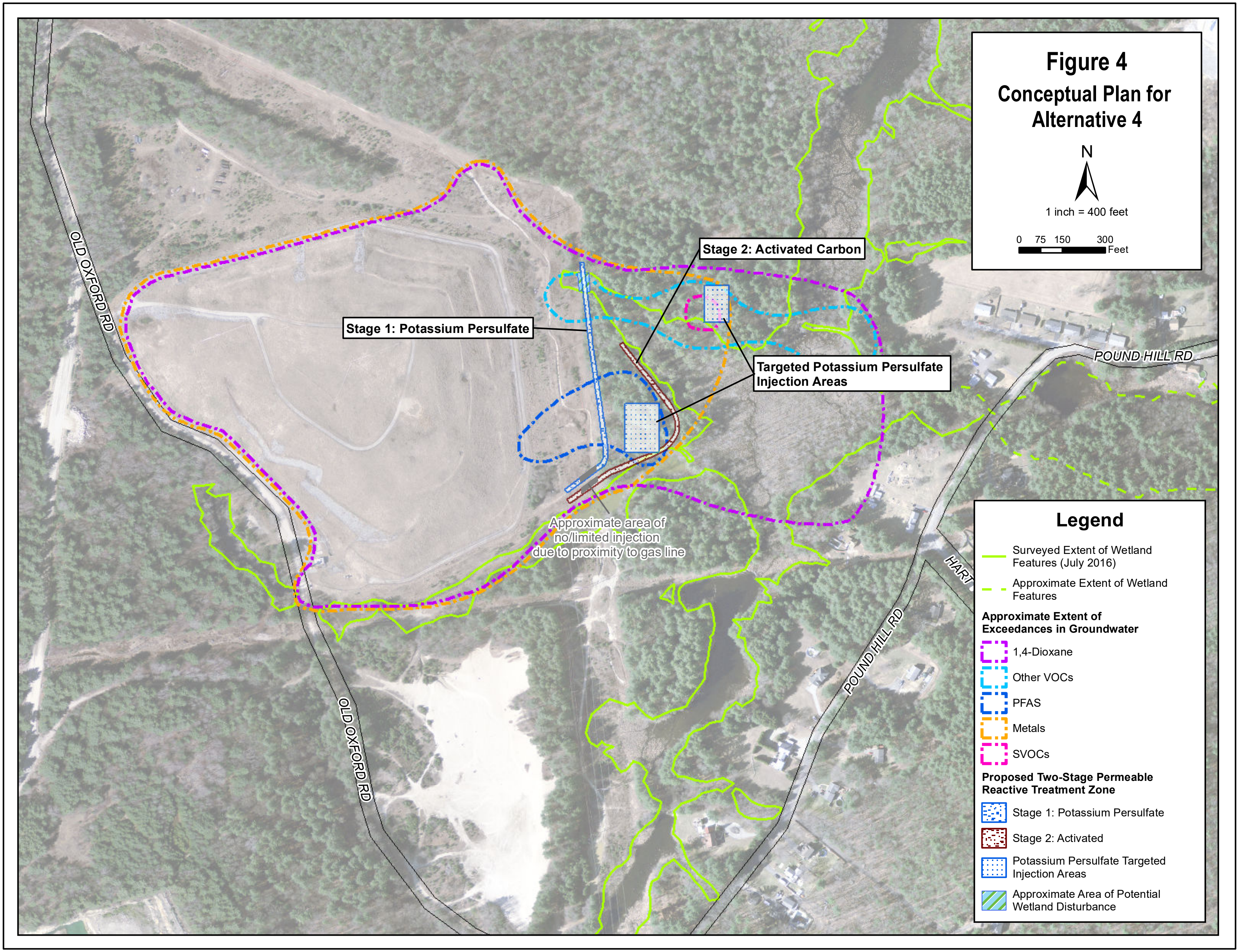

Figure 4
Conceptual Plan for Alternative 4
N
1 inch = 400 feet
0 75 150 300 Feet
Stage 2: Activated Carbon
Stage 1: Potassium Persulfate
Targeted Potassium Persulfate Injection Areas
Approximate area of no/limited injection due to proximity to gas line
OLD OXFORD RD
OLD OXFORD RD
POUND HILL RD
POUND HILL RD
HART
Legend
Surveyed Extent of Wetland Features (July 2016)
Approximate Extent of Wetland Features
Approximate Extent of Exceedances in Groundwater
1,4-Dioxane
Other VOCs
PFAS
Metals
SVOCs
Proposed Two-Stage Permeable Reactive Treatment Zone
Stage 1: Potassium Persulfate
Stage 2: Activated
Potassium Persulfate Targeted Injection Areas
Approximate Area of Potential Wetland Disturbance